



GLOBAL CHEMICALS OUTLOOK II

FROM LEGACIES TO
INNOVATIVE SOLUTIONS

IMPLEMENTING THE 2030 AGENDA
FOR SUSTAINABLE DEVELOPMENT



Global Chemicals Outlook II

From Legacies to Innovative Solutions: Implementing the 2030 Agenda for Sustainable Development

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Feedback and contact

The United Nations Environment Programme encourages interested readers of this report to engage and become part of the Global Chemicals Outlook II community. We are keen to hear your views about the report and how it makes a difference on the ground.

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About the Global Chemicals Outlook II

The first edition of the *Global Chemicals Outlook*, published in February 2013, assembled scientific, technical and socio-economic information on the sound management of chemicals. It covered trends and indicators for chemical production, transport, use and disposal, and associated health and environmental impacts; economic implications of these trends, including costs of inaction and benefits of action; and instruments and approaches for sound management of chemicals.

Decision 27/12, adopted by the Governing Council of the United Nations Environment Programme in 2013, recognized the significance of the findings of the first *Global Chemicals Outlook*, which highlighted the significant increase in the manufacture and use of chemicals globally, their importance to national and global economies and the costs and negative effects on human health and the environment of unsound chemicals management, and made recommendations for future action. Decision 27/12 also requested the Executive Director to continue work on the *Global Chemicals Outlook*, particularly in areas where data were found to be lacking or inadequate, and to enhance transparency through regionally balanced stakeholder involvement, inter alia, with a view to developing in the future a tool for assessing progress towards the achievement of the sound management of chemicals and hazardous wastes, including the existing 2020 goal, taking into account and building upon other existing sources of information.

Resolution 2/7, adopted by the United Nations Environment Assembly in 2016, requested the Executive Director to submit an update of the first *Global Chemicals Outlook*, addressing, inter alia, the work carried out particularly in relation to lacking or inadequate data to assess progress towards the 2020 goal, the development of non-chemical alternatives, and the linkages between chemicals and waste, in coordination with the *Global Waste Management Outlook*, and providing scientific

input and options for implementation of actions to reach relevant Sustainable Development Goals and targets up to and beyond 2020. Resolution 2/7 also requested the Executive Director to ensure that the updated *Global Chemicals Outlook* addresses the issues which have been identified as emerging policy issues by the International Conference on Chemicals Management (the governing body of the Strategic Approach to International Chemicals Management) as well as other issues where emerging evidence indicates a risk to human health and the environment.

The second edition of the *Global Chemicals Outlook* has been prepared with substantive contributions from more than 400 experts and under the guidance of a Steering Committee, which provided oversight, strategic directions and guidance on all aspects of the report's development, as well as technical inputs, where applicable. The Steering Committee was composed of representatives from Governments, non-governmental organizations (including civil society, industry/the private sector, and academia) and inter-governmental organizations, with participation from all regions and a wide range of stakeholders.

The *Global Chemicals Outlook II* is complemented by the *Global Chemicals Outlook II Summary for Policymakers* and the *Global Chemicals Outlook II Synthesis Report*. The *Synthesis Report*

summarizes key findings and insights of the full report and follows the same five-part structure. It was launched at the fourth session of the United Nations Environment Assembly in March 2019. The shorter *Summary for Policymakers* was tabled as a working document of the fourth session of the United Nations Environment Assembly and is available in all six UN languages.



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A Consultative Meeting for the Preparation of the *Global Chemicals Outlook II* took place in April 2016 in Geneva, Switzerland. It was attended by 70 experts. Subsequently a wide range of stakeholders provided input at five workshops. These consisted of a series of regional expert workshops in March–April 2018 in Nairobi, Kenya (Africa); Frankfurt, Germany (Europe, including Central and Eastern Europe); Panama City, Panama (Latin America and the Caribbean and North America); and Bangkok, Thailand (Asia-Pacific and West Asia), attended by a total of 115 participants; and a global workshop (June 2018, Bonn, Germany) with some 100 participants. Paul Hohnen provided valuable support, including by moderating sessions at several workshops.

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Foreword



Chemicals are part of our everyday lives. From pharmaceuticals to plant protection, innovations in chemistry can improve our health, food security and much more. However, if poorly used and managed, hazardous chemicals and waste threaten human health and the environment.

As the second *Global Chemicals Outlook* lays out, global trends such as population dynamics, urbanization and economic growth are rapidly increasing chemical use, particularly in emerging economies. In 2017, the industry was worth more than US dollars 5 trillion. By 2030, this will double. Whether this growth becomes a net positive or a net negative for humanity depends on how we manage the chemicals challenge. What is clear is that we must do much more.

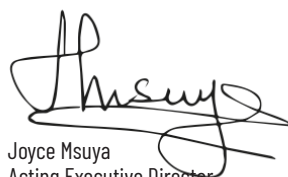
Large quantities of hazardous chemicals and pollutants continue to leak into the environment, contaminating food chains and accumulating in our bodies, where they do serious damage. Estimates by the European Environment Agency suggest that 62 per cent of the volume of chemicals consumed in Europe in 2016 were hazardous to health. The World Health Organization estimates the burden of disease from selected chemicals at 1.6 million lives in 2016. The lives of many more are negatively impacted.

We have made some progress in managing chemicals through national and stakeholder action, international treaties and voluntary

instruments. At the World Summit on Sustainable Development in 2002, countries committed to minimizing the adverse effects of chemicals by 2020. At our current pace, we will not achieve this goal. Considering the expansion of the market, and the associated increase in contamination, we cannot continue to gamble with our health.

Solutions do exist, as the report shows. Sustainable supply chain management, innovations in green and sustainable chemistry, and adopting common approaches to chemicals management can reduce the risks to human health, ecosystems and economies. But a solution is only as good as the will to implement it. Now, more than ever, key influencers such as investors, producers, retailers, citizens, academics and ministers must act. We have the chance to do what needs to be done. We are implementing the 2030 Agenda and developing a future framework for framework for the sound management of chemicals and waste beyond 2020.

We cannot live without chemicals. Nor can we live with the consequences of their bad management. My hope is that this Outlook inspires us all to increase our efforts to safely capture the benefits of chemistry for all humanity.



Joyce Msuya
Acting Executive Director
UN Environment

Key findings

The global goal to minimize adverse impacts of chemicals and waste will not be achieved by 2020. Solutions exist, but more ambitious worldwide action by all stakeholders is urgently required.



