



# UKHSA Advisory Board

**Title of paper** Preparedness for Environmental Hazards  
**Date** 17 May 2023  
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## 1. Purpose of the paper

- 1.1. The purpose of this paper is to describe current environmental threats and hazards to health, with a focus on climatic and natural hazards, and highlight the specialist scientific emergency response functions, capabilities, preparedness, and responsibilities of the UK Health Security Agency (UKHSA) to prepare and respond to these threats.
- 1.2. Threats posed by chemical, radiation, and nuclear incidents, and by infectious diseases have recently been covered in separate papers. This paper complements these previous papers to provide further assessment of environmental threats that the UK needs to monitor and respond to.

## 2. Recommendations

- 2.1. **NOTE** the activities underway in the UKHSA to build capacity to protect health from environmental hazards
- 2.2. **COMMENT** on the current work and development work underway in the UKHSA and identify any significant gaps in the approach
- 2.3. **COMMENT** on the key choices that the UKHSA and government may need to make to improve preparedness

## 3. Summary and conclusions

- 3.1. Our environmental conditions are important determinants of health and vary between populations and geographic locations. Environmental hazards that the UKHSA prepares for and responds to include a wide and diverse range of threats, including adverse and extreme weather (such as heat, drought, flooding, cold), environmental determinants of infectious diseases (for example vectorborne disease ecology and transmission), contamination of, water, and land, as well as noise and air pollution (wildfires, volcanoes), and radiological threats (UV, light, radon). The World Health Organization estimates that 21.2% of global deaths (12% in the UK) and 16.3% of



global disability-adjusted life years lost (13% in the UK) are attributable to environmental risk factors and the Lancet Commission reported that in 2019, pollution was responsible for approximately 9.0 million premature deaths. The recognition of importance of environmental hazards to health security is growing, with exposure and risks increasing due to climate and environmental change. UKHSA is addressing the evidence gaps in these areas to provide robust evidence-based advice to protect health as well as supporting evidence-based policy development. Our aim is to develop tools to quantify the burden of disease from existing and emerging environmental hazards and evaluate the effectiveness of interventions to reduce the contribution the environment makes to preventable illness and early death

- 3.2. UKHSA's remit includes preparedness and response to a number of key environmental hazards that are expected to increase in magnitude and threat over the next decades. Climate change is increasing risks associated with heat, flooding, and wildfires, and is expected to exacerbate inequalities. Climate change intersects with a range of other health threats, with significant potential to generate complex and compound health security challenges. Additionally, cold weather related deaths in the UK remain high, and the Agency will need to prepare for and minimise a rapid and substantial rise in heat-related morbidity and mortality. The projection of total economic costs of heat-related mortality from climate change and socio-economic change in England in this decade amounts to approximately £6.4 billion pounds per year.
- 3.3. UKHSA **preparedness** has experienced a step-change in the establishment of the Centre for Climate and Health Security (CCHS) in 2022 to coordinate partnership and integration on climate risks to health across the UKHSA and with partners. The CCHS now has capacity to support preparedness and response functions for extreme heat, cold, and flooding. Assessment of preparedness at different levels of warming and taking into account the potential for compound and cascading risks, however, remains limited, and inter-governmental coordination is still nascent.
- 3.4. **Response** capabilities within the UKHSA are associated with provision of evidence-based guidelines for response and advice to professionals, partners, and the public, and include the recently launched Adverse Weather and Health Plan. The ubiquity of many projected risks across the UK (for example extreme heat and inland and coastal flooding), and likelihood that Local Authorities and Local Resilience Forums (LRFs) will need to upgrade emergency planning and capabilities means that UKHSA capacity to provide localised support may be increasingly limited in the near-term. The local response within UKHSA is led by Health Protection Teams and their EPRR capability who are the frontline local responders.
- 3.5. UKHSA preparedness and response capabilities are constrained by the scope (breadth of causal pathways and potential magnitude) of environmental hazards to health and uncertainty regarding the level of warming and the associated health risks we will face. Adaptation to the health risks of climate change is thought to be feasible up to 1.5C warming, and potentially up to 2C warming with substantial expansion of

investment. At higher levels of warming, many health risks will be irreversible, and adaptations will be difficult, no longer suitable/available, or cost prohibitive. The UK Climate Change Committee 2023 assessment of UK preparedness for the health risks of climate change found preparedness to be 'insufficient'. The UKHSA shares responsibility with different government agencies, with remit in this area in some cases complex and requiring further clarity.

3.6. The UKHSA provides expert advice to various stakeholders on environmental threats to health, including for example the Department of Health and Social Care (DHSC) and Foreign Commonwealth and Development Office (FCDO). This role and related partnerships more broadly inform policy development across UK government agencies and health stakeholders meet domestic goals.

#### 4. Background

4.1. The aim of this paper is to primarily give an overview of the work that UKHSA is doing to protect the health of the UK population from environmental threats, and to discuss the planning and preparedness work being done within the organisation to strengthen our capacity and capability to respond to these threats. This paper complements recent papers considered by the Board on infectious diseases threats in January 2023 and on chemical, radiological and nuclear threats in March 2023.

4.2. UKHSA deals with a wide variety of environmental threats that have the potential to affect health security (Table 1). Work across these hazards includes surveillance and response, scientific research, provision of scientific advice to Government, guidance development, provision of advice to the public, response to incidents, and policy development.

**Table 1: Environmental hazards addressed at the UKHSA**

Categories of environmental hazard	Hazard	Coverage in this paper
Climate change	Adverse weather (extreme heat, extreme cold, storms, flooding, and drought)	Covered in depth
	Infectious diseases	Not covered
Natural hazards	Wildfires	Covered briefly
	Volcanic eruptions	Covered briefly
Chemical hazards	Contaminated land	Not covered
	Contaminated water	Not covered
	Air pollution	Covered briefly
Other	Noise	Covered briefly
Radiological hazards	Radon, electromagnetic fields, ultra-violet light	Covered briefly
Nuclear hazards		Not covered

- 4.3. Many environmental health threats – including climate change and extreme weather – interact with other health hazards, leading to compound, complex, and cascading health risks and challenges for preparedness and response. For example:
  - 4.3.1. Managing an infectious disease outbreak during extreme weather that impacts on NHS response and human behaviour
  - 4.3.2. Extreme heat leading to increased need for NHS response while simultaneously hampering working conditions in health care settings
  - 4.3.3. Vaccination roll-out compromised by extreme heat or flooding that disrupts supply chains and travel for staff and the public
- 4.4. Notably, climate change does not directly affect health outcomes, but rather influences a wide range of environmental and social determinants of health, including for example global food supply chains, migration, and conflict. Climate change is the context in which UKHSA will need to protect health from a wide range of hazards that are climate sensitive. While this paper focuses primarily on more direct environmental hazards, the extent to which climate change impacts diverse social and environmental domains means that all other health hazards must be considered within the context of climate change, which can both magnify other health threats and make responses more complex.

## 5. Roles and Responsibilities

UKHSA's responsibilities and role to protect health from environmental hazards relevant to this paper include the following mandates:

- 5.1. UKHSA is the expert body legally responsible for ensuring health security and is a Category 1 responder under the UK Civil Contingencies Act (2004). Preparedness and response in the context of environmental hazards is always a multi-agency response, however, and for the majority of environmental hazards the lead rests with other bodies for example the police, local authorities or other Government Departments. UKHSA's unique role is the health risk assessment and protection of the public's health. Remit and accountability can be complex. Key areas of accountability for UKHSA *vis a vis* other agencies is summarised in Appendix 1.
- 5.2. UKHSA's role in protecting health security from extreme weather events is a commitment under the **UK's third National Adaptation Programme (NAP)**, legislated within the **Climate Change Act (2008)**. Actions are articulated within the UK's Climate Change Risk Assessment (CCRA, latest version 2022), with implementation of actions scheduled for 2023. The UKHSA is jointly responsible, with the DHSC and NHS, for contributions to health risks and opportunities included within the CCRA.



