Chemicals and Climate Change Nexus:

Interventions to reduce interdependencies and their impacts

Executive summary

Climate change impacts chemical exposures in various ways (e.g. altering the materials made of chemicals or chemicals themselves due to intensive heat, remobilising chemicals into the environment through flooding events, exacerbating existing harmful conditions – air pollution, asthma, pests, and diseases, in turn requiring an increase in pesticide or pharmaceutical use). Conversely, the production and use of chemicals impact climate change through greenhouse gas (GHG) emissions and if harmful, through reduced recyclability of materials. The impacts on human health and the environment from these interlinkages cross two sectors - the climate change/energy sector and the chemicals sector. Recently discussions on how to address these interdependencies overlapping impacts have started as they are part of what is called the triple planetary crises (climate change, biodiversity loss and pollution including chemicals and waste). What is required is an understanding of each sectors's impacts on the other and how to address these collectively. This policy brief guides regulators and decision-makers within each sector, particularly in low- and middle-income countries (LMICs). The focus is on interventions addressing the interlinked impacts of climate change and chemicals (including agricultural pesticides), including promulgation into relevant regulations and promoting national intersectoral collaboration. It also presents advice for those involved in international conventions, frameworks and negotiations from the two sectors with the goal of protecting human health from chemical exposures and health consequences of climate change. Particularly more engagement between key stakeholders and decision-makers from both sectors is needed. Furthermore, it highlights the need for detailed research on these sector interlinkages, especially to inform the work of the United Nations Environment Programme's (UNEP) planned Science Policy Panel on Chemicals, Waste and Pollution Prevention (SPP).[1]

BACKGROUND

The chemicals and climate change sectors are fundamentally linked to fossil resource use and directly and indirectly impact each other through many different mechanisms. This interconnectedness between climate change and chemical pollution puts human health, especially vulnerable populations, at high risk.

Industrial ***chemicals*** refer to substances and pesticides used in industry, agriculture, construction, households, veterinary and human medicine. ***Chemical exposures*** have effects on human and ecosystem health and functioning. Chemical exposures have been researched for years. More recently, the growing threat and potential impacts caused by intertwining of climate change, environmental ***(chemical) pollution*** and biodiversity loss on our lives, eco-systems, human and animal health have caused additional concern resulting in (international) commitments to address the threat posed by this "triple crisis".

1 SPP - https://www.unep.org/oewg-spp-chemicals-waste-pollution

The ***Climate Change*** [or climate policy] sector refers to the United Nations Framework Convention on Climate Change (UNFCCC),[2] the fossil fuel industry, government departments working on climate adaptation or mitigation actions (described in Nationally Determined Contributions or NDCs), non-governmental organisations (NGOs), and others focusing on related policies. Coal, wood, petroleum, methane (natural gas), and oil shale are fossil materials used for fuel and feedstocks in the chemicals industry. Increasing greenhouse gas emissions trap some of the solar radiation in the atmosphere, which increases global temperatures (global warming). As these emissions rise, global climate change intensifies. This manifests in an increase in the frequency of extreme weather events (EWE) such as floods, heatwaves, droughts, high winds, and storms, rising global temperatures, sea-level rise, and changes in rainfall.

Similarly, the ***chemicals sector*** refers to the United Nations Global Framework on Chemicals (GFC)[3] – for a Planet Free of Harm from Chemicals and Waste, relevant chemical conventions, the chemical industry, government departments, NGOs, and others working on chemicals-related issues. In the 2023 negotiated agreement of the GFC, a target (**Box 1**) was included highlighting the need to identify and strengthen the linkages between chemicals, waste management and climate change as well as biodiversity loss.

There are several ways in which climate change and chemicals are interlinked and impact human health as illustrated in Figures 1 and 2.

Box 1: Global Framework on Chemicals (GFC) Target E6

By 2030, stakeholders identify and strengthen, as appropriate, synergies and linkages between chemicals and waste management and other key environmental, health and labour policies, such as those related to climate change solutions, biodiversity conservation, human rights protection, universal health coverage or primary health care.

CLIMATE CHANGE IMPACT ON CHEMICALS (FIGURE 1)

Climatic changes directly or indirectly affect the use, fate, or movement of chemicals. This is likely to directly alter the distribution and behaviour of chemicals in the environment, resulting in potentially toxic exposures, and indirectly impacting increased chemical/pesticide use. Ultimately, this will have a negative impact on human health (**Figure 1**; e.g. cancers, neurotoxicity, reproductive impacts, and behavioural problems). Although there is some epidemiological evidence of these impacts, they are only observational and document what has happened. What is **not being researched** are interactions between climate risk factors and chemical exposures or the impacts of future scenarios of chemical exposures.