1. The size of the global chemical industry exceeded United States dollars 5 trillion in 2017. It is projected to double by 2030. Consumption and production are rapidly increasing in emerging economies. Global supply chains, and the trade of chemicals and products, are becoming increasingly complex.



2. Driven by global megatrends, growth in chemical-intensive industry sectors (e.g. construction, agriculture, electronics) creates risks, but also opportunities to advance sustainable consumption, production and product innovation.



3. Hazardous chemicals and other pollutants (e.g. plastic waste and pharmaceutical pollutants) continue to be released in large quantities. They are ubiquitous in humans and the environment and are accumulating in material stocks and products, highlighting the need to avoid future legacies through sustainable materials management and circular business models.



4. The benefits of action to minimize adverse impacts have been estimated in the high tens of billions of United States dollars annually. The World Health Organization estimated the burden of disease from selected chemicals at 1.6 million lives in 2016 (this is likely to be an underestimate). Chemical pollution also threatens a range of ecosystem services.



5. International treaties and voluntary instruments have reduced the risks of some chemicals and wastes, but progress has been uneven and implementation gaps remain. As of 2018, more than 120 countries had not implemented the Globally Harmonized System of Classification and Labelling of Chemicals.



6. Addressing legislation and capacity gaps in developing countries and emerging economies remains a priority. Also, resources have not matched needs. There are opportunities for new and innovative financing (e.g. through cost recovery and engagement of the financial sector).



7. Significant resources can be saved by sharing knowledge on chemical management instruments more widely, and by enhancing mutual acceptance of approaches in areas ranging from chemical hazard assessment to alternatives assessment.



8. Frontrunner companies – from chemical producers to retailers – are introducing sustainable supply chain management, full material disclosure, risk reduction beyond compliance, and human rights-based policies. However, widespread implementation of these initiatives has not yet been achieved.



9. Consumer demand, as well as green and sustainable chemistry education and innovation (e.g. through start-ups), are among the important drivers of change. They can be scaled up through enabling policies, reaping the potential benefits of chemistry innovations for sustainable development.



10. Global knowledge gaps can be filled. This can be achieved, for example, by taking steps to harmonize research protocols, considering health or environmental impact information and harm caused to set and address priorities (e.g. emerging issues), and strengthening the science-policy interface through enhanced collaboration of scientists and decision-makers.

List of Abbreviations and Acronyms

ACC	American Chemistry Council	CMS	Chemical management services
ACS	American Chemical Society	CO₂	Carbon dioxide
AMAP	Arctic Monitoring and Assessment Programme	CO₂-eq	Carbon dioxide equivalent
AMR	Antimicrobial resistance	COP	Conference of the Parties
AOP	Adverse Outcome Pathway	DALYs	Disability-adjusted life years
ASBC	American Sustainable Business Council	DDT	Dichlorodiphenyltrichloroethane
ASGM	Artisanal and small-scale gold mining	DEHP	Bis(2-ethylhexyl) phthalate
BCG	Boston Consulting Group	EC	European Commission
BHRRC	Business and Human Rights Resource Centre	ECHA	European Chemicals Agency
BPA	Bisphenol A	EDCs	Endocrine-disrupting chemicals
BPS	Bisphenol S	EEA	European Environment Agency
BRS	Basel, Rotterdam and Stockholm	EFPIA	European Federation of Pharmaceutical Industries and Associations
CAGR	Compound annual growth rate	EFSA	European Food Safety Authority
CAPP	Chemical Accident Prevention and Preparedness	EHS	Environment, health and safety
CEE	Central and Eastern Europe	EIPs	Eco-industrial parks
Cefic	European Chemical Industry Council	eMARS	EU Major Accident Reporting System
CFC-11	Trichlorofluoromethane	EPIs	Emerging policy issues
CFCs	Chlorofluorocarbons	EPPP	Environmentally persistent pharmaceutical pollutants
CiP	Chemicals in Products	ESDs	Emission Scenario Documents
CIRS	Chemical Inspection and Regulation Service	EU	European Union
CLP	Classification, Labelling and Packaging	EWG	Environmental Working Group
CMR	Carcinogenic, mutagenic and reprotoxic	EY	Ernst & Young
		FAO	Food and Agriculture Organization of the United Nations
		GAHP	Global Alliance on Health and Pollution

GC3	Green Chemistry & Commerce Council	IGO	Intergovernmental organization
GCO-I	First Global Chemicals Outlook	IHR	WHO International Health Regulations
GCO-II	Second Global Chemicals Outlook	ILO	International Labour Organization
GDP	Gross domestic product	ILZSG	International Lead and Zinc Study Group
GEF	Global Environment Facility	IOMC	Inter-Organization Programme for the Sound Management of Chemicals
GHG	Greenhouse gas	IP	Intellectual property
GHS	Globally Harmonized System of Classification and Labelling of Chemicals	IPEN	International POPs Elimination Network
GPA	SAICM Global Plan of Action	IPM	Integrated Pest Management
GRI	Global Reporting Initiative	ISO	International Organization for Standardization
GRULAC	Group of Latin American and Caribbean Countries	ISWA	International Solid Waste Association
GSCE	Green and sustainable chemistry education	IT	Information technology
HCFCs	Hydrochlorofluorocarbons	IUPAC	International Union of Pure and Applied Chemistry
HDI	Human Development Index	JPOI	Johannesburg Plan of Implementation
HFCs	Hydrofluorocarbons	KEMI	Swedish Chemicals Agency
HHPs	Highly hazardous pesticides	LAC	Latin America and the Caribbean
HRC	Human Rights Council	LCA	Life cycle assessment
HSLEEP	Hazardous substances within the life cycle of electrical and electronic products	LMICs	Low- and middle-income countries
IARC	International Agency for Research on Cancer	MEA	Multilateral environmental agreement
ICCA	International Council of Chemical Associations	Mt	Megatonne
ICCM	International Conference on Chemicals Management	NAFTA	North American Free Trade Agreement
IEA	International Energy Agency	Natech	Natural hazard triggered technological (accident)
IFIC	International Food Information Council	ng	Nanogram
IFPMA	International Federation of Pharmaceutical Manufacturers and Associations	NGO	Non-governmental organization