- 5.3. UKHSA undertakes health response and investigation functions to environmental health threats through local Health Protection Teams (HPTs), field epidemiology, and specialist national teams.
- 5.4. UKHSA plays an important advisory role in partnership with other agencies, informing policy development more widely. For example, UKHSA expertise can inform policy decisions within DHSC and FCDO's international climate and health engagement.
- 5.5. To deliver those responsibilities most effectively and ensure we are best prepared to protect health in the context of a changing climate, UKHSA established the Centre for Climate and Health Security (CCHS) in 2022. The Centre brings together expertise and capacity across the UKHSA to respond to climate and adverse weather related threats. All parts of UKHSA contribute to this work. The public health risk assessment and expert advice on air pollution due to wildfires or volcanic eruptions is led by the Radiation, Chemical and Environmental Hazards (RCE) Directorate. UKHSA provides government and other stakeholders with up-to-date evidence on the health effects associated with air pollution exposure. Consideration of climate change implications for changing wildfire risk is undertaken in collaboration with CCHS.
- 5.6. There are additional threats to health associated with non-climatic natural disasters where UKHSA makes an important contribution to reduce adverse health effects including light, noise, radon, electromagnetic fields (EMF), mould, and space weather. These hazards are not covered in detail in this paper, but UKHSA remains responsible for the public health risk assessment and provision of scientific and public health advice to protect health as with other to environmental hazards.

## 6. Burden of disease and ill-health associated with environmental hazards

- 6.1. Each year England records a significant number of deaths attributable to the effects of adverse weather, such as cold snaps and heatwaves. Heatwaves, for example, can burden emergency services and increase strain on water, energy, and transportation, resulting in power outages, crop loss, and food contamination. Such adverse weather events are increasing in frequency and magnitude, with associated pressures on the NHS, including morbidity and mortality and worsening inequalities.
- 6.2. In the context of the changing climate, threats to health from **extreme and severe heat** pose a substantial and growing burden. Across five heat periods in the summer of 2022, UKHSA observed an estimated total excess mortality (excluding COVID-19) of 2,803 for those aged 65 and over, the highest excess mortality figure during heat-periods observed since the introduction of the Heatwave Plan for England in 2004. According to the [CCRA3 Technical report](#), the number of heat-related deaths in the UK could increase to 7,040 deaths per year by 2050. Many deaths from heat are



avoidable with simple cooling measures and adaptive interventions. from heat are avoidable with simple cooling measures and adaptive interventions.

- 6.3. Threats to health from **cold weather** are still high in the UK despite rises in average ambient temperature under climate change. The ONS estimates that 28,300 Excess Winter Deaths (EWDs) occurred in England and Wales in Winter 2019-2020. The rate of winter deaths in England is twice the rate of some northern European countries (e.g. Finland). Cold weather can compound the effects of other hazards such as respiratory viruses and increase pressures on health and social care services.
- 6.4. **Flooding** resulting from **extreme rainfall** has extensive and significant impacts on health that are frequently associated with both acute and long-term effects on health and wellbeing. Flooding can lead to physical injury or trauma ( for example drowning, heart attack), increased risk of waterborne and respiratory disease associated with water contamination and mould/damp, and socioeconomic impacts that have secondary effects on health and inequalities. In England, most of the health burden associated with flooding is due to impacts on mental health and wellbeing, which range from stress or anxiety to more severe mental health impacts requiring specialist health interventions.
- 6.5. Threats to health from **wildfires** include risks associated with both the actual fire and the resulting smoke, including burn injuries, suffocation, and inhalation of a range of hazardous chemicals that exacerbate asthma and other chronic health conditions. Epidemiological studies from a number of countries showed significant associations between wildfire smoke exposure and respiratory and cardiovascular morbidity and mortality. For example, studies of the impact of the large wildfires on Saddleworth Moor in 2018 found that as many as 4.5 million people were exposed to poor air quality caused by smoke and that this may have increased air pollution related mortality by 165% compared to if there were no fires. In the future, wildfire events are also likely to coincide with periods of extreme hot weather, air pollution (ozone) events and drought which will also challenge people's health. Wildfires can also cause soil erosion which can increase the risk of landslides and flooding, contaminate water courses and supplies and, of course, damage the natural environment which plays an important part in our health and wellbeing. There is increasing evidence from countries such as the USA, Canada, and Australia that wildfires can additionally impact mental health and community resilience. Wildfires also emit gases such as carbon dioxide, carbon monoxide and methane, and deep burning fires in peatland may also release stored carbon. These emissions will also contribute to climate change.
- 6.6. Health threats for the UK associated with **volcanic eruptions** arise rarely but can have potentially serious consequences, due to air pollution from particulate matter (volcanic ash), sulphur dioxide and other noxious gases, hence the inclusion of volcanic eruptions in the national risk register. UKHSA is responsible for the public health risk assessment as was evident during the two volcanic eruptions in Iceland



in 2010 and 2011 where our teams advised on the public health risks, contributed to the cross-Government response, and developed health messages for the public.

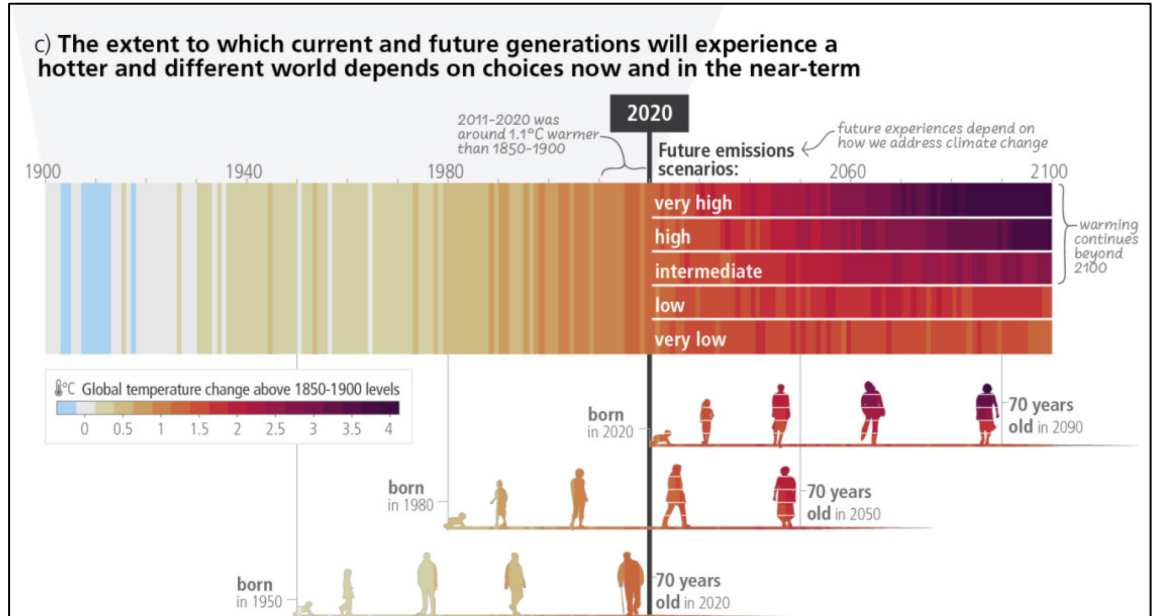
- 6.7. Short-term increases in **air pollution** occur several times a year and lead to an exacerbation of pre-existing health conditions, such as asthma, increases in respiratory and cardiovascular hospital admissions and fatalities, and pressure on healthcare (e.g. hospital referrals, demands on ambulances). Long-term exposure to air pollution shortens life expectancy and is associated with an effect equivalent of 29,000-43,000 deaths/yr, contributing to respiratory, cardiovascular diseases and lung cancer, dementia and cognitive decline.
- 6.8. Chronic exposure to **environmental noise** leads to psychological and physiological ill-health, via the human body's autonomous, cognitive and behavioural response to external stress, and via repeated disturbance to the sleep structure. The evidence linking long term noise exposure to cardiovascular and metabolic disease, psychological ill-health and cognitive impairment in children is growing rapidly. The disease burden is substantial – recent estimates by UKHSA and the University of Leicester suggest road traffic noise in England had an attributable disease burden equivalent to 100,000 DALYs (Disability Adjusted Life Years) in 2018. There are no regulatory limits for exposure to environmental noise in the UK, and population exposure is increasing over time due to growth in traffic and in the population living next to transport infrastructure. Health inequities are present from unequal exposures and vulnerability.
- 6.9. The **radiological environmental hazards** noted briefly in this paper include radon exposure, exposure to ultraviolet (UV) light and exposure to electromagnetic fields (EMF). Exposures to each of these hazards is unavoidable but levels of exposure can vary significantly depending on location and behaviours.
  - 6.9.1. The major risk posed by exposure to elevated **radon** levels in housing or workplaces is lung cancer, radon exposure is the second leading known cause of lung cancer after tobacco smoking. Around 1000 lung cancer cases per year are attributable to radon exposure in the UK.
  - 6.9.2. Exposures to **UV light** come from natural and artificial sources, and exposures vary depending upon personal behaviour and location/season. The primary concern associated with UV exposure is skin cancer, with melanoma being of greatest concern due to relatively poor therapeutic outcomes. Around 11,500 cases of melanoma are attributable to UV exposure per year in the UK.
  - 6.9.3. Exposure to other elements of the **electromagnetic spectrum** arise from a range of technologies in current use, including electrical power supply and equipment, radio/TV broadcasting and mobile telephony. Public exposures to these EMFs are low and within internationally recognised guideline levels, therefore the direct health impacts are low; however, there are segments of the population that are concerned that such exposures are affecting their health with the recent focus having been on exposures to 5G mobile phone frequencies.

