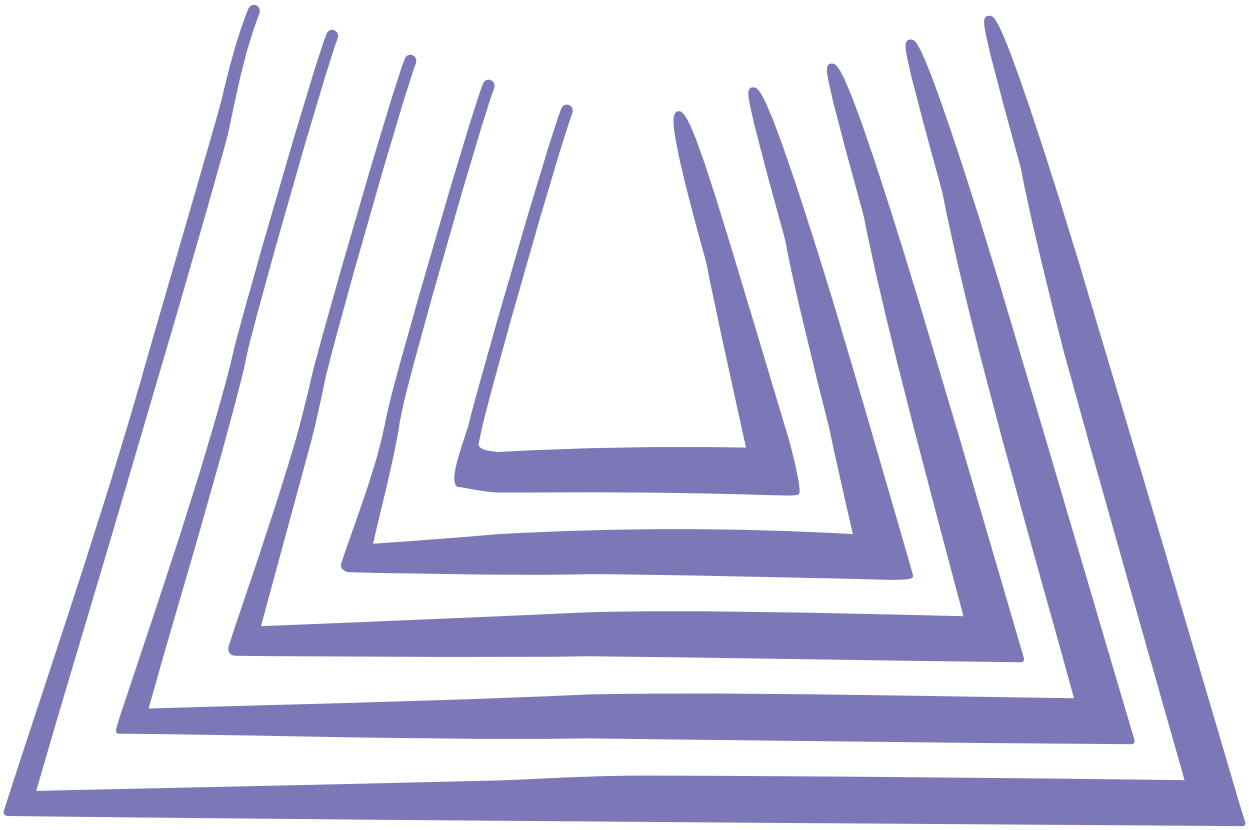
Compendium of WHO and other UN guidance on health and environment

2024 update

Chapter 5. Chemicals



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Contents

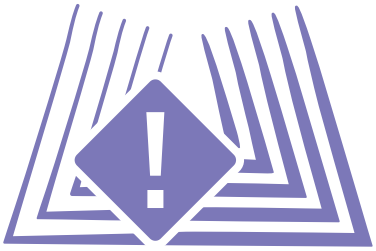
5. Chemicals

5.1 Introduction

Chemicals, whether of natural origin or produced by human activities, are part of our environment and daily life *(1).* Manufactured chemicals include industrial and agricultural products such as pesticides, petroleum products and processed metals. Some chemicals are manufactured for specific uses, while others are unwanted by-products, including waste or products of combustion, such as toxic gases and particles from industrial emissions and the burning of fuel. In 2017, the chemical industry was the second largest manufacturing industry in the world, and the trend is upwards: sales of chemical are projected to almost double from 2017 to 2030 *(2)*.

All people come into contact with chemicals as part of normal life, through the food and drinking-water they consume, the products they use or are surrounded by at home or in the workplace, through contact with the environment (e.g. while breathing air, touching the soil, and swimming in recreational waters) or as a result of a chemical incident. Many of the chemicals people use and are exposed to are harmless or even beneficial; others pose a threat and are hazardous to people's health and the environment. Levels of exposure and the resulting health impacts are determined by social as well as biological factors. Men, women and children are exposed to different kinds and levels of chemicals and are exposed at different frequency. In addition, men, women and children vary in their physiological susceptibility to the health effects of exposure to hazardous chemicals *(3, 4)*.

5.2 Chemical safety



In May 2017, the Seventieth World Health Assembly approved the Chemicals Road Map to enhance health sector engagement in the Strategic Approach to International Chemicals Management (SAICM) *(5)*. The Road Map identifies concrete actions in which the health sector has a lead or important supporting role to play in the sound management of chemicals, while recognizing the need for multisectoral cooperation. The health sector plays an important part in helping reduce health risks from exposures to chemicals by promoting health protection strategies, regulating chemicals, increasing public education, and sharing information and best practices. In taking these actions, the role of the health sector is to increase knowledge and evidence about the toxicological properties of chemicals and their related risks to and impact on human health. Another role of the health sector is to promote the inclusion of health considerations in all chemicals policies, including those developed by other sectors.

At the national level, countries usually have laws to ensure the safe handling of chemicals, and to protect the environment from contamination and consumers and workers from exposure to hazardous chemicals. In addition, laws are often in place to prevent, prepare for and respond to chemical incidents, including accidents at hazardous installations (e.g. chemical plants) and during transport. Regulations may specify how hazardous materials, including chemicals, must be classified, labelled, packaged and transported *(6)*. National laws often also define quality standards for chemicals and standards for chemical emissions, for example the permitted concentration of specific chemicals in air, water, food and consumer products. Specific laws may regulate the management of groups of chemicals, for example pesticides.