ODS	Ozone-depleting substance	PRTRs	Pollutant Release and Transfer Registers
OECD	Organisation for Economic Cooperation and Development	PTFE	Polytetrafluoroethylene
OHS	Occupational Health and Safety	PV	Photovoltaic
OOG	SAICM Overall Orientation and Guidance	PVC	Polyvinyl chloride
OPS	SAICM Overarching Policy Strategy	PwC	PricewaterhouseCoopers
PAHs	Polycyclic aromatic hydrocarbons	QSP	SAICM Quick Start Programme
PAN	Pesticide Action Network	R&D	Research and development
PBDEs	Polybrominated diphenyl ethers	REACH	Registration, Evaluation, Authorization and Restriction of Chemicals
PBT	Persistent, bioaccumulative and toxic	Rio+20	United Nations Conference on Sustainable Development
PCBs	Polychlorinated biphenyls	RSC	Royal Society of Chemistry
PCDDs	Polychlorinated dibenzo-p-dioxins	SAICM	Strategic Approach to International Chemicals Management
PCDFs	Polychlorinated dibenzofurans	SDGs	Sustainable Development Goals
PE	Polyethylene	SDS	Safety data sheet(s)
PET	Polyethylene terephthalate	SEA	Socio-economic assessment
PFASs	Per- and polyfluoroalkyl substances	SEI	Stockholm Environment Institute
PFCs	Perfluorinated chemicals	SMEs	Small and medium-sized enterprises
PFDA	Nonadecafluorodecanoic acid	SVHC	Substances of very high concern
PFHxS	Perfluorohexanesulfonic acid	TCE	Trichloroethylene
PFNA	Perfluorononanoic acid	TRI	United States Toxics Release Inventory
PFOA	Perfluorooctanoic acid	TSCA	United States Toxic Substances Control Act
PFOS	Perfluorooctanesulfonic acid	UBA	German Environment Agency
PFRs	Organophosphate-based flame retardants	UK	United Kingdom
pg	Picogram	UN	United Nations
PHAs	Polyhydroxyalkanoates	UNCED	United Nations Conference on Environment and Development
PLA	Polylactic acid		
POPs	Persistent organic pollutants		
PPE	Personal protective equipment		

UN DESA	United Nations Department of Economic and Social Affairs	US NOAA	United States National Oceanic and Atmospheric Administration
UNDP	United Nations Development Programme	US NRC	United States National Research Council
UNEA	United Nations Environment Assembly of the United Nations Environment Programme	US NTP	United States National Toxicology Program
UNECE	United Nations Economic Commission for Europe	US OSHA	United States Occupational Safety and Health Administration
UNEP	United Nations Environment Programme	VCI	German Chemical Industry Association
UNESCO	United Nations Educational, Scientific and Cultural Organization	VOCs	Volatile organic compounds
UNIDO	United Nations Industrial Development Organization	WBCSD	World Business Council for Sustainable Development
UNISDR	United Nations Office for Disaster Relief Reduction	WECF	Women in Europe for a Common Future/Women Engage for a Common Future
UNITAR	United Nations Institute for Training and Research	WEEE	Waste electrical and electronic equipment
UNRISD	United Nations Research Institute for Social Development	WEF	World Economic Forum
US/USA	United States	WEOG	Western European and Others Group
US ATSDR	United States Agency for Toxic Substances and Disease Registry	WIPO	World Intellectual Property Organization
US CDC	United States Centers for Disease Control and Prevention	WHO	World Health Organization
US EPA	United States Environmental Protection Agency	WMO	World Meteorological Organization
US FDA	United States Food and Drug Administration	WSSD	World Summit on Sustainable Development
US GAO	United States Government Accountability Office	ZDHC	Zero Discharge of Hazardous Chemicals
USGS	United States Geological Survey		
US NASEM	United States Academies of Science, Engineering and Medicine		
US NHANES	United States National Health and Nutrition Examination Survey		

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1/ The global context for the sound management of chemicals and waste

The *Global Chemicals Outlook II* (GCO-II) is released at a crucial moment. Since the publication of the GCO-I in 2013, the global consumption and production of chemicals¹ has continued to grow, with a number of trends that are a cause for concern about human health and the environment. This period also witnessed the adoption in 2015 of the 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals (SDGs), which include several targets specifically related to chemicals and waste management. Shortly thereafter, the International Conference on Chemicals Management (ICCM), which is the governing body of the Strategic Approach to International Chemicals Management (SAICM), initiated an intersessional process to prepare by 2020 recommendations regarding the Strategic Approach and the sound management of chemicals and waste beyond 2020. By using a back-casting approach that envisaged a sustainable future, the GCO-II has identified a range of actions for consideration by policymakers around the world and informing chemicals and waste management beyond 2020.

Production, use and trade of chemicals are growing in all regions, driven by global megatrends

Global income levels are rising and the global middle class is expanding, creating increasing demand for a range of goods and products for which chemistry is essential. Chemical-intensive industry sectors (e.g. construction, agriculture, electronics, cosmetics, mining and textiles) are growing, affecting market demand for chemicals and creating both risks and opportunities. In light of these trends and the changing consumption and production patterns that accompany them, the chemical industry is growing rapidly. The production and consumption of chemicals has spread worldwide, with an increasing share now located in low- and middle-income countries, many of which may have limited regulatory capacity. Cross-border trade in chemicals and products is also growing, and increasing amounts of chemicals are shipped through long and complex global supply chains.

Table 1.1 Chemicals and waste in the 2030 Agenda for Sustainable Development: SDG Targets 3.9 and 12.4

SDG 3: Ensure healthy lives and promote well-being for all at all ages



Target 3.9: By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination.

SDG 12: Ensure sustainable consumption and production patterns



Target 12.4: By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment.

¹ The term "chemicals" is understood throughout this report to include pharmaceuticals, unless otherwise noted.

Sound management and innovations in chemistry are essential for sustainable development

From pharmaceuticals and plant protection products to the production of cars, computers and textiles, many manufactured chemicals have helped improve human health, food security, productivity and quality of life throughout the world. While the number of chemicals registered by the American Chemical Society's global Chemical Abstracts Service exceeds 142 million, only a fraction of these chemicals are placed on the market (American Chemistry Council [ACC] 2018).