6.10. The health impacts from exposure to environmental hazards are not equality distributed, with impacts typically greater among those in socioeconomically deprived neighbourhoods (e.g. noise, flooding), and among vulnerable populations such as the elderly and those with pre-existing health conditions (e.g. heatwaves). A recent report from the Institute of Health Equity indicated, for example, that cold homes contribute to 21.5% of excess winter deaths, and fuel poverty contributes 10%. The most socioeconomically disadvantaged suffer most from air pollution. UKHSA research has shown that schools in areas with high annual mean particulate matter (PM2.5) levels had a significantly higher median intake of pupils on free school meals compared to schools in low PM2.5 areas. Schools in the highest PM2.5 concentration range were more likely to be ethnically diverse, near major roads and less likely to be near significant green space.

## 7. Risk Assessment

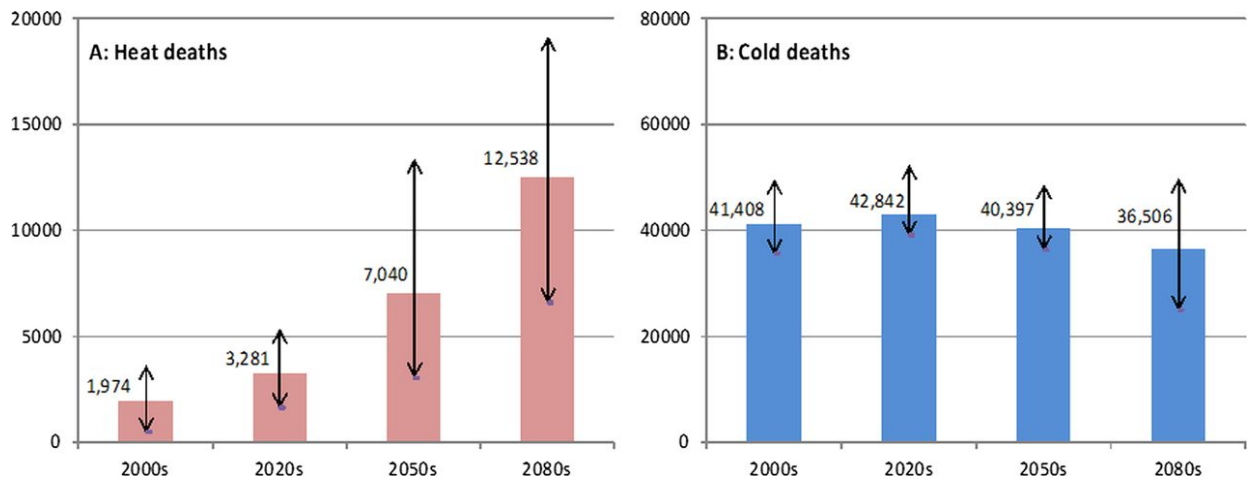
- 7.1. The development of the national threat assessments has involved UKHSA expert input to a Cabinet Office standardised framework throughout 2021/22. In addition, UKHSA **All Hazards Intelligence division** (AHI) is developing a health security threat assessment which will compare a range of current public health threats that the UK faces and examine how these may evolve over the next 5 years. UKHSA is currently reviewing its response capabilities against these risks. This process is ongoing, with a Phase 2 Health Security Threat Assessment paper scheduled for submission to ExCo shortly (late May 2023).
- 7.2. Key factors determining the extent and severity of human health impacts of extreme weather events and natural hazards include: the **magnitude of hazard** (such as temperature or level of flooding); **duration of hazard** (for example number of days or nights of extreme heat, flooding, or fire); **location of hazard** (that is, location of hazard in proximity to populations and infrastructure); **vulnerability of population-at-risk**, including demographic risk factors, behaviour, underlying health conditions, and inequalities; and **preparedness and response**.
- 7.3. In the case of climate-related hazards, the **magnitude** and **duration** – and to some extent location – of hazards over time will be strongly influenced by the level and trajectory of warming that we experience globally. As per assessments by the Intergovernmental Panel on Climate Change and the UK Climate Change Committee, we can expect continued warming and impacts over the next 2 decades, with impacts likely to peak in the mid- to late-century. The magnitude and severity of these impacts will depend on the rate and level of warming, with policy and investment decisions made today determining impacts in the second half of the century (see Appendix 3 for Horizon Scanning related to climate change risks).





**Figure 1:** Future climate trajectories, from the Intergovernmental Panel on Climate Change 6<sup>th</sup> Assessment Report (Synthesis Report, 2023)

- 7.4. In the UK over the next decades, mortality due to cold weather is expected to decrease, while mortality due to extreme heat will increase.
- 7.4.1. The latest UK climate projections show a hot summer like that experienced in 2018 is likely to occur every other year by 2050. Updated projections for average annual deaths due to **extreme heat** estimate that deaths could rise from around 1,400 per year in the near past to around 2,500, 3,700, 8,200 and > 18,500 at 1.5°C, 2°C, 3°C and 4°C respectively by 2050. These projects assume some level of adaptation at low-moderate warming.
- 7.4.2. Mortality due to **cold weather** is projected to decrease but remain substantially higher than heat-related mortality in the first half of the century. Projected decreases in cold deaths are expected to be outweighed by increasing health risks due to extreme heat.