Overview

In 2019, a small number of chemicals for which data are available were estimated to cause 2 million deaths from a variety of health outcomes, including poisoning, heart disease, chronic respiratory disease and cancer *(7)*. Chemical pollution also negatively impacts different facets of the ecosystem, which can harm human health.

Some hazardous chemicals raise particular health concerns because of their widespread presence in the environment, their toxicity and their capacity to magnify and accumulate in the environment and in people, and the fact that many people come into contact with them, thereby harming the health of large populations. Chemicals or groups of chemicals of major public health concern include air pollution, arsenic, asbestos, benzene, cadmium, dioxin and dioxin-like substances, inadequate or excess fluoride, lead, mercury and highly hazardous pesticides (HHPs) *(8)*.

Who is impacted by unsafe levels of chemicals in my country?

Exposure of the general population
Some countries routinely conduct surveys to study current exposure to chemicals (e.g. through the environment, food and consumer products), changes in exposures over time and the related health risks. Biomonitoring is often used to determine chemical exposure – that is, concentrations of chemicals are measured in human fluids (e.g. blood, urine) or cells (e.g. hair, fingernails) *(9, 10)*.

Exposure through air, water and food
Mandatory environmental and food monitoring programmes routinely measure chemicals in certain contexts, for example in ambient and indoor air, surface water and groundwater, and in foods, as well as in occupational environments. Often these programmes focus on monitoring specific chemicals that indicate a broader exposure pattern and, therefore, the range of substances being monitored may be limited (see Chapter 2. Air pollution and Sections 3.2.1 Drinking-water, 10.1 Food safety and the environment, and 12.3 Workplaces). Environmental monitoring data provide an estimate of health risks when compared with the WHO Global Air Quality Guidelines and the WHO Guidelines for Drinking-Water Quality *(11, 12)*.

Data from monitoring food for pesticide residues, additives and contaminants can be compared with guidance values (e.g. acceptable daily intakes prepared by the Joint Food and Agriculture Organization of the UN (FAO)/WHO Meeting on Pesticide Residues and the Joint FAO/WHO Expert Committee on Food Additives *(13, 14)*.

Exposure through soil
Chemicals in soil are generally assessed only when contamination is suspected, for example in the case of an abandoned waste site where there is a risk of pollution affecting groundwater. Activities and industries that have been shown to pollute soil include, among others, the recycling of used lead-acid batteries, mining and ore processing, tanning, smelting, artisanal small-scale gold mining, product manufacturing, chemical manufacturing and the dye industry; places such as dumpsites and industrial estates are also associated with soil pollution.

What levels of chemicals do we want to achieve, for example in the air, water and products?

Chemicals in the air
The WHO Global Air Quality Guidelines present standards for concentrations of pollutants: in ambient air, these are for particulate matter, ozone, nitrogen dioxide and sulfur dioxide; and there are additional standards for chemicals in indoor air, such as formaldehyde, benzene and naphthalene *(11, 15)* (see Chapter 2. Air pollution).

Chemicals in drinking-water
The WHO Guidelines for Drinking-Water Quality propose values for a variety of chemicals *(12)*.

Chemicals in soil
Some countries have set different standards for contaminants in soil in residential areas and for farming and crop production.

Chemicals in food
WHO and the FAO established the Codex Alimentarius, which is a collection of standards, guidelines and codes of practice intended to protect consumer health as it relates to food; the Codex includes information about chemical contaminants and food additives *(14, 16, 17)*.

Additional guidance and guideline values (e.g. for occupational exposure limits) can be found in environmental health criteria documents, concise international chemical assessments and International Chemical Safety Cards (ICSCs); all of these resources are available in the International Programme on Chemical Safety (IPCS) Internationally Peer Reviewed Chemical Safety Information (INCHEM) database *(18)* and in the Inter-Organization Programme for the Sound Management of Chemicals (IOMC) Internet-based Toolbox for Decision Making in Chemicals Management *(19)*.

The Guidance table provides an overview of the most relevant advice from WHO and other UN organizations. The guidance is further classified according to principally involved sectors, level of implementation, instruments and evidence category.

Guidance	Sector principally involved in planning/ implementation	Level of implementation	Instruments	Category of evidence
Policies and actions				
1. Implement the WHO Chemicals Road Map, approved by the World Health Assembly in 2017, to enhance health sector engagement in the SAICM towards meeting the 2020 goal and beyond *(5, 20)*. The Chemicals Road Map contains information about the following action areas: • managing health risks from exposure to chemicals – developing health protection strategies, regulating chemicals, educating the public about health risks, sharing information and best practices, developing high-quality health care settings; • improving knowledge and evidence about the health effects and impacts of chemicals – improving risk assessment methodologies, increasing biomonitoring and surveillance, estimating the disease burden from chemicals, sharing information and collaborating with partners; • strengthening national capacities to address health threats from chemicals, including in response to chemical incidents and emergencies – strengthening national policies and regulatory frameworks, implementing the IHR (2005) and providing training and education; • strengthening leadership and coordination – promoting the inclusion of health considerations in all policies related to chemicals; engaging the health sector in chemicals management activities at the national, regional and international levels; and ensuring engagement between the health sector and other sectors.	Health	National; health care; workplace	Governance; regulation; assessment and surveillance; information, education and communication	B
2. Implement the IHR (2005) to establish or strengthen core capacities for preparedness for chemical incidents and emergencies and to detect and respond to chemical events, including by increasing capacity at poison centres and laboratories *(5,21, 22)*.	Health	National	Regulation	A, B
3. Implement multilateral environmental agreements focusing on chemicals and waste, particularly those concentrating on health protection (5), for example the: • Minamata Convention on Mercury *(23)*; • Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal *(24)*; • Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade *(25);* • Stockholm Convention on Persistent Organic Pollutants *(26)*; • Montreal Protocol on Substances that Deplete the Ozone Layer *(27)*.	Health Environment	National	Regulation	B, C