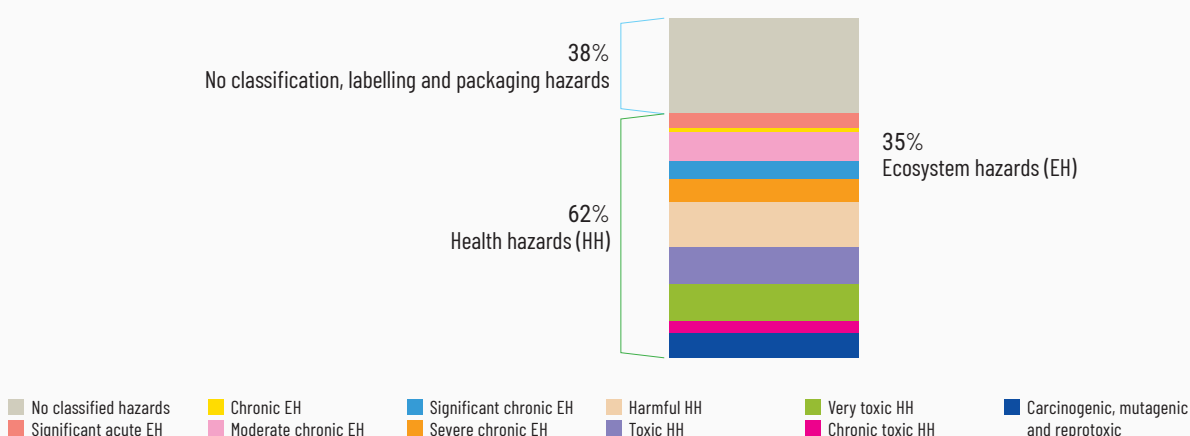
A 2019 report jointly developed by the United Nations Environment Programme and the International Council of Chemical Associations estimated the total number of industrial chemicals in commerce globally at 40,000 to 60,000, with 6,000 of these chemicals accounting for more than 99 per cent of the total volume (United Nations Environment Programme [UNEP] and International Council of Chemical Associations [ICCA] 2019). The number of chemicals on the market is exceeded by a larger – and growing – number of chemical-intensive products such

as computers, mobile phones, furniture and personal care products – with billions of items sold each year.

Many chemicals, products and wastes have hazardous properties and continue to cause significant adverse impacts on human health and the environment because they are not properly managed. Chemicals or groups of chemicals that are receiving attention in research and policymaking because of their hazardous properties and potential risks include, but are not limited to, carcinogens, mutagens and chemicals hazardous to reproduction, persistent bio-accumulative and toxic substances, endocrine-disrupting chemicals, and chemicals with neurodevelopmental effects. According to 2018 data compiled by the European Environment Agency (EEA), approximately 62 per cent of the total volume of chemicals consumed in the European Union (EU) in 2016 were hazardous to health (EEA 2018).

Ensuring the sound management of chemicals and waste, as called for internationally at the highest political level during several major United Nations Conferences, is essential to advance sustainable development across its

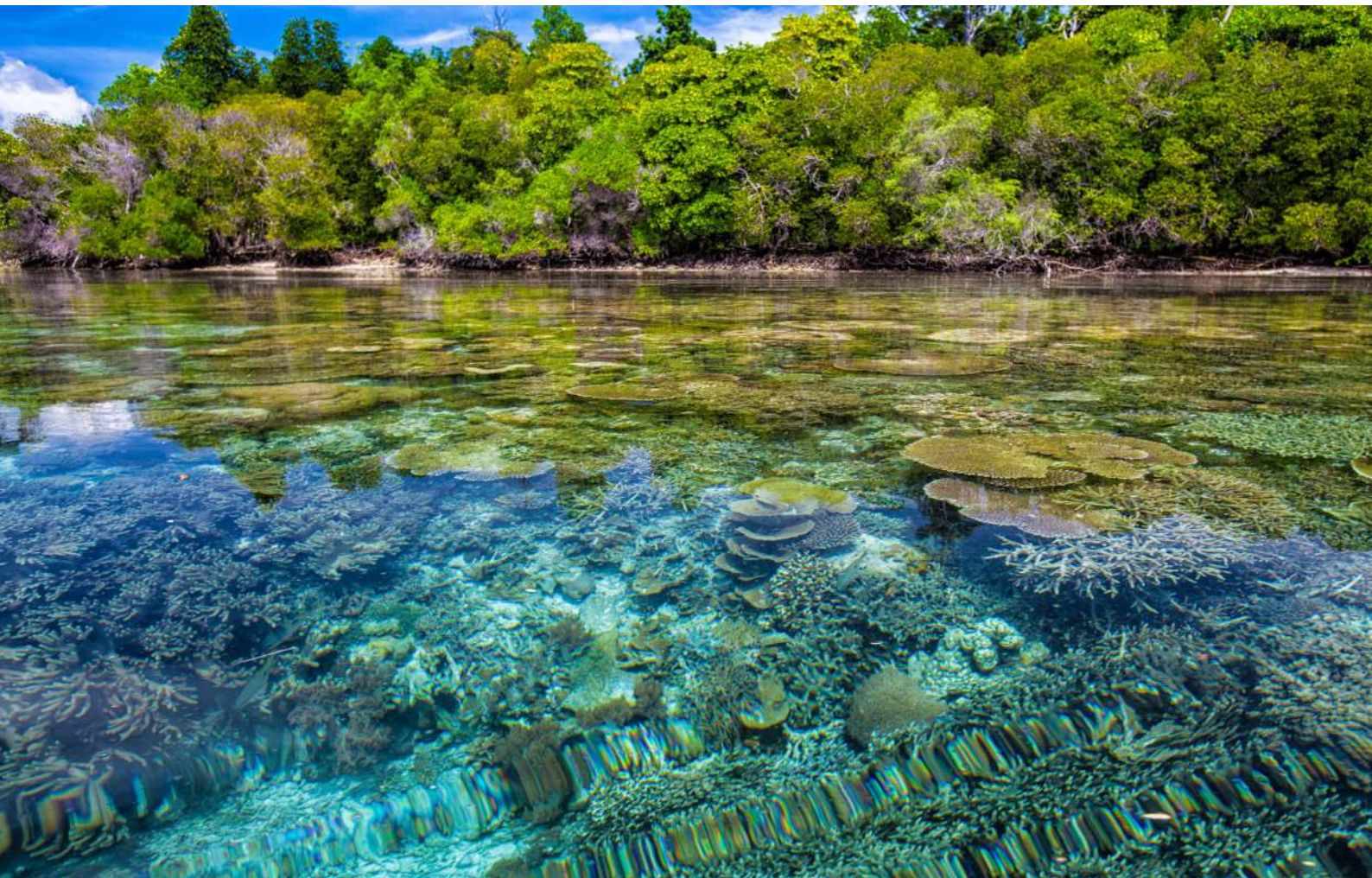
Figure 1.1 Share of the volume of chemicals consumed in the European Union in 2016 by hazard categories (based on European Environment Agency 2018)



According to data from Eurostat (the statistical office of the EU) compiled in 2018 by the European Environment Agency, approximately 62 per cent of the 345 million tonnes of chemicals consumed in the EU in 2016 were hazardous to health. In presenting the data, the Agency noted that volumes of hazardous chemicals consumed are not a proxy for the risks posed by those chemicals.

social, economic and environmental dimensions. Chemistry and the chemical industry have important roles to play in achieving the sound management of chemicals and waste within a sustainable development context. Addressing legacies, coupled with innovations in chemistry

and materials science, has the potential to create safer chemicals, increase resource efficiency, and reduce the health and environmental impacts associated with the current global production and consumption system.