**Figure 2:** Heat-related (A) and cold-related (B) deaths in the UK per year for all ages based on an ensemble of nine regional climate model realisations. Mean estimates across the nine models are shown, and upper and lower limits of arrows represent the maximum and minimum of these (Hajat et al., 2014). Estimates are based on analysis of 1993–2006 data and do not include specific adaptation measures; these data are currently being updated and will be released as part of the upcoming HECC report.

- 7.5. Projections for the UK indicate an increase in the frequency and magnitude of both flooding and drought events, associated with **extremes in rainfall**.
- 7.5.1. Sea level rise, coastal storm surges and **flooding** associated with climate change will have implications for human health, particularly in coastal communities. Impacts on infrastructure and ecosystems are projected to increase risks of injury, impact livelihoods, and affect mental health.
- 7.5.2. The National Flood Resilience Review – published in response to the severe floods of 2014–2015 – identified 530 sites around the country where key local infrastructure (e.g., clean water, electricity, health and telecoms) remain vulnerable to flooding, each potentially affecting at least 10,000 people. The number of people living in properties exposed to flooding is projected to increase from 1.8 million today to 2.5million (< 2°C climate change). Projections of flood impact are higher if warming exceeds 2°C.
- 7.5.3. The impacts of climate change are predicted to have a significant effect on the future of water supply and resources in England and we are likely to see more instances of **drought** throughout the country over the next 25 years, and an increasing frequency of worse droughts.
- 7.6. Current climate change predictions suggest that we will see conditions more favourable for **wildfires**.
- 7.6.1. Hotter and drier summers will create the ideal conditions for fire while milder and wetter winters will encourage plant growth, which can then act as a fuel for fires when conditions dry out.
- 7.6.2. Projections from the Met Office show that a 2°C increase in global temperatures will double the days in the UK with very high fire danger and extend the wildfire season into late summer and autumn. It is likely that this

will mean more severe and larger wildfires, many in areas that are not used to having them. This was demonstrated during the UK wide heatwave in the summer of 2022 which led to an unprecedented number of wildfires in urban locations, with the London Fire Brigade seeing its busiest day since WWII.

- 7.6.3. In the future, wildfire events are likely to coincide with periods of extreme hot weather and drought, resulting in complex health challenges and seasonal surges in burden on the NHS.
- 7.7. Climate change is known to be exacerbating the risks from **infectious diseases**. Long-term changes in temperature, humidity, rainfall patterns and the frequency of extreme weather events have an impact on food safety and security and are increasing the frequency and severity of food-borne outbreaks. Many infectious diseases are climate sensitive, and we are already observing a change in the distribution of vectors. Infectious diseases risks were considered in a separate Board paper and are not described here, but it should be noted that the CCHS has an all hazards approach and leads on vector surveillance.
- 7.8. Evidence on the **economic costs** of the health impacts of extreme weather remains limited but indicates substantial current and projected cost, with predictions rising and greatest at higher levels of warming and delayed intervention.
- 7.8.1. The current total economic costs of heat-related mortality from climate change and socio-economic change in the UK is currently £6.8 billion per year. This amount is projected to increase to £14.7 billion per year by the 2050s.
- 7.8.2. According to the UK Climate Change Committee (CCC), several adaptation investments deliver particularly high value for money. For example, their assessment of monetary risks and opportunities estimates that every £1 invested in heatwave planning or weather and climate services could result in £10 in economic benefits.
- 7.8.3. The cost to the NHS per year to treat people that are affected by poor housing – much of this due to living in cold housing – is estimated at £1.4bn. This is for first year treatment only and excludes social spending and economic losses due to work absence.
- 7.8.4. Annual societal damages (not specific to health) attributable to flooding are expected to rise by 50%, with related projected costs of flooding reaching £10 billion in the next 25 years with implications for increased risks of cascading infrastructure failures in terms of energy, transport, water and communication links. These estimates are based on current levels of adaptation and assume 2°C of warming.
- 7.8.5. The impact of health and cold is already significant. For comparison, in the UK, the current burden from cold-related deaths is similar to, or even greater than, the annual mortality from lung cancer, which is the most common cause of cancer death.



- 7.8.6. The economic cost of other environmental hazards is also significant. For example, the excess mortality due to exposure to particulate air pollution from the wildfires on Saddleworth Moor in 2018 was estimated to have cost in the region of £21 million. Also, government estimates the social cost of urban road traffic noise in England to be £7-10billion per year.
- 7.9. The extent to which adverse weather events and natural hazards generate adverse health impacts is strongly influenced by population vulnerability, including demographic risk factors, behaviour, underlying health conditions, and socio-economic conditions in which people are housed, live and work which contribute to health inequalities. An identical heatwave in one region may result in no deaths, while the same event in another region may lead to high mortality, for example.
- 7.9.1. The UKHSA has an important role in helping strengthen resilience and implement measures to reduce population vulnerability to these hazards. These include measures to plan, prepare for, respond to, and build resilience to the health impacts of extreme weather and natural disasters.
- 7.9.2. UKHSA has a remit to reduce health inequalities and promote health equity and this work is an important element of our overall approach.
- 7.9.3. Many or most of the deaths attributed to extreme weather and natural disasters are considered preventable at low levels of warming (below 1.5°C and possibly up to 2°C warming).

## 8. Response functions, capabilities, and preparedness

### Prepare and respond

- 8.1. UKHSA's specialist capabilities on the health implications of adverse and extreme weather events are located within the **Centre for Climate and Health Security (CCHS)** working with Health Protection Teams and other functions across UKHSA. A key aim of the CCHS is to facilitate partnerships and collaborations across the UKHSA and its partners, and support integration of climate preparedness and resilience into cross-Agency programming and provide an advisory role for other agencies on climate and health (see Appendices).
- 8.2. The UKHSA, provides strategic and operational planning advice on health risks and coordinates cross-government emergency response for health and social care during weather alerts. This includes for example the recently launched **Adverse Weather and Health Plan (AWHP)** (see Appendix 4), providing a core planning function for partners to plan for the health impacts of adverse weather events, **weather-health alerts, and health 'Action Cards'**.
- 8.3. UKHSA protects health against the adverse health effects of acute and chronic exposure to environmental hazards by improving the evidence base on the

environment and health which informs the development of advice and guidance in support of Government policy development but to especially support local Government and communities to build healthy, sustainable and resilient communities

- 8.4. The UKHSA, contributes to national planning and response to wildfires, including Providing public health risks assessment during wildfire events and supporting planning and preparedness at local, regional and national levels. During the hot weather in June to August 2022, UKHSA responded to 46 wildfires with community health security implications. This compares to 1 such event in 2021, and 6 in 2020. Work also includes strengthening the evidence on wildfires and health through a chapter on wildfires and public health as part of the UK Health Effects of Climate Change Report. This chapter identifies areas of research into the public health impacts of wildfires in the UK including the need to improve exposure assessment and UK health studies. Additional wildfires activities include developing public and social media messaging around wildfires, contributing to the Cabinet Office led Wildfire Framework for England and the Wildfire Charter for Wales, and working closely with Fire and Rescue Services through initiatives such as the England and Wales Wildfire Board to raise awareness of the health risks associated with wildfires.
- 8.5. The UKHSA also has activities of a similar nature related to light, radon, EMF, mould, wildfires, volcanic hazards, and space weather.
- 8.5.1. In the case of damp and mould, the UKHSA is preparing up-to-date information on the health effects of damp and mould and supporting the Office for Health Improvement and Disparities to develop guidance for housing associations. This is part of government's response following a Prevention of Future Deaths report sent to the Secretary of State for Levelling Up and the Secretary of State for Health. This follows the coroner's investigation into the death of Awaab Ishak, who died because of exposure to damp and mould in his home.
- 8.5.2. UKHSA has a well-developed radon survey capability that is available nation-wide, and survey results feed into the development and refinement of radon maps that are available through UKHSA working with British Geological Survey.
- 8.5.3. In terms of UV exposures, UKHSA has a network of solar UV monitoring stations providing real-time data on levels across the country. This monitoring data has been used in conjunction with satellite data to produce a mobile phone app to provide exposure information direct to individuals, work carried out in conjunction with an SME industrial partner, Si-Health.
- 8.5.4. UKHSA also has capabilities to characterise and assess EMF exposures, this capability has been used in collaboration with academic partners internationally in large multi-national studies of the potential health impacts of mobile phone use.