2 UNFCCC - https://unfccc.int/
3 GFC - https://www.chemicalsframework.org/

Climate change can exacerbate health impacts linked to chemical exposures in different ways. **For example**,

Warmer temperatures can increase exposure to toxic chemicals.

- Increased temperatures aid volatile chemicals to evaporate more easily (i.e. **volatilisation**) resulting in contaminated air, soil, and water. Increased volatilisation could also lead to **increased pesticide use**. **Temperature-sensitive chemicals** may be more volatile leading to increased risks of accidents happening (e.g. stored ammonium nitrate can explode during heat waves).
- Increased temperature can also result in the **degradation** (i.e. breaking down) of chemicals into toxic byproducts, as well as non-toxic byproducts impacting their effectiveness.
- Humans' **difficulty to adapt to heat stress** could make it easier to absorb chemicals compromising immune systems and resulting in chronic health effects. For example, heat stress causes the body to sweat, opening skin pores and making skin more receptive to absorbing chemicals in the air or on the skin. Also, people breathe more rapidly and deeply to cool down, increasing inhalation of contaminated air.
- Pest populations, vector borne diseases (e.g. mosquitoes transmitting malaria or dengue fever), and crop vulnerability to pests are predicted to increase with rising temperatures and changes in precipitation, leading to **increased use of pesticides to manage pests and diseases, increased production season** and **ensure crop survival**.

Extreme weather events

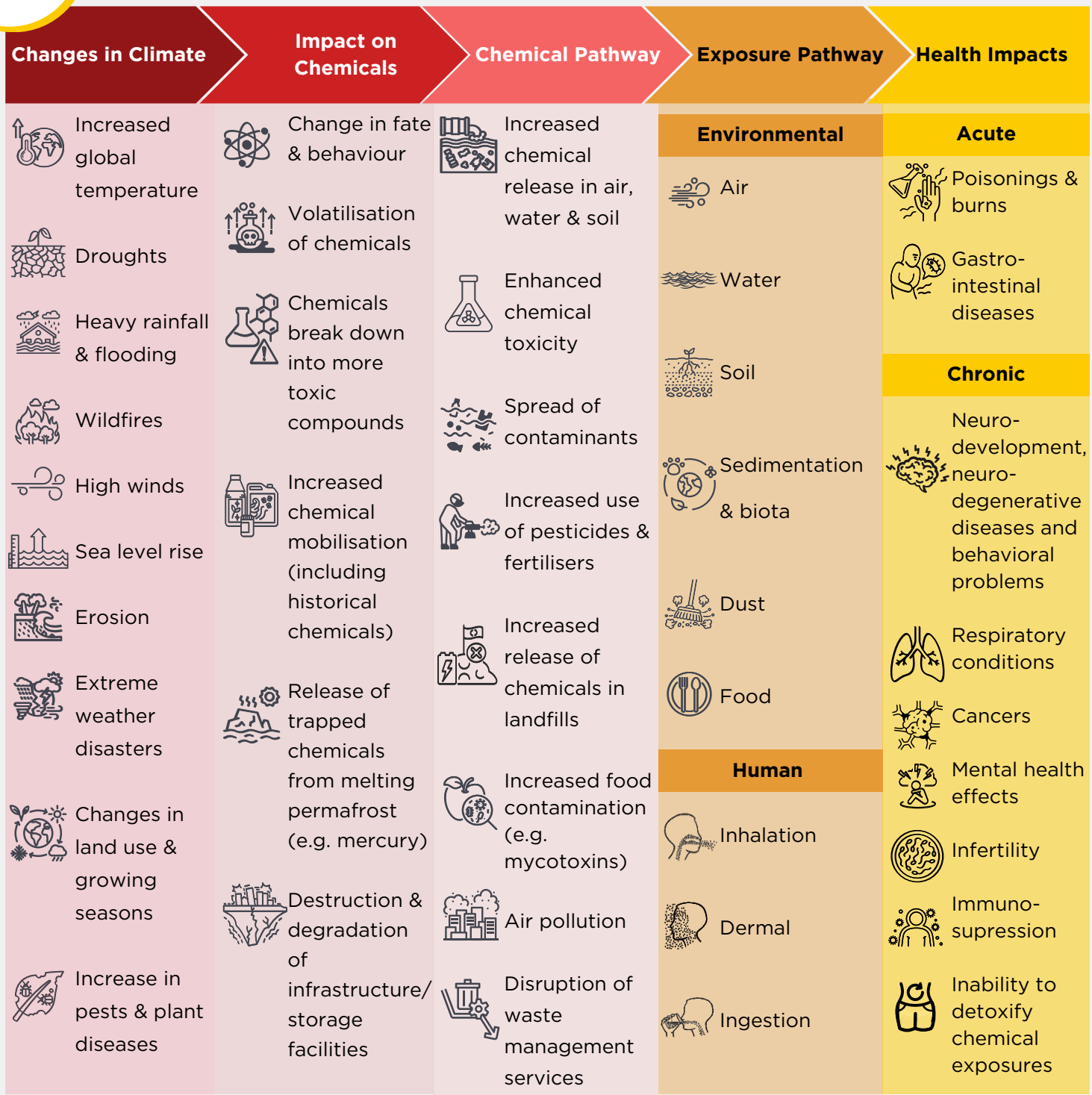
- **Extreme precipitation, storms and floods** (and sea rise) can contaminate water through the increase of urban and agricultural run-off of petrochemicals, pesticides and fertilisers, chemical waste, and industrial and consumer chemicals, including, persistent organic pollutants (POPs) into surface waters and groundwater.
- **Wildfires** can lead to increased aerial spreading of fire-fighting chemicals, and release of toxic chemicals from burning homes, buildings and factories.
- **Drought** can result in increased concentration of chemicals and toxic materials that are released into water sources when it rains.