2/ Milestones in international chemicals and waste management

The transboundary movement of chemicals through the air or water, as well as international trade in chemicals and products, call for global collaborative action to minimize adverse impacts. For several decades the international community has recognized the need for action. It has undertaken various initiatives to advance the sound management of chemicals and waste, which have played an important role in global efforts to minimize their adverse impacts. In developing a future framework for the sound management of chemicals and waste beyond 2020, valuable lessons can be learned from their design and implementation. Some of these initiatives are explored in more detail in Part II of the GCO-II, where progress towards the sound management of chemicals and waste is assessed.

From early action to the Rio Earth Summit

Examples of early action include the International Labour Organization (ILO) White Lead (Painting) Convention (1921), the establishment of the Codex Alimentarius Commission (1961), and the United Nations Recommendations on the Transport of Dangerous Goods (1956). At the 1992 United Nations Conference on Environment and Development (UNCED), also known as the Rio Earth Summit, Heads of State and Government adopted Agenda 21, an international action plan which promoted an integrated life cycle approach and contained dedicated chapters on the environmentally sound management of toxic chemicals (Chapter 19) and hazardous wastes (Chapter 20). Also adopted in 1992, the Rio Declaration on Environment and Development contained a number of principles and approaches relevant to the sound management of chemicals and waste, including the polluter pays principle, the right-to-know, and the precautionary approach.

The 2002 Johannesburg Plan of Implementation and the 2020 timeline



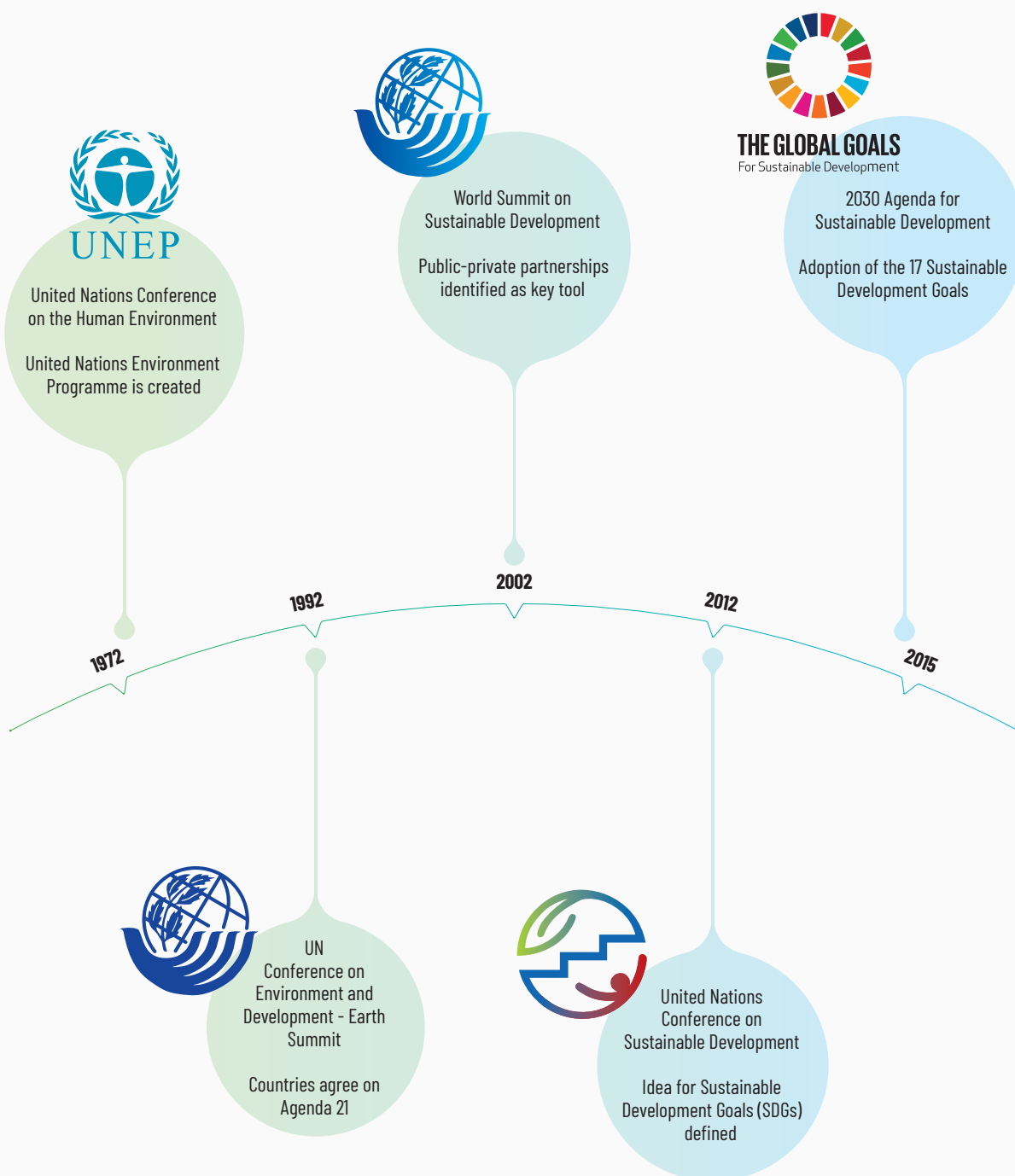
In 2002 the World Summit on Sustainable Development (WSSD) adopted the Johannesburg Plan of Implementation (JPOI), in which Governments agreed to “renew the commitment, as advanced in Agenda 21, to sound management of chemicals throughout their life cycle and of hazardous wastes for sustainable development as well as for the protection of human health and the environment, inter alia, aiming to achieve, by 2020, that chemicals are used and produced in ways that lead to the minimization of significant adverse effects on human health and the environment [...]” (paragraph 23) (UN 2002). Countries further agreed to “using transparent science-based risk assessment procedures and science-based risk management procedures, taking into account the precautionary approach [...], and support developing countries in strengthening their capacity for sound management of chemicals and hazardous wastes by providing technical and financial assistance”. A number of actions at all levels to achieve these goals were outlined, including to:

- › promote the ratification and implementation of relevant international instruments;
- › develop a strategic approach to international chemicals management;
- › implement the globally harmonized system for the classification and labelling of chemicals;
- › encourage partnerships;
- › promote efforts to prevent international illegal trafficking;

- › encourage development of coherent and integrated information on chemicals, e.g. through Pollutant Release and Transfer Registers (PRTs); and
- › promote reduction of the risks posed by heavy metals (UN 2002).