Guidance	Sector principally involved in planning/ implementation	Level of implementation	Instruments	Category of evidence
4. Nominate a health ministry contact point for issues related to chemicals and health, including for implementation of the Chemicals Road Map, and establish a national network of professionals focusing on chemicals and health *(5)*.	Health	National	Governance	B
5. Support the inclusion of health priorities in all policies relevant to chemicals *(5)*.	Health Multiple sectors	National	Governance	B
6. Facilitate the participation of all relevant sectors and stakeholders in chemicals management and strengthen the engagement between the health sector and other sectors, recognizing the shared leadership of the health and environmental sectors *(5)*.	Health Multiple sectors	National	Governance	B
7. Establish health-based guidelines for chemicals in water, air, soil, food and products, and for occupational exposure, and participate in their development, drawing on WHO norms, standards and guidelines, as appropriate *(5, 11, 12)*.	Health Environment	National	Regulation	A, B
8. Support regulations to prevent the discharge of toxic chemicals and advocate for appropriate recovery and recycling technology, as well as for safe storage and disposal *(5)*.	Health Environment Agriculture Industry	National	Regulation	B
9. Support implementation of the Globally Harmonized System of Classification and Labelling of Chemicals, coordinating internationally, where appropriate *(5, 6)*.	Health Environment	National	Regulation	B, C
10. Prevent the construction of homes, schools and playgrounds near polluted areas and hazardous installations (i.e. places that process, store or handle hazardous substances) *(28, 29)*.	Health Land use planning Construction Housing	National; community	Regulation	B
Awareness-raising and capacity-building				
11. Promote the communication of relevant information, including training, about chemicals used in products and processes to enable informed decision-making by all actors throughout a product's life cycle and to promote safer alternatives *(5)*.	Health Environment Labour	National; workplace	Information, education and communication	B

Guidance	Sector principally involved in planning/ implementation	Level of implementation	Instruments	Category of evidence
12. Educate the population (e.g. the public, teachers, medical professionals, staff at nongovernmental organizations) and raise awareness about the health effects of chemicals and about actions to prevent exposure to toxic chemicals *(5, 8)*.	Health	National; community; workplace Universal health coverage	Information, education and communication	B
13. Promote the safe storage of chemicals at home *(28, 29)*. Selected actions include: • keeping all chemicals out of the reach of children, either locked away or stored in places they cannot access. This applies to cleaning products, paraffin or kerosene, medicines, fuels, caustic products and pesticides; • using child-resistant packages for pharmaceuticals and other chemical products; • never storing chemicals in drinking-water bottles.	Health	National; community Universal health coverage	Information, education and communication	B
14. Ensure clear labelling on cleaning products, fuels, solvents, pesticides and other chemicals used, for example, at home and in schools *(29)*.	Health	National; community Universal health coverage	Information, education and communication	B
15. Raise awareness among parents, teachers and childminders about potential chemical hazards in the places where children spend their time *(8, 28)*.	Health	National; community Universal health coverage	Information, education and communication	B
16. Raise awareness among families and communities about poison control centres and ways to contact them *(28)*. See also the *World directory of poison centres (30)* and guidance about establishing them *(22)*.	Health	National; community Universal health coverage	Information, education and communication	A, B
Arsenic: reducing exposure through drinking-water				
17. Screen drinking-water and identify whether it contains more than the WHO provisional guideline value of 10 µg arsenic/L or the national permissible limit *(12, 31)*. Combine screening activities with awareness-raising campaigns.	Health Environment Water/sanitation	National; community Universal health coverage	Assessment and surveillance	A, B
18. Use and make available alternative groundwater sources, microbiologically safe surface water (e.g. via rainwater harvesting) or arsenic removal technologies, if necessary *(31)*.	Health Environment Water/sanitation	National; community	Infrastructure, technology and built environment	B

Guidance	Sector principally involved in planning/ implementation	Level of implementation	Instruments	Category of evidence
Asbestos: eliminating asbestos-related diseases				
19. Stop the use of all types of asbestos, which is the most efficient way to eliminate asbestos-related disease *(32)*.	Health Construction Housing	National; community	Regulation	B
20. Replace asbestos with safer substitutes, and develop economic and technological mechanisms to stimulate its replacement *(32)*.	Construction Housing	National; community	Infrastructure, technology and built environment; regulation; taxes and subsidies	B
21. Prevent exposure to asbestos that is already in place and prevent exposure during removal (i.e. during abatement) *(32)*.	Construction Housing Labour	National; community	Infrastructure, technology and built environment; regulation	B
22. Improve the early diagnosis and treatment, and social and medical rehabilitation of people with asbestos-related diseases, and establish registries of people with past or current exposure to asbestos *(32)*.	Health	Health care; community Universal health coverage	Assessment and surveillance; other management and control	B
Benzene: reducing exposure at work and for the population				
23. Support the use of alternative solvents in industrial processes *(33)*.	Health Industry Labour	Workplace	Regulation; information, education and communication	B
24. Develop or update policies and legislation to remove benzene from consumer products *(33)*.	Health Industry	National	Regulation	B
25. Minimize exposure to emissions from vehicle exhaust through encouraging less motorized traffic and improving the design and regular monitoring of engine settings *(33)*.	Land use planning Industry	National	Regulation; infrastructure, technology and built environment	B
26. Promote building codes requiring detached garages *(33)*.	Construction Housing	National	Regulation	B

Guidance	Sector principally involved in planning/ implementation	Level of implementation	Instruments	Category of evidence
27. Prevent exposure to tobacco smoke, which is a significant source of benzene exposure *(33)*.	Health	National; community Universal health coverage	Regulation; information, education and communication	B
28. Increase public awareness to discourage the domestic use of benzene-containing products *(33)*.	Health	National; community Universal health coverage	Information, education and communication	B
Cadmium: reducing exposure at work and for the population				
29. Reduce cadmium emissions from mining and smelting, and waste incineration; reduce the application of sewage sludge to the land; and reduce the use of phosphate fertilizers and cadmium-containing manure, among others *(34)*.	Industry Agriculture Labour	Workplace; national; community	Infrastructure, technology and built environment; regulation	B
30. Support safe and effective measures to increase the recycling of cadmium *(34)*.	Industry	Workplace; national; community	Infrastructure, technology and built environment; regulation	B
31. Restrict nonrecyclable uses of cadmium *(34)*.	Industry	National	Regulation	B
32. Eliminate the use of cadmium in products such as toys, jewellery and plastics *(34)*.	Health Industry	National	Regulation; other management and control; information, education and communication	B
33. Prevent exposure to tobacco smoke, which is a significant source of cadmium exposure *(34)*.	Health	National; community Universal health coverage	Regulation; information, education and communication	B
Dioxins and dioxin-like substances: reducing emissions of these substances as required by the Stockholm Convention *(26)*				
34. Identify and safely dispose of material containing or likely to generate dioxins and dioxin-like substances, such as electrical equipment *(35)*.	Industry Environment Waste	Workplace; national; community	Regulation; infrastructure, technology and built environment	B