Exacerbation

- Climate change can **exacerbate the health impacts of air pollution.** For, example volatile organic compounds released by chemical products contribute to the production of smog and poor air quality, impacting the lungs or existing respiratory diseases such as asthma or chronic obstructive pulmonary disease (COPD).

Figure 1

Pathways of Climate Change Impacts on Chemicals and Health



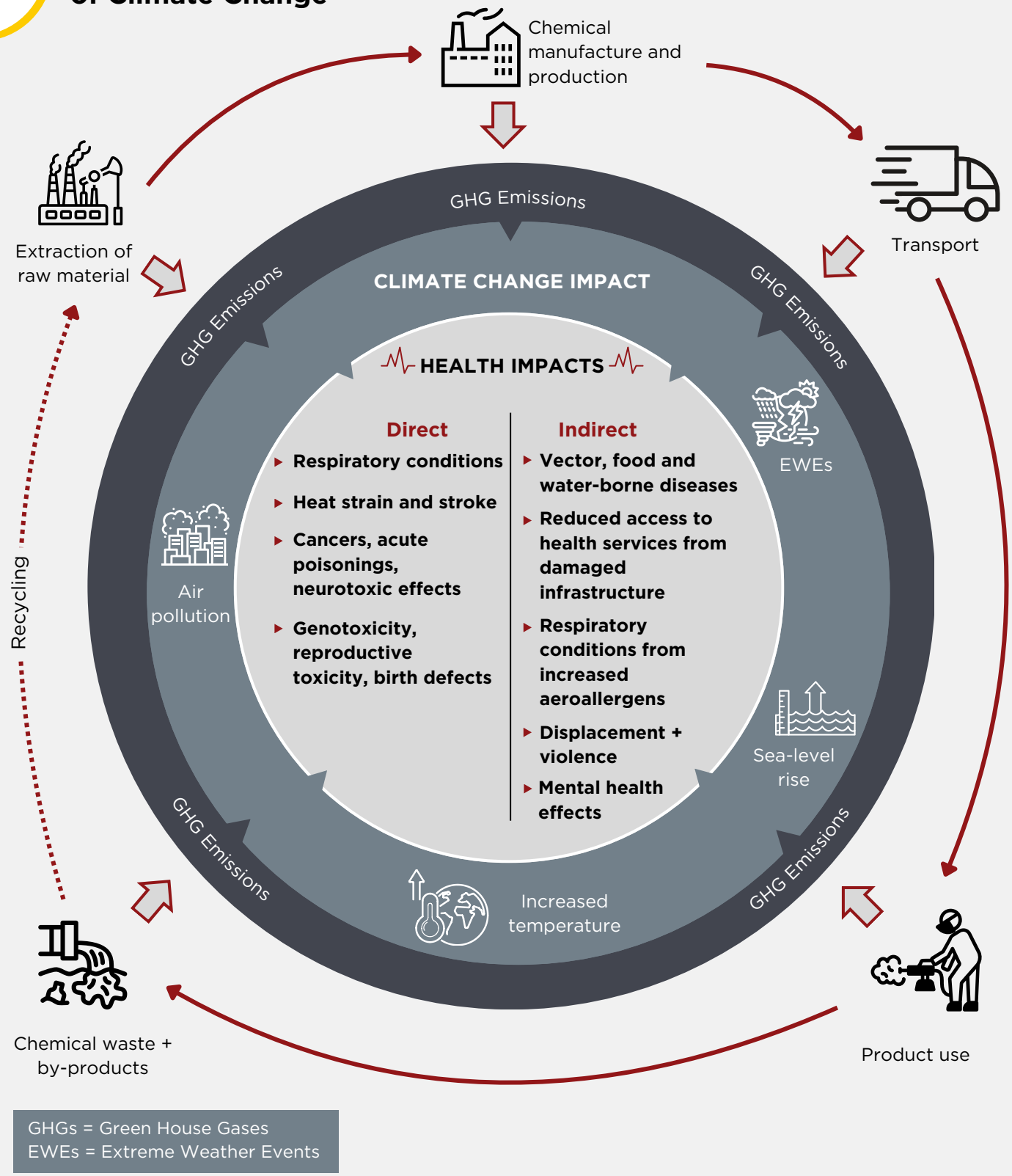
CHEMICALS IMPACT ON CLIMATE CHANGE (FIGURE 2)