The 2020 timeline was reiterated at the Rio plus 20 Summit in 2012 (referring to chemicals and hazardous waste) (UN 2012), as well as in the 2030 Sustainable Development Agenda through SDG Target 12.4 (referring to chemicals and all wastes). SDG Target 3.9, which focuses on reducing deaths and illnesses, features a 2030 timeline.

Figure 2.1 Key milestones in global sustainable development governance (which also included the sound management of chemicals and waste)



Multilateral treaties and voluntary agreements

Since around the time of the Rio Summit and in the following decades, the international community has taken concerted action through multilateral treaties on specific hazardous chemicals and issues of global concern. Prominent examples, explored in greater detail in Part II, include the following:

- › Montreal Protocol on Substances that Deplete the Ozone Layer (entry into force in 1989)
- › Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (entry into force in 1992)
- › International Labour Organization (ILO) Conventions C170 - Chemicals Convention (entry into force in 1993) and C174 - Prevention of Major Industrial Accidents Convention (entry into force in 1997)
- › Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (entry into force in 2004)
- › Stockholm Convention on Persistent Organic Pollutants (POPs) (entry into force in 2004)
- › World Health Organization (WHO) International Health Regulations (IHR) (2005) (entry into force in 2007)
- › Minamata Convention on Mercury (entry into force in 2017)

Moreover, several voluntary international instruments adopted by the governing bodies of international organizations address a range of chemicals and issues. Prominent examples include the International Code of Conduct on Pesticide Management (hereinafter referred to as the “Code of Conduct”), originally developed in 1985 with a fourth version adopted in 2013, and the Globally Harmonized System of Classification and Labelling of Chemicals (GHS), which was adopted in 1992. The GHS was specifically mentioned in the 2002 Johannesburg Plan of Implementation with a view to the system being fully operational by 2008.

Adoption of the Strategic Approach to International Chemicals Management in 2006



In 2006, following the call made at the WSSD, the Strategic Approach to International Chemicals Management (SAICM) was adopted by the first session of the ICCM (ICCM1) as a multi- and cross-sectoral and participatory strategic approach. SAICM's overall objective is “to achieve the sound management of chemicals throughout their life cycle so that by the year 2020, chemicals are produced and used in ways that minimize significant adverse impacts on the environment and human health” (Secretariat of the Strategic Approach to International Chemicals Management [SAICM Secretariat], UNEP and WHO 2006). SAICM comprises the Dubai Declaration on International Chemicals Management, which expressed high-level political commitment to SAICM, and an Overarching Policy Strategy (OPS).



BASEL CONVENTION



ROTTERDAM CONVENTION



STOCKHOLM CONVENTION



International
Labour
Organization



MINAMATA
CONVENTION
ON MERCURY

The Overarching Policy Strategy referenced the WSSD 2020 timeline, referring to the “2020 goal”, a term subsequently used in various international fora. Objectives to achieve this goal are grouped under five areas: risk reduction, knowledge and information, governance, capacity building and technical cooperation, and illegal international traffic. Furthermore, the Dubai Declaration recommends the use and further development of the Global Plan of Action as a working tool and guidance document for meeting the commitments to chemicals management expressed in, among others, the Johannesburg Plan of Implementation. In 2015, ICCM4 endorsed the “overall orientation and guidance for achieving the 2020 goal of sound management of chemicals” as a voluntary tool that will assist in the prioritization of efforts for the sound management of chemicals and waste as a contribution to the overall implementation of the Strategic Approach.

Chemicals and waste in the 2030 Sustainable Development Agenda

The 2030 Agenda for Sustainable Development, including its 17 SDGs (Figure 2.2) and 169 targets, was adopted by the United Nations General Assembly at a summit of Heads of State in 2015. The SDGs, which are integrated and indivisible, integrate the three dimensions of

sustainable development: economic, social and environmental. While SDG Targets 12.4 and 3.9 are of direct relevance for a range of chemicals and waste management issues, SDG Target 6.3 focuses specifically on improving water quality. The sound management of chemicals and waste is also relevant for the achievement of many other SDGs. Those include halting biodiversity loss, clean water and sanitation, facilitating access to clean energy, climate action, ensuring quality education, and gender equality. Furthermore, implementation of other SDGs is essential in achieving the sound management of chemicals and waste, such as those concerned with education, financing and partnerships.

Chemicals and sustainability: concerns and opportunities

Despite global agreement reached at high-level UN Conferences and significant action already taken, scientists continue to express concerns regarding the lack of progress towards the sound management of chemicals and waste. These include calls for systemic and transformational changes towards safer chemicals and innovations in chemistry that will contribute to sustainable development.

In this context, “green chemistry” (Anastas and Eghbali 2010), “sustainable chemistry” (Blum

Figure 2.2 The Sustainable Development Goals



Sound management of chemicals and waste cuts across the Sustainable Development Goals. It is relevant for the achievement of much of the 2030 Agenda for Sustainable Development.

et al. 2017), “one-world chemistry” (Matlin *et al.* 2016) and related concepts are challenging chemistry to help meet sustainable development needs. Other stakeholders have raised similar concerns. A number of initiatives in the private sector have also identified opportunities to advance sustainability in relation to chemicals. These initiatives include the World Business Council for Sustainable Development (WBCSD) Chemical Sector SDG Roadmap (WBCSD 2017), the Together for Sustainability initiative bringing together 22 companies in the chemical industry, and the Zero Discharge of Hazardous Chemicals (ZDHC) initiative bringing together frontrunner textile companies (ZDHC 2018).