## Build

- 8.6. UKHSA partners across government to ensure a lined-up approach to preparedness and response to environmental hazards. This includes collaboration with the Environment Agency, the DHSC, the Office for Health Improvement and Disparities (OHID), NHS England, the Department for Food, Environment & Rural Affairs (DEFRA), the Met office, the Department for Levelling Up, Housing and Communities (DLUHC), the Department for Education (DfE), the Department of Justice (DoJ), the Department for Digital, Culture, Media and Sport (DCMS), the Department for Transport (DfT), FCDO, and Cabinet Office, as well as local authorities. Engagement with these partners is a core remit and objective of the new climate centre, for example.
- 8.7. Comparable capabilities are currently being developed in the United States (US Centers for Disease Control) and Canada (Public Health Agency of Canada, Health Canada), with growing **bilateral and multilateral partnership** and cooperation to increase learning and support rapid mobilisation of capabilities and preparedness. Australia is also initiating national climate and health capabilities, and a range of organisations and institutions are engaging in this area, including for example the World Health Organisation and the UK Faculty of Public Health. The CCHS, for example, represents a key point-of-contact with international governments and multilateral initiatives coordinating evidence and response to the health security threats from climate change globally and an opportunity for UKHSA to provide global leadership
- 8.8. Research funding agencies have identified climate and health as a **key priority for research investment**, including for example the Wellcome Trust, who have prioritised climate change and health as one of their three top strategic areas of investment. The UKRI similarly has a special £10M call now out for bids to develop a national Centre for Climate and Health. The UKHSA is partnering on 3 consortia bidding to lead this Centre.
- 8.9. UKHSA **partners with academic institutions** to improve the evidence base on environmental risks, and options for adaptation and resilience, as well as providing provision for training in public health and environmental hazards. This includes, for example, **substantial external investment** to increase research capacity, develop and embed the best available science and evidence to support UKHSA's preparedness and response capabilities (Appendix 2).

**Professor Isabel Oliver**  
*Chief Scientific Officer*  
May 2023



## APPENDIX 1 UKHSA roles and responsibilities vis a vis partner agencies

UKHSA is the organisation responsible for securing health from hazards in the environment including risk assessment and provision of advice to protect health from those risks. The policy lead for environmental hazards usually rests outside DHSC and UKHSA as indicated in the table below.

Hazard	Lead government department <sup>1</sup>	UKHSA role
High temperatures and heatwaves	LGD: Met Office / Cabinet Office COBR Unit  OGD: DHSC, DfE, DfT, DESNZ, DBT, DLUHC, DCMS, DSIT, DoJ, DEFRA	UKHSA has a leading role in the preparedness, response and recovery of extreme heat events, as well as comms messages. UKHSA is responsible for the coordination of the response until an Amber Heat-Health Alert. If required, and after a joint dynamic risk assessment, the coordination may change to the Cabinet Office COBR Unit, since there is the risk of a national emergency and starting to observe impacts that affect other sectors than health.
Low temperatures and snow	LGD: Met Office / Cabinet Office COBR Unit  OGD: DfE, Defra, DESNZ, DBT, DfT, DLUHC, DCMS, DHSC, DSIT	Develop and support the implementation of the Adverse Weather and Health Plan and associated guidance and materials  Issue heat-health and cold-health alerts, in partnership with the Met Office
Storms	LGD: Met Office / Cabinet Office COBR Unit	Support the overall governmental response to storm events
Flooding (coastal, fluvial and surface water)	LGD: DEFRA  OGD: DLUHC, HO, DfT, DHSC, DESNZ	Develop and support the implementation of the Adverse Weather and Health Plan and associated guidance and materials.  Support the overall governmental response to flooding events
Drought	LGD: DEFRA  OGD: DESNZ, DCMS, DfT, Home Office	Provide public health guidance on the impacts of drought on health
Wildfires	Wildfire: HO, DEFRA, Cabinet Office.  Fire and rescue services, represented by the National Fire Chiefs Council	Provide public health risk assessments into the LRF and cross government command and control structures  Facilitate and encourage collaboration with other Category One responders and researchers into the public health effects of wildfires  Provide public health risk assessment during wildfires
Volcanic eruptions	Cabinet Office lead and fund the Met Office forecasting capability  DfT lead for transport  DEFRA lead for air quality	UKHSA will facilitate Public Health group for UK and ROI and coordinate public health advice, including health messages to the public, briefings for government departments and liaison with international partners, as required. UKHSA will ensure the air quality information is appropriate for the audience producing evidence-based guidance



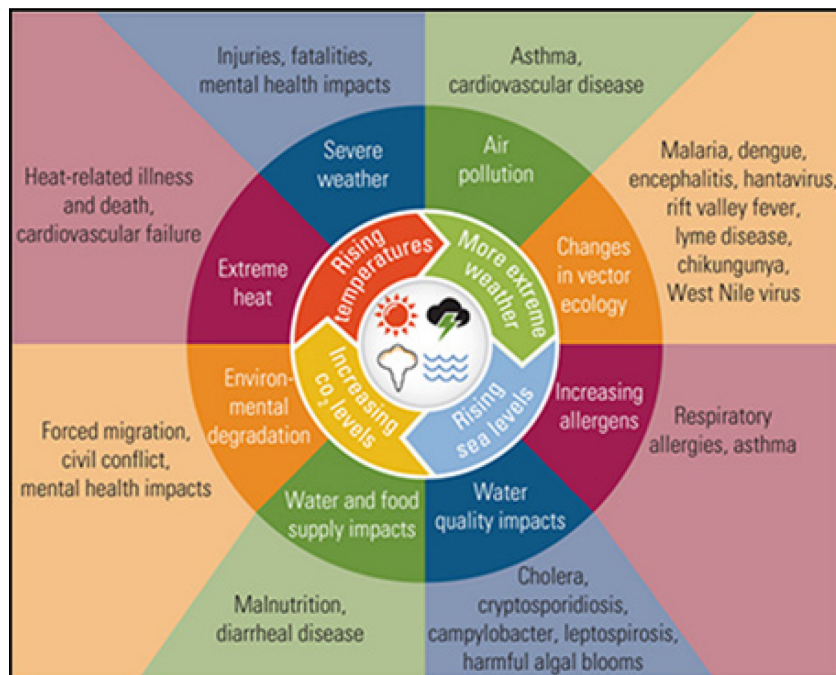
<p>Air pollution due to natural hazards</p>	<p>DEFRA (outdoor air pollution only).</p> <p>No lead government department for indoor</p>	<p>UKHSA will ensure that DHSC, other government departments, the public and other stakeholders have up-to-date information on the health impacts of air pollution to encourage behaviour change at every level, and the actions to take to mitigate against health impacts, including health inequalities.</p> <p>As part of its core activities, UKHSA:</p> <ul style="list-style-type: none"> <li>• develops and shares the evidence base on air quality impacts on health and actions to take to mitigate exposure, both outdoor and indoor</li> <li>• improves on how information on the health impacts of air pollution is communicated</li> <li>• works to counter false narratives that threaten behavioural change through an evidence-based approach</li> </ul>
<p>Noise pollution</p>	<p>DEFRA for Policy Statements for England &amp; statutory nuisance</p> <p>DfT for transport</p> <p>DLUCH for planning &amp; Approved Documents (building standards)</p> <p>DENSNZ noise from energy sources</p> <p>DfT noise in schools</p> <p>DHSC noise in hospitals</p> <p>HAS noise in workplaces</p>	<p>Making sure DHSC, OGDs and other stakeholders have up to date information on the health effects of noise in the community (i.e. explicitly excluding noise in the workplace).</p> <p>Our long-term aim is to build up the evidence on actions to reduce the health burden attributable to noise.</p> <p>We are a statutory consultee on noise impact assessments for NSIPs</p>
<p>Radiological hazards</p>		