Chemicals also influence climate change, resulting in health impacts.

The life cycle of chemicals starts with the extraction of raw materials and feedstocks, then to transportation, production and use, and the waste and disposal stage (**Figure 2**). All these processes rely heavily on fossil fuels, which emit large quantities of **greenhouse gases** (GHG) into the atmosphere.

Figure 2

Pathways of Chemicals' Impact on Human Health Through Mechanisms of Climate Change



Fossil fuels are used to make 99% of all synthetic chemicals, including pesticides. In 2021, the pesticide company Syngenta reported its operations emitting 9.8 million tonnes of carbon dioxide (CO_2 equivalent to more than two million cars). The chemical sector is the third largest industrial emitter of carbon dioxide. The most significant volume of chemical products comes from plastics. However, there are hidden contributions within the chemical life-cycle (**Figure 2**), for example, by-products from chemical reactions, the release of and leaking of chemicals during use and end of life-management and the improper disposal of waste.

Many chemicals used in industrial processes and agriculture are also classed as having a high **global warming potential** (GWP). That is, certain chemicals can trap heat in the atmosphere far more effectively than CO_2. Many chemicals with a high GWP remain in the atmosphere for a long time resulting in increased warming effects for many years.

Direct health impacts are those that are caused as an explicit result of a climatic event. For example, rising temperatures directly cause heat stroke and strain and contribute to cardiovascular diseases and stroke, and air pollution causes and worsens respiratory conditions. **Indirect impacts** are the result of indirect pathways such as mental health effects from forced displacement and migration due to extreme weather events such as flooding or drought.

The chemical industry is responsible for high levels of GHG emissions throughout the life-cycle of a chemical. The biggest impact on GHG emissions comes from chemical use and the pollution this generates.

The chemical and fossil fuel industries are intimately linked. That is, the chemical sector relies on fossil fuel resources as energy sources and feedstock for most of its products.

All these processes contribute to climate change and its impacts such as rising temperatures and extreme weather events that cause direct and indirect health effects.

CALL FOR ACTION

By recognising the interlinkages between these two sectors can avoid either not taking responsibility for impacts, while also realising the co-benefits of solutions that address both chemicals and climate change. Therefore, there is an urgent need to:

Reduce the quantity of **hazardous chemicals** that humans are directly and indirectly exposed to daily. This is critical to lowering the overall stress on human health caused by various factors (e.g. temperature, chemicals, infections).

Reduce the contribution of the production and use of chemicals to **GHG emissions**.

TIMELY ACTION INTERVENTIONS

Below are suggested actions for those working and researching in both sectors. Both sectors are encouraged to immediately start incorporating these interventions into their current activities and strategies.