Intersessional process on the Strategic Approach and the sound management of chemicals and waste beyond 2020

In 2015 Governments and other stakeholders participating in ICCM4 noted that “in most countries more progress has to be made towards actually minimizing the significant adverse effects

on human health and the environment that may be associated with some chemical production, use and end-of-life disposal”. They also noted “with urgency the limited time remaining to achieve the 2020 goal” (SAICM Secretariat 2015). Shortly after the adoption of the 2030 Agenda in 2015, Governments and other stakeholders participating in ICCM4 initiated a process to prepare recommendations regarding the Strategic Approach and the sound management of chemicals and waste beyond 2020. The Conference agreed that the process should be open to all stakeholders and be concluded by ICCM5 in 2020. The period until ICCM5 in 2020 thus represents a historic window of opportunity for reflection on lessons learned in international chemicals and waste management, some of which has already started within the environment sector, as shown in Resolution 1/5 adopted by the United Nations Environment Assembly (UNEA) in 2014 (United Nations Environment Assembly of the United Nations Environment Programme [UNEA] 2014).



3/ Opportunities to link international policy agendas

Given the relevance of chemicals and waste across the 2030 Agenda, the beyond 2020 intersessional process provides an opportunity to link and create synergies between chemicals and waste management and other international policy agendas.

Chemicals and health



The sound management of chemicals and waste plays an important role in avoiding and minimizing risks posed by harmful chemicals in order to protect human health, in particular that of vulnerable populations such as pregnant women, infants and children. While the links between chemicals and health are well-established and the health sector has been an important partner in efforts to minimize risks, further efforts to strengthen linkages between the achievement of SDG Targets 12.4 and 3.9,

increase awareness of the important role of the health sector in the management of chemicals, and enhance its participation in international chemicals management activities can build on the UNEA-3 Resolution on chemicals and health (UNEA 2018a), which underlined the importance of chemicals management for human and environmental health, and the WHO Chemicals Road Map, developed based on the World Health Assembly Resolution 69.4 and approved by the 70th World Health Assembly in 2017, which aims to enhance health sector engagement in international chemicals management (WHO 2017).

Chemicals and the world of work

Workers are among those most exposed to hazardous chemicals in various sectors and across global supply chains. Ratification and implementation of international labour standards help achieve decent work that is safe and healthy, while simultaneously advancing towards greener work processes.

Chemicals and climate change

Linkages range from the remobilization of chemicals due to melting glaciers, to reducing the greenhouse gas emissions of the chemical industry, to the potential of chemistry to develop adaptation and mitigation solutions. The chemical industry and downstream sectors therefore have an important role to play in achieving the objectives of the Paris Agreement.

Chemicals and biodiversity

Hazardous chemicals not only affect human health, but also have significant adverse effects on terrestrial and aquatic life. Successful efforts to minimize the risks posed by hazardous chemicals can thus reduce direct pressures on biodiversity. The critical role of pollution and

chemicals was recognized in the Strategic Plan for Biodiversity 2011-2020 (UNEP 2010), adopted under the Convention on Biological Diversity. Given current activities to develop a biodiversity framework beyond 2020, opportunities exist to create linkages with the chemicals and waste process beyond 2020.

Chemicals, agriculture and food

Chemicals play a major role with respect to agriculture and food, for example in plant protection and food conservation. This link has long been recognized, and many countries have long-standing legislation to control chemicals used in agriculture and food production. International agreements and bodies that address these and related topics include the Code of Conduct and the Codex Alimentarius, which is a collection of international food standards.

Chemicals and sustainable consumption and production

Target 12.4 is embedded in SDG 12, “Ensure sustainable consumption and production patterns”, reflecting the insight that chemicals and waste management is inextricably linked to the broader quest for resource efficiency, waste reduction, and the need to decouple economic growth from natural resource use and environmental impacts. Individuals, companies and organizations play a critical role through their consumption choices and



© Alan D. Wilson, Sow and cub Polar Bears (*Ursus maritimus*) in the Arctic National Wildlife Refuge, Alaska. CC-BY 3.0



directly or indirectly impact chemicals production and sustainability. The realization that a global shift towards sustainable consumption and production would require the commitment of diverse actors throughout the world spurred Heads of State and Government at Rio+20 to adopt the 10-Year Framework of Programmes on Sustainable Consumption and Production Patterns (10YFP) (UNEP 2013). The 10YFP seeks to develop, replicate and scale up sustainable consumption and production policies and initiatives in areas such as public procurement, consumer information, education, construction, and food systems. All of these areas are highly relevant from a chemicals and waste perspective, pointing towards opportunities to strengthen linkages with the 10YFP.

Chemicals and the international pollution agenda

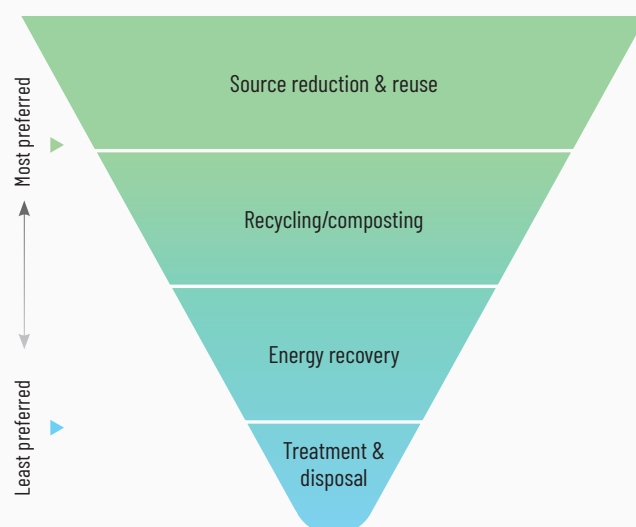
As highlighted in 2017 at the third session of the United Nations Environment Assembly (UNEA-3), whose theme was “Towards a Pollution-Free Planet”, chemicals and waste issues are a key dimension of a broader international and integrated approach to pollution. Chemicals

and waste issues were also identified as a key dimension of a broader international and integrated approach to address pollution. Several resolutions were adopted which recognized these linkages, including on lead and on environment and health. The UNEA-3 Declaration requested UNEP to prepare an implementation plan on the issue of a pollution-free planet for consideration by UNEA-4 in 2019. As pointed out in that Declaration, meeting the need for rapid, large-scale and coordinated action against pollution and for moving towards a pollution-free planet is a long-term endeavour. Shaping a pollution-free planet and contributing effectively and equitably to the SDGs requires system-wide transformation and strengthened capacities – global, national and subnational – to act on air, water, soil, marine and coastal pollution and sound management of chemicals and waste (UNEA 2018b).