<sup>1</sup> LGD: Lead Government Department; OGD: Other Government Departments contributing



**Appendix 2**
  
**Recent development: the centre for climate and health security**

Climate change is a major current and future risk to the global population, representing not only extreme risks to biodiversity but also to human health. The impact of climate change is already being felt with an increasing number and severity of extreme weather events, negative impacts on air quality and pollution, altered distribution and ecology of climate-sensitive infectious diseases and negative impacts on food safety and food supply as well as negative mental health impacts. Indirect, cascading, and compound risks have the potential to generate multi-region and catastrophic cascading impacts across the globe, with widespread implications for societal stability and population health and safety. These may arise from forced migration, environmental refugees, civil conflict, cybersecurity threats and violence, arising from conflict over disrupted food, water, or energy supplies. Cascading risks may also arise from low-probability, high-impact events such as climate tipping points (e.g. collapse of West Antarctic ice sheet).



This figure is a derivative of "Impacts of Climate Change on Human Health", in Patel, V., D. Chisholm., T. Dua, R. Laxminarayan, and M. E. Medina-Mora, eds. 2015. Mental, Neurological, and Substance Use Disorders. Disease Control Priorities, third edition, volume 4. Washington, DC: World Bank. It has been adapted with permission from Dr. George Luber (PhD), National Center for Environmental Health, Centers for Disease Control and Prevention, Atlanta, GA, USA

The UKHSA has established the new, Centre for Climate and Health Security (the 'Centre' or 'CCHS') to respond to this public health priority. Building upon existing UKHSA work in this area, the Centre has been established to deliver a 'step change' in UKHSA's contribution to climate and health and secure improved public health outcomes. Specifically, **the Centre will provide scientific advice and support to local, national and international partners to ensure that the impacts of climate change and extreme weather on public health are considered and embedded in system design**. In practice, this entails:

1. Increasing awareness of the impacts of climate change on public health across local and national government and with international partners
2. Developing the evidence base concerning the impacts of climate change on public health
3. Mobilising this evidence base to inform the design and implementation of climate change policies across local and national government and with international partners

UKHSA's advisory and influencing roles are guided and targeted according to the following:

- Those stakeholders and partners that have the power to make decisions and control resources to act on adaptation initiatives for climate change
- Those that may align with us to form 'coalitions' of evidence-based advice to increase influence on decision-makers (for example supporting Greener NHS in their work with ICS's).

In addition, the Centre also provides core **operational** capability to **prevent** health harms arising from the impacts of climate change by providing surveillance for climate-sensitive vector-borne diseases and alerting systems concerning extreme weather events. The Centre will **respond** with health protection teams to extreme and adverse weather hazards that will be exacerbated by climate change, providing public health advice and guidance concerning how to protect health during vector-borne disease outbreaks and during extreme weather events. The CCHS will also **build** the UK's Health Security capacity by developing knowledge around resilience to climate risks working alongside industry, academia and government.

**In the past 6 months**, the Centre for Climate and Health Security, for example, has been launched, released its Adverse Weather and Health Plan, established renewed partnerships with the DHSC, Met Office, and FCDO (among others), secured close to £1M in external funding, partnered on several grant proposals, and established a training hub that welcomes its first 3 Specialist Public Health Registrars. For example, the Centre was recently successfully awarded funding totaling approx. £5M (£800K to UKHSA) to support vector borne disease research, partnering with academia and the Animal and Plant Health Agency (APHA). An additional £134k has been awarded in 23/24 to support UK Overseas Territories with capacity building, technical expertise and mosquito surveillance. The Centre is additionally developing a UKHSA-led bid to establish a Centre for Doctoral Training in Climate Services for National Health Security (NERC funded), with the potential to co-host and train up to 50 PhD students (£2.5M), and partnering on 3 consortia bids for UKRI funding (up to £2.5 for UKHSA). This complements ongoing engagement with several Health Protection Research Units (HPRUs).



In doing so, the Centre is attracting growing opportunities for new funding, training and partnership requests, and bilateral and multilateral interest. These early successes have received substantial attention national and internationally as other governments and agencies seek to develop capability to respond to the health threats associated with climate change.

### Appendix 3 Horizon scanning: medium-long term climate risks

The UK's annual average temperature over the last decade (2013-2022) has risen by around 0.75°C above the average for the 1981-2000 period. The longer-term risk from climate-related health hazards depends upon global trajectories of decarbonisation and warming, and **there is substantial uncertainty regarding the trajectory of risks that will need to be prepared for and respond to**, largely due to the difficulty of predicting the extent to which global nations will mobilise to decarbonise and mitigate warming. The UKHSA has limited control over these factors as determinants of health.

A **best-case scenario** for climate change risks to health would be rapid and aggressive decarbonisation to limit warming to 1.5°C, combined with high levels of adaptation to mitigate the health impacts of unavoidable warming. National capacity and preparedness would require additional expansion of current capabilities (e.g. for extreme events, vectorborne disease emergence) to mitigate health impacts up to 1.5°C (0.5°C further warming). This scenario is now considered unlikely given a lack of substantive global decarbonisation.

**Current global ambitions are consistent with 2-3°C of warming**, reflecting a trajectory of constant and slowly accelerating but disjointed efforts to decarbonise, combined with current and modestly increasing levels of adaptation. In this case, national capacity would need to be substantively expanded to account for major changes in health risks (such as new vectors and disease emergence, more severe and frequent heat waves, severe and extensive flooding). National capacity may approach or exceed its ability to prevent and mitigate severe health risks.

A **worst-case scenario** of warming beyond 4°C remains possible but unlikely, and would be associated with catastrophic health impacts, both within the UK but also through global migration and conflict associated with impacts outside of the UK. Global tipping points for climate, natural, social, and health systems may be reached even at modest levels of warming (for example melting of the Greenland and West Antarctic ice sheets and associated sea level rise of several metres).

The UK Climate Change Committee (CCC)'s most recent Report to Parliament on Progress Adapting to Climate Change (March 2023) rated the UK's progress on health-related adaptation to climate change as '**Insufficient**' and provides a suitable basis for assessment of progress on climate risks to health within the UKHSA's remit, as well as a basis for the CCHS's priorities for growth.

The CCC estimates that prevention of deaths due to extreme weather events is **feasible at low-moderate levels of warming** (1.5-2°C). Given this, it will be important to consider the implications of different levels of warming for health risks and interventions across the UKHSA to ensure resilience of programming and policy recommendations. In the longer-term, **the UKHSA will be unable to meet its objectives if global decarbonisation follows a scenario**



**leading to higher levels of warming (>2°C)** given increasingly challenging health risks, unsuitability of many interventions, and high costs associated with alternative interventions.

The CCHS is currently identifying and prioritising plans for **Phase 2** of its growth model, including development of provision of **econometric** (in collaboration with UKHSA's Data, Analytics and Surveillance Group) **and evaluation** (in collaboration with the Behavioural Sciences Unit and new Evaluation Division) **capabilities to provide robust evaluation and assessment of the cost-effectiveness** and impact of intervention options. This includes development of data analytics capability to enhance surveillance of climate-related risks and vulnerabilities.