Guidance	Sector principally involved in planning/ implementation	Level of implementation	Instruments	Category of evidence
35. Ensure appropriate combustion practices are implemented, for example in waste management, to prevent emission of dioxins and dioxin-like substances *(35)*.	Industry Waste Environment	Workplace; national; community	Regulation; infrastructure, technology and built environment	B
36. Implement FAO/WHO strategies to reduce contamination by dioxins and dioxin-like substances in food and feed, and monitor food items and human breastmilk *(35, 36)*.	Food Agriculture	National	Regulation; assessment and surveillance	B, C
Inadequate or excess fluoride				
37. Ensure sufficient fluoride intake where it is lacking to minimize tooth decay *(37)*.	Health Food Water/sanitation	National; community Universal health coverage	Regulation	B
38. Provide drinking-water with a safe fluoride level in areas where groundwater contains high levels *(37)*. Guideline values for fluoride in drinking-water and air are available *(12, 37)*.	Water/sanitation Health	National; community	Regulation	A, B
39. Provide guidance on the need to control population exposure to fluoride while balancing the important needs for caries prevention and protection against adverse effects *(37)*.	Health	National; community Universal health coverage	Information, education and communication	B
Lead: mitigating risks				
40. Develop and enforce health, environmental and safety standards for manufacturing and recycling lead-acid batteries, electronic waste (i.e. e-waste) and other substances that contain lead *(38-40)*.	Health Industry Waste Environment	National; workplace	Regulation	B
41. Enforce environmental and air-quality regulations for smelting operations *(38, 39)*.	Health Industry Environment	National; workplace	Regulation	B

Guidance	Sector principally involved in planning/ implementation	Level of implementation	Instruments	Category of evidence
42. Include strict standards for lead in national drinking-water quality standards, and monitor them as part of a drinking-water quality surveillance programme *(12)*. The provisional guideline value is 0.01 mg/L, although lead concentrations should be kept as low as possible because no safe threshold for health effects has been established *(38, 39)*.	Health Industry Environment	National	Regulation	A
43. Ensure that health care practitioners have training in, and resources for, diagnosing and managing lead poisoning *(38, 39)*.	Health	National; community Universal health coverage	Information, education and communication	B
44. Ensure the availability of laboratories with the capacity to test blood for lead *(38, 39)*.	Health	National; community Universal health coverage	Regulation	B
45. Phase out the use of lead additives in fuels and lead in paint if this has not yet been done; adopt legally binding limits on lead in paint *(38, 39)*.	Industry Transport Environment Health	National	Regulation	B
46. Eliminate the use of leaded solder in food and drink cans and water pipes; and eliminate lead in homes, schools, school materials and children's toys; in glazing for pottery intended for cooking, eating or drinking; spices; and in traditional medicine and cosmetics *(38, 39)*.	Industry Multiple sectors	National	Regulation	B
47. Identify lead-contaminated sites and exposure routes, and take necessary action to prevent human exposure to lead from these areas *(38, 39)*. Identify sources of lead exposure in children, such as lead in contaminated soil, paint, toys and water distribution pipes *(29, 41)*.	Environment Health Multiple sectors	National; community	Assessment and surveillance; information, education and communication	B
48. In at-risk populations, monitor blood lead concentrations using sensitive analytical methods *(38, 39, 42)*.	Health	National; community Universal health coverage	Assessment and surveillance	B
49. Enhance the collection of data about lead in foodstuffs, and make this information publicly available so that appropriate action can be taken *(38, 39)*.	Food	National; community	Assessment and surveillance; information, education and communication	B

Guidance	Sector principally involved in planning/ implementation	Level of implementation	Instruments	Category of evidence
50. Educate the public regarding the dangers of using lead-containing products, including risks from lead exposure, and about ways to protect themselves, their families and their communities *(38, 39)*. These efforts may include public education campaigns aimed at parents and caregivers; at schools, including classroom teachers and students; at youth associations, community leaders and health care workers; and workers at and owners of lead-related industries (e.g. lead-acid battery recyclers and smelters, ceramic potters, spice adulterators) *(38, 39)*. Media and communication resources can be used to reach audiences that may not be aware of the risks of lead exposure to children and pregnant women *(38, 39)*.	Health Education	National; community Universal health coverage	Information, education and communication	B
Mercury: preventing health risks				
51. Implement the Minamata Convention on Mercury *(23)*. Strengthen the engagement of health ministries in implementing the health-related articles of the Minamata Convention *(45)*.	Environment Health	National	Regulation	B, C
52. Phase out the use of mercury-containing medical devices and consumer products; promote mercury-free alternatives; and ensure that mercury-containing devices are properly disposed of *(43, 44)*.	Health Industry Waste	National	Regulation	B
53. Conduct national assessments of mercury use and disposal *(43, 44)*.	Health Environment	National	Assessment and surveillance	B
54. Implement educational activities about mercury and its health and environmental impacts for those working in the health, environment and other sectors, and raise awareness among the general population, including providing special advice for pregnant and lactating women and about children *(43, 44)*.	Health Environment	National; community Universal health coverage	Information, education and communication	B
HHPs: reducing exposure				
55. Establish national regulations for the registration, licensing, labelling, marketing, purchase and use of pesticides, including regulations for HHPs *(46–50)*.	Agriculture Labour	National	Regulation	A, C
56. Implement FAO guidance on the appropriate handling and use of pesticides *(46, 51)*.	Agriculture Labour	National	Regulation	B, C