Improved sectoral collaboration

- **International level** – key stakeholders (e.g. intergovernmental organisations (IGOs), NGOs, government officials) to attend key sector meetings to raise sector-relevant issues – e.g. UNFCCC, GFC, relevant conventions (e.g. Rotterdam, Stockholm, Basel, Plastics Treaty); identify incentives to break down silos and promote cross-sector engagement. More research and, how to implement into policy, on the nexus of the two sectors is included in reports from the Intergovernmental Panel on Climate Change (IPCC) and the upcoming SPP.
- **Regional level** – chemical regulators, researchers, and NGOs, to attend relevant regional meetings led by climate change officials (e.g. environment, health) and other organisations, and vice versa.
- **National level** – regular engagement and meeting attendance between climate change and chemical policymakers/regulators/government officials. This collaboration has many co-benefits, as reducing greenhouse gases has a high potential to mitigate harms from hazardous chemicals and vice versa. The various strategies for mitigating one can have synergistic beneficial outcomes for the other.

Increase research and data access

- **Alternatives** – identify low acute toxic chemicals and processes to reduce toxicity (replace chemicals with chronic hazards), emissions and hazardous waste.
- **Data generation**– providing evidence of the impact of chemicals and climate change on each other. Include research on the specific impacts on children, and other vulnerable groups (especially with poor health or from low socio-economic backgrounds) and provide gender-disaggregated data.
- **Data access** – documenting impacts requires access to transparent data from the chemical sector.
- **Use and waste** – research on efficient institutional arrangements to reduce the production and use of fossil-based materials and chemicals, and toxic exposures to increased prolonged use, reuse, refurbishment, and recycling of materials containing various chemicals and mixtures.

Legislate changes nationally

- **Grouping chemicals** into classes for regulation to accelerate the control of hazardous substances rather than regulating one chemical at a time.
- Legislation should specifically refer to **workers** at risk from climate change and chemicals interlinked impacts (e.g. firefighters).
- **Banning and eliminating the most hazardous chemicals, as well as preventing future hazardous chemicals**, particularly endocrine-disrupting chemicals in consumer products, "forever chemicals" (i.e. PFAS), and highly hazardous pesticides.
- **Improved governance structures** for chemical regulation, enforcement, and monitoring (e.g. implement specific legislation (**Box 2**), request data from industry on chemical and climate change impacts).
- **Promote inclusion of chemical health hazards in climate policies**.
- **Require the chemical industry to publish its chemical footprint annually** (similar to other sectors publishing their carbon footprint).
- **Increase implementation of Extended Producer Responsibility schemes** – bill-of-contents to make tracing and circular use of materials and chemicals easier, clean up chemical contaminated sites to prevent leaching during flooding and spread by high winds.
- **Implement sustainable financing mechanisms** – fees, taxes, cost incentives and other cost recovery measures for chemicals and climate change to cover the cost of acting on the joint health impacts.

Box 2: National/regional legislation examples:

- The European Union's Registration, Evaluation, Authorisation, and Restriction of Chemicals (REACH) legislation promotes the substitution of hazardous chemicals with alternatives that lower GWP and the development of the Safe and Sustainable by Design (SSbD) criteria for chemicals and materials.
- The US Environmental Protection Agency's Toxic Substances Control Act (TSCA) considers the impacts of chemicals' potential contribution to climate change (e.g. phasing out of hydrofluorocarbons (HFC) with high GWP).
- California developed a strategy to reduce short-lived climate pollutants that included methane, black carbon and fluorinated gases.
- The Canadian Environmental Protection Act (CEPA) and HFC regulations included provisions to control and reduce the use of HFCs.

RESOURCES

- CHEMTrust. (2021) Climate change and chemicals: what are the connections? Available at: https://chemtrust.org/climate/
- International Labour Organisation (ILO). (2023) Chemicals and climate change in the world of work. Impacts for occupational safety and health. Research report. Available at: https://www.ilo.org/publications/chemicals-and-climate-change-world-work
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- UCT Chemical Network. Various digests and discussion on Chemicals and Climate Change. Available at: https://health.uct.ac.za/environmental-health-projects/chemical-network
- UK Health Security Agency (UKHSA). (2023) Health Effects of Climate Change (HECC) in the UK: 2023 report, Chapter 12. Impact of climate change on human exposure to chemicals in the UK. United Kingdom. Available at: https://www.gov.uk/government/publications/climate-change-health-effects-in-the-uk
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https://health.uct.ac.za/school-public-health/divisions/environmental-health

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