Phase 2 growth planning also includes provision of a **co-benefits toolkit** to support Local Authorities in assessing potential benefits or synergies and trade-offs to health from a range of intervention and planning options, a need that has been widely and strongly expressed across the country. This will complement and be integrated into Phase 2 development of a **Climate and Health Knowledge Portal**.

Phase 2 additionally includes plans for an expansion beyond SpR training to develop **training provision for local authorities and cross-government bodies** on climate risks to health. Finally, Phase 2 plans include launch of a **Climate and Health Assessment Reporting cycle**, mirroring the Intergovernmental Panel on Climate Change and providing a regular assessment mechanism for UK climate and health security preparedness and response. This will replace the current 'Health Effects of Climate Change' report, which focuses primarily on impacts and risks, and does not capture response options, effectiveness/evaluation, or assessment of progress.

## **Appendix 4**

### **Deep dive: preparedness and response to extreme weather**

UKHSA's specialist capabilities on the health implications of adverse and extreme weather events are located within the **Centre for Climate and Health Security (CCHS)** working with Health Protection Teams and other functions across UKHSA. A key aim of the CCHS is to facilitate partnerships and collaborations across the UKHSA and its partners, and support integration of climate preparedness and resilience into cross-Agency programming.

The UKHSA, provides **strategic and operational planning** advice on public health risks and **coordinates cross-government emergency response** for health and social care during weather alerts, if impacts are not observed in other sectors. This includes for example weekly calls with the Met Office to review forecasted weather events that might impact on health and wellbeing and leading or supporting the joint dynamic risk assessments with other governmental departments.

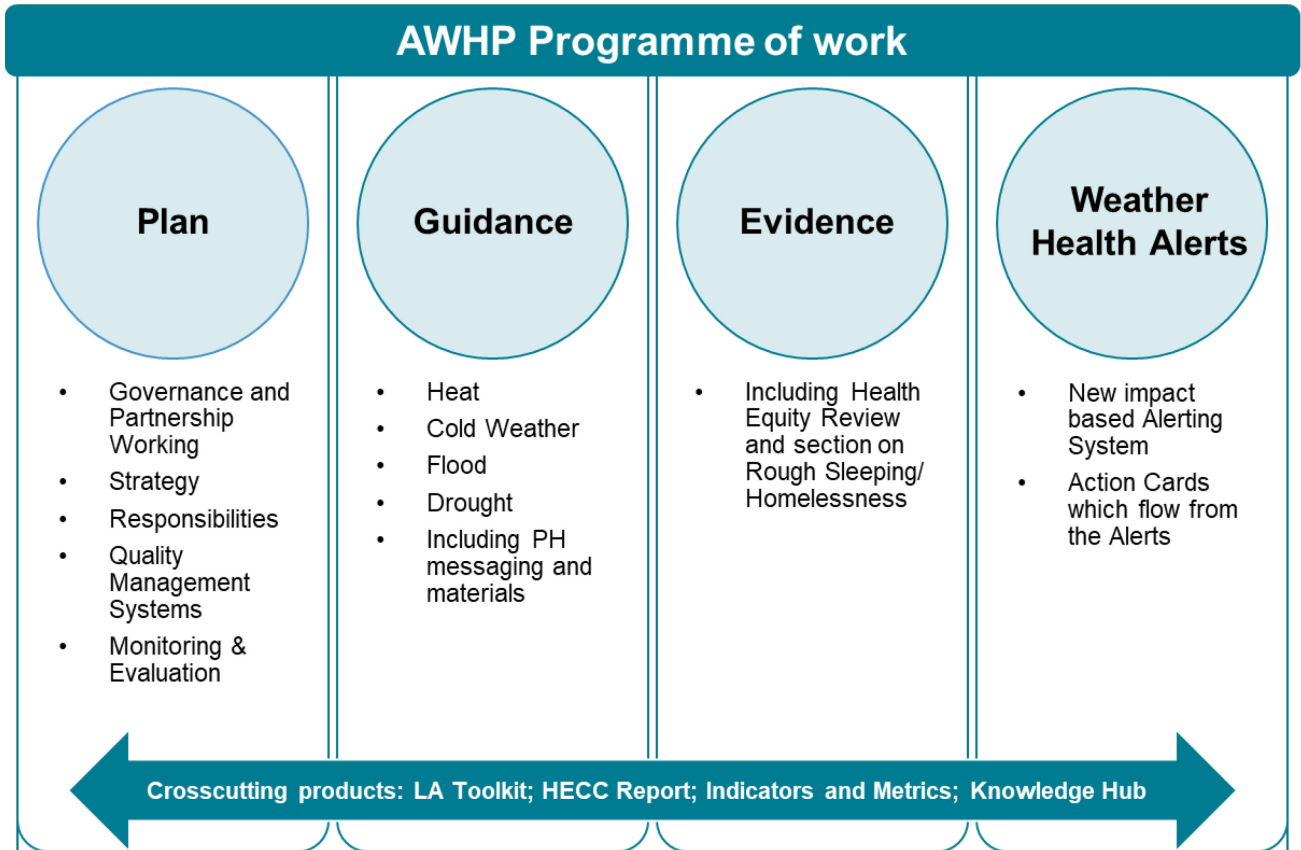
In April 2023, the UKHSA launched the first **Adverse Weather and Health Plan (AWHP)**, providing a core planning function for partners to plan for the health impacts of adverse weather events. The AWHP establishes standard operating procedures for adverse weather. This is among the first comprehensive adverse weather plan of this scope in the world and reflects a step-change in preparedness for the health impacts of extreme weather events.

#### **The Adverse Weather and Health Plan (AWHP)**

In response to the 2003 heatwave which struck Europe and the UK causing many excess deaths, in 2004 the Department of Health published its first Heatwave plan designed to keep the public safe and ensure business continuity during periods of extreme heat. In addition, in the early 2000s, it set up a system of "winter planning" for the NHS and though this continues, it has been supplemented by the Cold Weather plan (since 2011) where the wider impact of cold and wintery weather on the public's health is addressed.

However, in 2017, the second Climate Change Risk Assessment for the UK (CCRA2), set out priorities for climate action across the Government for the United Kingdom (UK). In the following year, 2018, the second National Adaptation Programme (NAP2) for the UK set out actions that government departments would need to take to address these risks. One of these actions was to develop a 'Single Adverse Weather and Health Plan',

UKHSA agreed with DHSC that previous separate plans for weather events will be pulled together for summer 2023 in the AWHP (formerly called the Single Adverse Weather and Plan). This was first published launched in April, with two webinars for a broader engagement of key partners in May 2023 in preparation for the start of the summer. The programme has several components as illustrated below:



The Plan sets out the overall strategy and covers issues related to governance and partnership working and responsibilities of stakeholders in delivering the Plan under the CCA and other guidance. It also sets out the quality management systems and how the plan will be monitored and evaluated. The Plan has been published with the support of key stakeholders including the NHS England, Met Office, and Local Government Association to underscore the partnership involved in delivering the AWHP.