Guidance	Sector principally involved in planning/ implementation	Level of implementation	Instruments	Category of evidence
57. Eliminate the use of persistent HHPs and eliminate inappropriate waste disposal, especially of HHPs subject to the Stockholm and Rotterdam Conventions *(25, 26, 46)*.	Agriculture Labour	National	Regulation	B, C
58. Supply and ensure that appropriate, comfortable and affordable personal protective equipment is used, and provide training on appropriate use *(46)*.	Agriculture Labour	National; community	Regulation; other management and control	B
59. Promote integrated vector management rather than relying primarily on pesticides *(46)*.	Agriculture Labour	National; community	Information, education and communication; other management and control; regulation	B
60. Ensure proper storage and disposal of pesticides to prevent human exposure and contamination of the environment *(46)*.	Agriculture Labour	National; community	Regulation; other management and control	B
61. Train people who apply pesticides in their appropriate use, and raise awareness about the importance and ways of protecting health and the environment, and educate them about the existence of less hazardous alternatives *(46)*.	Health Agriculture Environment Labour	National; community Universal health coverage	Information, education and communication	B
62. Educate health professionals about how to recognize and treat pesticide-related poisoning *(46)*.	Health	Health care Universal health coverage	Information, education and communication	B
63. Monitor exposure to pesticides and conduct health surveillance in those who use them and in other vulnerable populations *(46)*.	Health	National; community Universal health coverage	Assessment and surveillance	B

Note: Actions to reduce risks from chemicals used in health care settings are described in 12.4 Health care facilities. Additional information and more comprehensive guidance about health sector engagement is available in the Chemicals Road Map *(5)*.

A – WHO guideline, B – WHO best practice/strategy, C – other UN best practice/strategy
FAO: Food and Agriculture Organization of the UN; HHPs: highly hazardous pesticides; IHR (2005): International Health Regulations (2005); SAICM: Strategic Approach to International Chemicals Management.

Selected resources for the Guidance table

Please note that only selected references are listed here. Please consult the reference section for all cited resources.

WHO 2020: Ten chemicals of public health concern [website] *(8)* – This page includes information for decision-makers about different chemicals of public health concern, including tools for action, norms and guidelines, and fact sheets.
Additional information about these chemicals is also available *(31–35, 37, 38, 44, 46)*.

WHO 2017: Chemicals road map *(5)* – The Road Map identifies concrete actions for the safe management of chemicals that can be led by those working in the health sector. An accompanying workbook helps to prioritize and plan actions outlined in the Road Map *(20)*.

Additional selected tools and further resources

This list contains additional selected material that is not cited in the Guidance table.

Inter-Organization Programme for the Sound Management of Chemicals (IOMC) 2024: IOMC Toolbox for Decision Making in Chemicals Management [website] *(19)* – The Toolbox is a web-based platform that provides access to information and tools for the safe management of chemicals. It was developed by organizations participating in the IOMC: the FAO, the International Labour Organization (ILO), the UN Development Programme, the UN Environment Programme (UNEP), the UN Industrial Development Organization, the UN Institute for Training and Research (UNITAR), WHO, the World Bank and the Organisation for Economic Co-operation and Development.

WHO 2024: INCHEM: Internationally Peer Reviewed Chemical Safety Information [online database] *(18)* – This database, published through IPCS, contains detailed information about the physicochemical properties and toxicological effects of numerous chemicals.

ILO, WHO 2024: ILO–WHO International Chemical Safety Cards (ICSCs) [online database] *(52)* – The ICSCs provide essential health and safety information about chemicals to promote their safe use. The cards are used on the shop floor by workers and by those responsible for health and safety in factories, agriculture, construction and other workplaces; also, they are often a component of education and training activities. They can also be used by agencies responding to chemical incidents. ICSCs are available in many languages for more than 1 700 chemicals.

WHO 2024: Chemical hazards in drinking-water [website] *(53)* – This website provides links to background documents about chemicals covered in the Guidelines for Drinking-Water Quality *(12)* that can be used as an authoritative basis for setting national regulations and standards for water safety to support public health.

UNITAR 2024: Risk reduction of chemicals [online course] *(54)* – This course provides guidance to national governments and authorities about the risk assessment and risk management of chemicals.

ILO 2022: Framework for Action on Chemicals and Waste *(55)* – The Framework aims to identify concrete actions for which the labour sector has either a lead or important supporting role to play in the sound management of chemicals, while recognizing the need for multisectoral cooperation.

SAICM 2022: The potential key role of SAICM national focal points in reducing harm from highly hazardous pesticides (HHPs): factsheet 2022 *(56)* – This factsheet assists SAICM national focal points in informing relevant stakeholders about HHPs and provides advice and suggestions about how to phase out HHPs.

Secretariats of the Basel, Rotterdam, Stockholm Conventions and the Minamata Convention on Mercury 2021: Chemicals, wastes and climate change: interlinkages and potential for coordinated action *(57)* – This report presents a comprehensive technical review of the literature about climate change and the management of hazardous chemicals, and works to identify opportunities for simultaneously addressing these two critical elements of the broader sustainability challenge.

ILO 2020: The sound management of chemicals and waste in the world of work *(58)* – This brochure provides a detailed summary of the ILO's engagement with the areas of chemicals and waste.

UNEP 2019: UNEP guidance: enforcement of chemicals control legislation *(59)* – This document provides guidance about how to ensure effective compliance with rules and regulations for industrial and consumer chemicals through the use of enforcement mechanisms.

UNEP 2015: UNEP guidance: on the development of legal and institutional infrastructures and measures for recovering costs of national administration for sound management of chemicals *(60)* – This guidance aims at providing practical, step-by-step support to policy-makers for strengthening national legislation and institutional set-ups for achieving the sound management of chemicals, and includes proposals for measures to finance the necessary related administration activities.

Arsenic

UN Children's Fund (UNICEF), WHO 2018: Arsenic primer: guidance on the investigation & mitigation of arsenic contamination *(61)* –This primer provides practical advice for the staff of UN agencies, their government counterparts and development workers responding to the challenge of arsenic contamination of drinking-water.

Asbestos

WHO 2014: Chrysotile asbestos *(62)* – This document provides general information about chrysotile asbestos and the health effects associated with exposure to it; it also addresses questions commonly raised during policy discussions.

Dioxins and dioxin-like substances

UNEP, Stockholm Convention 2013: Toolkit for identification and quantification of releases of dioxins, furans and other unintentional POPs under Article 5 of the Stockholm Convention *(63)* – This toolkit provides a harmonized framework to establish comparable figures on the release of unintentional persistent organic pollutants (or POPs), and it provides default emission factors and detailed complementary technical information.

Fluoride

WHO 2013: Oral health surveys: basic methods, fifth edition *(64)* – This manual encourages countries to conduct standardized oral health surveys that are comparable internationally.

Lead

WHO 2022: Lead in drinking-water: health risks, monitoring and corrective actions *(65)* – This document provides practical guidance about assessing and managing lead contamination in drinking-water.

WHO 2022: Update on the global status of legal limits on lead in paint, December 2021 *(66)* – This report describes lead paint laws in different countries, as well as activities undertaken by countries where such laws are in the process of being established.

WHO 2021: WHO guideline for clinical management of exposure to lead *(67)* – The purpose of this guideline is to assist physicians in making decisions about the diagnosis and treatment of lead exposure.

WHO 2020: Global elimination of lead in paint: why and how countries should take action. Policy brief *(68)* and Technical brief *(69)* – These documents explain the health and economic importance of preventing lead exposure by establishing legally binding controls to stop the addition of lead to paint. They also describe the support available to countries to take this action.

WHO 2020: Guidance on organizing an advocacy or awareness-raising campaign on lead paint *(70)* – This document provides guidance and tools to support advocacy or awareness-raising activities to build momentum in a country to develop, adopt and implement legally binding measures, such as lead paint laws.

UNICEF, Pure Earth 2020: The toxic truth: children's exposure to lead pollution undermines a generation of future potential *(71)* – This joint report describes how lead is a potent neurotoxin that causes irreparable harm to children's brains.

UNEP 2019: Suggested steps for establishing a lead paint law *(72)* – This factsheet helps countries by providing basic information about adopting lead paint laws.

UNEP 2018: Model law and guidance for regulating lead paint *(73)* – This document assists countries in establishing and implementing regulations about lead paint.

Mercury

WHO 2022: Prevention and treatment of dental caries with mercury-free products and minimal intervention *(74)* – This document provides guidance for dental professionals, nonspecialists and the general public about replacing mercury-containing products when treating dental caries.

UNEP, Minamata Convention on Mercury 2022: Becoming a party to the Minamata Convention on Mercury: factsheet *(75)* – This factsheet provides basic information about the key steps to becoming a party to the Convention, including the obligations and benefits.

WHO 2021: Minamata Convention on Mercury: annotated bibliography of WHO information *(76)* – This annotated bibliography of key WHO resources is relevant to the Minamata Convention and the associated World Health Assembly Resolution, WHA67.11 (Public health impacts of exposure to mercury and mercury compounds: the role of WHO and ministries of public health in the implementation of the Minamata Convention).

WHO 2021: Mercury and human health: educational course *(77)* – This course supports the training of public health and health care professionals, medical and other allied students and professionals, and decision-makers in the health and environmental sectors.

WHO 2021: *Step-by-step guide for developing a public health strategy for artisanal and small-scale gold mining in the context of the Minamata Convention on Mercury* *(78)* – This guide provides easy-to-use instructions for developing a public health strategy as part of a national action plan for artisanal and small-scale gold mining.

WHO 2019: Strategic planning for implementation of the health-related articles of the Minamata Convention on Mercury *(79)* – This guide supports national health authorities in understanding the implications that the Minamata Convention has for national health programmes and in planning the implementation of the mercury risk assessment and control measures required by the Convention.

WHO 2018: Health sector involvement in the Minamata Convention on Mercury: outcomes of World Health Organization regional workshops for ministries of health *(80)* – This document provides information about the outcomes of workshops focusing on health sector involvement in implementing the Minamata Convention, including region-specific challenges and opportunities.

WHO 2015: Developing national strategies for phasing out mercury-containing thermometers and sphygmomanometers in health care, including in the context of the Minamata Convention on Mercury: key considerations and step-by-step guidance *(81)* – This document provides advice to health ministries about their role in leading the phasing out of manufacturing, importing and exporting mercury-containing thermometers and sphygmomanometers.

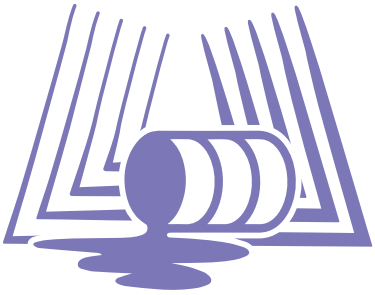
Highly hazardous pesticides

UNEP 2022: Synthesis report on the environmental and health impacts of pesticides and fertilizers and ways to minimize them *(82)* – This report is a comprehensive review of information about the environmental and health effects and potential impacts of pesticides and fertilizers.

WHO 2020: The WHO recommended classification of pesticides by hazard and guidelines to classification, 2019 edition *(83)* – This document lists common technical grade pesticides and their recommended classifications, together with active ingredients believed to be obsolete or discontinued for use as pesticides, pesticides subject to the prior informed consent procedure from the Rotterdam Convention, limitations to trade arising from the Stockholm Convention regarding POPs, and gaseous or volatile fumigants not classified under these recommendations.

FAO, WHO 2019: Detoxifying agriculture and health from highly hazardous pesticides: a call for action *(84)* – This brochure explains the risks posed by HHPs, the possible alternatives and what can be done to phase them out and opt for more sustainable solutions.

5.3 Chemical incidents



Overview

A chemical incident is the uncontrolled release of a toxic substance, potentially resulting in harm to public health and the environment.

Chemical events arising from technological incidents (such as industrial and transport accidents), natural disasters, conflict and terrorism, polluted environments, and contaminated food and products are common and occur worldwide. The term chemical incident refers to anthropogenic or technological events, including:

- an explosion at a factory that stores or uses chemicals;
- contamination of the food or water supply with a chemical;
- an oil spill;
- a leak from a storage unit during transportation;
- the deliberate release of chemicals during conflicts or as a result of terrorism;
- an outbreak of disease that is associated with exposure to a chemical.