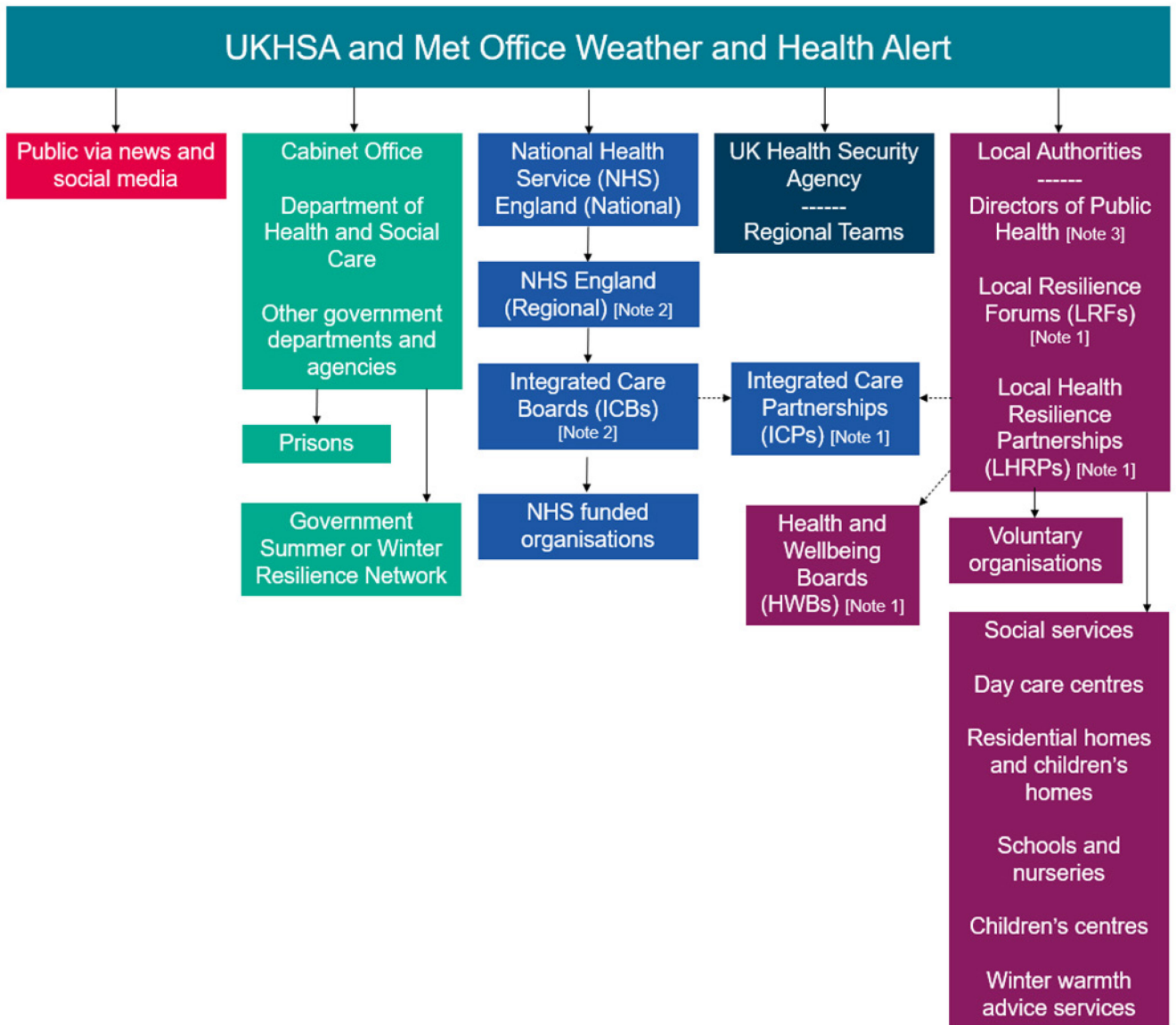
Previous guidance for hot weather was reviewed ahead of the Summer, providing guidance for organisations, professionals and communities in dealing with adverse weather events. Associated public health messages and materials were updated and are a crucial element of the plan. The cold weather related guidance will be reviewed and published by September 2023, as well as the flooding guidance that will be published by October 2023.

The AWHP is underpinned by a Supporting Evidence document. The evidence base underpinning the issues of adverse weather and health has been reviewed as, including an examination of those groups most vulnerable and at-risk.

UKHSA produces, in conjunction with the Met Office, **weather-health alerts** for cold weather and heatwaves to advise local and national teams of impending events and the actions to take to respond to these. A major upgrade to the weather-health alert system (for heat and cold) is being introduced starting summer 2023, which provides a stronger evidence base for health

risks (including severity and likelihood of extreme weather events by region) and a move to impact-based dynamic risk assessment. Alerts are underpinned by guidance within the AWHP and a series of **'Action Cards'** advising the NHS, social care organisations and professionals and the voluntary and community sector with the actions they should take to keep the public healthy and safe under different levels of risk. Heat-health action cards and guidance, for example, are customised to guide differential response among Providers and Commissioners of health and social care, staff at social care facilities, and those who provide care for vulnerable populations.

Figure X below illustrates how an Alert when issued is disseminated across the wider system to raise awareness and for appropriate bodies to take action.



Communications cascade during heat-health alerts





Figure Y below, is a summary of actions to be taken by different organisations and stakeholders when a Heat-Health alert is issued as noted previously. The actions cover both periods of heatwave events as well as indicating the sorts of actions which agencies should take to prepare for future events as well. Chapter 5 of the [AWHP](#) outlines more generally how agencies should consider developing plans to meet the goals of the plan to protect health from weather related harm.

Summary hot weather actions for health and social care organisations and professionals, communities, and national government					
	Long-term strategic actions	Pre-summer readiness and summer preparedness	Yellow Alert	Amber Alert	Red Alert
Commissioners of health and social care	<ul style="list-style-type: none"> <li><input type="checkbox"/> Identify those at risk</li> <li><input type="checkbox"/> Coordinate and update Business Continuity Plans (BCPs) and/or hot weather plans</li> <li><input type="checkbox"/> Develop training Plans</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Test alerts and information cascades</li> <li><input type="checkbox"/> Ensure relevant staff are trained and aware of hot weather guidance and plans</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Update local risk assessments and cascade alerts</li> <li><input type="checkbox"/> Communicate alerts and public health messaging</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Continue Yellow Alert actions</li> <li><input type="checkbox"/> Increase advice to staff and the public</li> </ul>	<ul style="list-style-type: none"> <li>Central government will declare an emergency in the event of severe or prolonged hot weather affecting sectors other than health and if requiring coordinated multi-agency response</li> <li><input type="checkbox"/> Continue Amber Alert actions</li> </ul>
Providers of health and social care	<ul style="list-style-type: none"> <li><input type="checkbox"/> Consider surveillance and monitoring for evaluating effectiveness of interventions</li> <li><input type="checkbox"/> Consider any environmental improvements</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Test alerts and information cascades</li> <li><input type="checkbox"/> Identify cool rooms and install or check thermometers</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Update local risk assessments and cascade alerts</li> <li><input type="checkbox"/> Ensure staff in all settings are considering room temperature</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Continue Yellow Alert actions</li> <li><input type="checkbox"/> Ensure vulnerable individuals are actively monitored</li> </ul>	
Voluntary and Community Sector		<ul style="list-style-type: none"> <li><input type="checkbox"/> Test alerts and information cascades</li> <li><input type="checkbox"/> Ensure relevant staff are trained and aware of hot weather guidance and plans</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Update local risk assessments</li> <li><input type="checkbox"/> Communicate alerts and public health messaging</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Continue Yellow Alert actions</li> <li><input type="checkbox"/> Monitor indoor temperatures and increase support to vulnerable clients</li> </ul>	
National Government		<ul style="list-style-type: none"> <li><input type="checkbox"/> Test alerts and information cascades</li> <li><input type="checkbox"/> Coordinate plans across national organisations</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> UKHSA and Met Office to monitor forecast and conduct dynamic risk assessments</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Continue Yellow Alert actions</li> <li><input type="checkbox"/> Organisations to monitor own information and intelligence</li> </ul>	

An example Heat-Health Action Card for heat-health alerts