Between 2000 and 2020, there were more than 1 000 technological incidents involving chemicals worldwide, affecting more than 1.85 million people *(85)*.

Some chemical incidents can have international consequences, for example when a chemically contaminated product is distributed to multiple countries or when a chemical release contaminates the environment, such as the air or water and subsequently traverses national borders *(86)*. Such incidents fall under the International Health Regulations (2005) (IHR) *(21)*. Under the IHR (2005), Member States must have in place the necessary capacities to detect, evaluate and respond to public health events caused by any hazard, including chemicals. WHO, in turn, should provide assistance on request to Member States to investigate and control such events.

How do we assess a chemical incident?

Many chemical incidents are overt and are quickly recognized, such as a fire at or large leak from a chemical plant. Some chemical releases may, however, become apparent only with the presentation or reporting of a number of cases with similar signs and symptoms, who have a common history and are linked in time and space. The timely identification of the cause of clusters or suspected outbreaks associated with exposure to chemicals may require a detailed investigation involving clinical, toxicological, epidemiological, environmental and laboratory analytical approaches.

Adequately resourced poison centres can play a key role in identifying chemical incidents and in supporting the necessary assessment and response. They are centres of expertise on clinical toxicology and have access to databases about products and substances. Most poison centres perform toxicovigilance – that is, they actively engage in the process of identifying and assessing toxic risks in a community or population from consumer products, pesticides, pharmaceuticals, environmental and industrial chemicals, controlled substances and natural toxins. Toxicovigilance involves monitoring data from poison centres to identify trends in exposures to poisons and the emergence of new risks associated with toxic substances *(22)*.

Chapter updated in 2024

What do we want to achieve?	Comprehensive management of chemical incidents requires prevention and preparedness, early detection and effective response and recovery. **Prevention** focuses on general measures that can be taken to diminish the likelihood of a chemical incident and to limit its severity. **Emergency planning and preparedness** detail broad goals that can be achieved to ensure adequate public health preparedness for all parties involved in responding to a chemical incident. **Detection and alert** describe the various channels that can be used to detect a chemical incident and to alter the response of the stakeholders involved in a chemical event emergency. **Response** deals with the public health tasks that should be carried out during an emergency. **Recovery** details the methods used to evaluate the causes of and responses to chemical incidents and to follow up with victims to learn from incidents and near-incidents, and to restore and remediate the affected environment *(87, 88)*. National guidelines for addressing acute chemical exposure are available, including guidelines on levels for acute exposure to airborne chemicals *(89)* and values for occupational exposures that are considered immediately dangerous to life or health *(90)*.

The Guidance table provides an overview of the most relevant advice from WHO and other UN organizations. The guidance is further classified according to principally involved sectors, level of implementation, instruments and evidence category.

Guidance	Sector principally involved in planning/ implementation	Level of implementation	Instruments	Category of evidence
Policies and actions				
1. Implement international agreements through national laws. Selected international agreements include: • the IHR (2005), a legally binding agreement providing a framework to ensure better prevention of, preparedness for and response to public health events and emergencies potentially of international concern, including chemical events *(21)*; • the ILO Prevention of Major Industrial Accidents Convention (also known as C174) *(91)*.	Multiple sectors	National	Regulation	B, C
2. Develop or update national policies and plans for ensuring the prevention of, preparedness for, response to, detection of and recovery from chemical incidents, including from chemical incidents arising from natural hazard events (e.g. earthquakes, floods and cyclones) *(88)*.	Multiple sectors	National	Regulation	B

Guidance	Sector principally involved in planning/ implementation	Level of implementation	Instruments	Category of evidence
Core capacities required under the International Health Regulations (2005)				
3. Establish designated focal points for IHR (2005) in all authorities that have an important role in managing chemical events to coordinate and communicate; establish a multisectoral national chemical emergency coordinating body; and ensure there is adequate health-sector preparedness capacity to provide prompt and adequate responses to chemical events *(21, 86)*.	Health	National	Governance	B
4. Implement a tested surveillance system for the detection, verification and risk assessment of chemical events potentially of international health concern as part of a multihazard surveillance strategy, and ensure the system is accompanied by a surveillance plan *(21, 86)*. Important sources of chemical incident notifications and alerts include: • poison centres; • hospital emergency departments; • primary health care facilities; • toxicology laboratories; • non-health-sector sources, such as agencies for consumer protection and food safety, environmental agencies, chemical plant operators, first responders and the public *(21, 86)*.	Health	National	Assessment and surveillance	B
5. Implement tested emergency response plans that take into account possible event scenarios and address priority chemicals, hazardous sites and vulnerable populations *(21, 86)*. Detailed information about developing an emergency response plan is provided in the *Manual for the public health management of chemical incidents (88)*.	Health	National	Other management and control	B
6. Ensure access to expertise – that is, maintain an updated roster of experts and specialized centres, including poison centres, for: • risk assessment; • exposure modelling; • chemical fate and transport assessment; • biological and environmental monitoring; • clinical toxicology; • diagnosis and treatment; • health surveillance *(21, 86)*.	Health	National	Information, education and communication	B
7. Ensure that experts and specialist centres have access to specialized medicines and equipment that are placed strategically to ensure national coverage of: • antidotes; • personal protective equipment; • decontamination equipment; • equipment for biological and environmental monitoring *(21, 86)*.	Health	National	Infrastructure, technology and built environment	B

Guidance	Sector principally involved in planning/ implementation	Level of implementation	Instruments	Category of evidence
8. Ensure access to toxicological and environmental laboratories – that is, ensure that laboratories are prepared to accept and analyse human and environmental samples during a chemical emergency and arrangements are in place to ship the samples to them *(21, 86)*.	Health Environment	National	Information, education and communication; other management and control	B
9. Conduct chemical event scenario analyses, including modelling adverse impacts, to guide the building of surveillance and response plans and to develop related capacities *(21, 86)*.	Environment Health	National	Other management and control	B
Additional recommendations for the prevention of, preparedness for, detection of, response to and recovery from chemical incidents				
Prevention				
10. Avoid locating chemical facilities in hazard-prone or densely populated areas *(88)*.	Land use planning	National	Regulation	B
11. Enforce a minimum set of safety standards and building regulations for all chemical facilities *(88)*.	Environment	National	Regulation	B
12. Restrict and control the transportation and storage of chemicals, including requiring licensing for hazardous sites and transport routes *(88)*.	Environment	National	Regulation	B
13. Implement labour, health and safety regulations that include minimum levels of training, protection from chemicals and medical surveillance *(88)*.	Labour	National; workplace	Regulation	B
14. Control waste disposal sites *(88)*.	Waste Environment	National; community	Regulation; other management and control	B
15. Implement inspections of hazardous sites and the transportation sector to help enforce the minimum set of safety standards *(88)*.	Environment	National	Regulation	B
16. Implement early-warning systems for weather-related natural events *(88)*.	Health Environment	National	Assessment and surveillance; other management and control	B
17. Raise awareness about potential exposures and vulnerabilities to, and health impacts from, chemicals *(88)*.	Health	National; community Universal health coverage	Information, education and communication	B

Guidance	Sector principally involved in planning/ implementation	Level of implementation	Instruments	Category of evidence
Preparedness				
18. Establish databases of hazardous sites, contents of transportation (e.g. containers or ships), information about chemicals, health care resources and emergency contact information *(88)*.	Health Environment	National	Assessment and surveillance	B
19. Implement an incident management system – that is, a standardized approach to the command, control and coordination of emergency responses *(88)*.	Environment Health	National	Other management and control	B
Response				
20. A response should aim to stop the release of the chemical, prevent the spread of contamination and limit exposure *(88)*.	Multiple sectors	National; community	Other management and control	B
21. Provide an initial risk assessment, and advise and alert health care services *(88)*.	Health Environment	National; community Universal health coverage	Assessment and surveillance	B
22. Disseminate information and advice to responders, the public and the media *(88)*.	Health Environment	National; community Universal health coverage	Information, education and communication	B
23. Register all individuals exposed during an incident. Collect appropriate human and environmental samples, which may include blood, urine, and soil and water *(88)*.	Health Environment	National; community Universal health coverage	Assessment and surveillance	B
24. Conduct investigations during the incident *(88)*.	Health Environment	National; community Universal health coverage	Assessment and surveillance	B
Recovery				
25. Provide support to those affected, such as medical care and a single point of contact for information and advice *(88)*.	Health	Health care; national; community Universal health coverage	Information, education and communication; other management and control	B
26. Register exposed persons to ensure there are follow up and surveillance *(88)*.	Health	Health care; national; community Universal health coverage	Assessment and surveillance	B

Guidance	Sector principally involved in planning/ implementation	Level of implementation	Instruments	Category of evidence
27. Conduct risk and health outcome assessments and environmental assessments *(88)*.	Health Environment	Health care; national; community Universal health coverage	Assessment and surveillance	B
28. Implement rehabilitation actions, including remediation and restoration of the environment; actions to prevent a further occurrence, such as through causative factor analysis and emergency response evaluations; and actions to improve health in the affected community *(88)*.	Health Environment	Community; national Universal health coverage	Other management and control	B
29. Contribute information about the event to the international community *(88)*.	Health Environment	National	Information, education and communication	B

A – WHO guideline, B – WHO best practice/strategy, C – other UN best practice/strategy
IHR (2005): International Health Regulations (2005); ILO: International Labour Organization.

Selected resources for the Guidance table
Please note that only selected references are listed here. Please consult the reference section for all cited resources.
WHO 2020: Guidelines for establishing a poison centre *(22)* – These guidelines address the history and policy background of poison centres as well as the practical aspects of planning a poison centre, and its services and operation.
WHO 2016: International Health Regulations (2005), third edition *(21)* – The IHR (2005) provides an overarching legal framework that defines countries' rights and obligations in handling public health events and emergencies that have the potential to cross borders. The IHR (2005) is an instrument of international law that is legally binding on 196 countries, including the 194 WHO Member States.
WHO 2015: International Health Regulations (2005) and chemical events *(86)* – This document provides information about building IHR (2005) core capacities for chemical events, assists national IHR (2005) focal points in identifying institutions that have a role in managing chemicals, raises awareness about the IHR (2005) among professionals who have a role in managing chemicals in various regulatory contexts but who are not familiar with the Regulations, and provides information to facilitate an interministerial approach to managing chemical events, including building synergies in implementing relevant international agreements.
WHO 2009: Manual for the public health management of chemical incidents *(88)* – This manual provides a comprehensive overview of the principles and roles of public health during each phase of the management of chemical incidents and emergencies.

Additional selected tools and further resources
This list contains additional selected material that is not cited in the Guidance table.
ILO, WHO 2024: ILO–WHO International Chemical Safety Cards (ICSCs) [online database] *(52)* – The ICSCs provide essential health and safety information about chemicals to promote their safe use.
WHO 2021: WHO human health risk assessment toolkit: chemical hazards, second edition *(92)* – This toolkit provides guidance for decision-makers about how to identify and characterize chemical hazards, assess exposures to these chemicals and determine whether these exposures are dangerous to public health.
WHO 2021: Manual for investigating suspected outbreaks of illnesses of possible chemical etiology: guidance for investigation and control *(93)* – This manual describes methods for investigating clusters or outbreaks that may be of chemical origin and discusses the importance of using a structured, coordinated, collaborative, multidisciplinary and multiagency approach at the local, regional, national and international levels.
WHO 2019: Health Emergency and Disaster Risk Management Framework *(87)* – This Framework emphasizes the critical importance of the prevention of, preparedness for and readiness to respond to emergencies and disasters.
WHO 2018: Chemical releases caused by natural hazard events and disasters: information for public health authorities *(94)*- This manual describes methods for investigating clusters or outbreaks that are potentially of chemical origin.
WHO 2017: Health emergency and disaster risk management: chemical emergencies *(95)* – This factsheet is part of a series focusing on emergency and disaster risk management, and it is an introduction for health workers engaged in the disaster risk management sector and for multisectoral partners to help them consider how to integrate health into their disaster risk management strategies.

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