Recognizing the interface of chemicals and waste management

For many years the chemicals and waste agendas have been addressed separately, both internationally and in many countries. For example, in Agenda 21 chemicals and waste

Figure 3.1 The waste hierarchy, sustainable materials management and the circular economy (adapted from United States Environmental Protection Agency [US EPA] 2017)



The waste hierarchy strives to achieve similar objectives as the related concepts of sustainable materials management and the circular economy. They have in common the quest to minimize the use of materials and maximize reuse. The sound management of chemicals and waste and innovations in chemistry play a key role in enabling these concepts.

management were covered in separate chapters. However, it has been increasingly recognized that the design and use of safer chemicals and sustainable production processes is essential for reducing releases throughout the life cycles of chemicals and products, including during the reuse, the recycle and disposal stages. These front-of-the-pipe solutions also help ensure that secondary raw materials rechannelled into a circular economy are not contaminated with unwanted hazardous chemicals. In turn, the widely known waste hierarchy (Figure 3.1) focuses on source reduction, reuse and recycling of materials, while energy recovery, waste treatment and waste disposal are seen as least preferred options. The waste hierarchy also emphasizes sustainable material management, resource efficiency and life cycle management.

This brief discussion suggests that important aspects of chemicals and waste management are converging, in line with a life cycle management approach.

At the international level, critical progress towards bringing the chemicals and waste management concepts together has been made through SDG Target 12.4, under SDG 12 on sustainable consumption and production, and through including waste in the mandate of the intersessional process on the Strategic Approach and the sound management of chemicals and waste beyond 2020. While GCO-II focuses on the sound management of chemicals and front-of-the-pipe-solutions, the interface with waste management is addressed throughout the GCO-II.

4/ Overview of the Global Chemicals Outlook II

In responding to the UNEA mandate to provide options for the implementation of actions to reach relevant SDGs and targets up to and beyond 2020 and, among others, to assess progress towards the 2020 goal, the GCO-II is structured in five parts:

Part I sets the scene by presenting existing and emerging knowledge on production, releases, concentrations and effects of chemicals and waste, as well as the current state of knowledge for estimating the costs of inaction and benefits of action for the sound management of chemicals and waste. Part I also addresses relevant interlinkages, including global resource flows, megatrends, industry sector trends, and the growing complexity of global supply chains.

Part II assesses, to the extent possible, progress towards achieving the sound management of chemicals and waste as called for by the 2020 goal. Given the lack of consolidated data and fragmented indicators and reporting schemes, established through various multilateral treaties and voluntary international instruments, a qualitative approach is taken to assess progress.

Part III assesses progress and outlines opportunities concerning science-based approaches, tools, methodologies and instruments used in the management of chemicals to protect human health and the environment. Over the past decades, valuable lessons have been learned in their practical application, and opportunities have emerged to enhance their effectiveness, simplify their

use, and employ them more systematically in all countries. Part III also provides specific suggestions for developing countries and economies in transition to consider in order to benefit from scientific work undertaken in countries with advanced management schemes.

Part IV discusses enabling policies and action that have the potential to scale up innovative solutions to achieve the sound management of chemicals and waste. Advancing sound management and a future chemistry that is fully sustainable requires the engagement of new actors and the shaping of enabling policies and approaches ranging from education reform, support for technology innovation and financing, to innovative business models, sustainable supply chain management and empowerment of citizens, consumers and workers through information and participation rights.

Part V places insights generated in the four previous parts within the context of the 2030 Sustainable Development Agenda, focusing on opportunities for collaborative action to achieve the sound management of chemicals and waste. There is an emphasis on collaborative action to integrate chemicals and waste considerations into key economic and enabling sectors. Part V concludes with a forward-looking discussion with respect to securing commitment by key stakeholders relevant for the future framework on chemicals and waste beyond 2020. It also presents options for the implementation of actions at all levels until and beyond 2020.

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A photograph of two young children playing in a lush green rice field. The child on the left, a girl with short dark hair, is wearing a blue denim shirt and pants, and is holding a large bundle of rice seedlings on her shoulder. The child on the right, a boy, is also wearing a blue denim shirt and dark shorts, and is kicking up a cloud of water or mud. The background is a soft-focus view of the rice field under a bright sky. A semi-transparent blue circle is overlaid on the right side of the image, containing the text.

**Key messages for
policymakers: a call for
more ambitious action at
all levels**

The 2020 goal will not be achieved: business as usual is not an option

The findings of the GCO-II indicate that the sound management of chemicals and waste, and minimizing adverse impacts, will not be achieved by 2020. Furthermore, trends data presented in Part I suggest that the projected doubling of the global chemicals market between 2017 and 2030 will increase global chemical releases, exposures, concentrations, and adverse health and environmental impacts unless prevailing gaps to manage chemicals and waste are addressed worldwide. Business as usual is therefore not an option. However, accelerating progress in order to achieve sound management and minimize adverse impacts in the context of the 2030 Agenda is possible under a sustainability scenario. This will require more ambitious, urgent and worldwide collaborative action by all stakeholders and in all countries.

A comprehensive global framework is needed, with ambitious priorities and coherent indicators

To address gaps, a global framework for the sound management of chemicals and waste beyond 2020 needs to be developed that is aspirational, comprehensive, and creates incentives to foster commitment and engagement by all relevant actors in the value chain. Drawing upon lessons

learned from the Strategic Plan for Biodiversity 2011-2020, a global common vision, strategic goals, targets and indicators could facilitate linkages across all relevant agreements and initiatives, and make reporting schemes simpler, country-driven and linked to global targets. Under such a scheme, indicators would need to distinguish between outputs (e.g. adoption of legislation) and impacts (e.g. reduction of adverse impacts from hazardous chemicals).

Implementation of actions up to and beyond 2020

Responding to the United Nations Environment Assembly (UNEA) mandate to provide options for the implementation of actions to reach relevant Sustainable Development Goals (SDGs) and targets up to and beyond 2020, and based on a review of implementation of the 2020 goal to date, the GCO-II presents a range of options for the implementation of actions (hereinafter referred to as “actions”) to reach relevant SDGs and targets up to and beyond 2020. The identified actions are considered of particular relevance to developing and implementing an international approach for chemicals and waste management beyond 2020. Equally important, they target policy- and decision-makers around the world and from all stakeholder groups in order to generate enhanced commitment for implementation.



The actions are presented under 10 topics which were derived using a back-casting method, imagining a sustainability scenario, where legacy problems are addressed and future legacies are avoided, including through green and sustainable chemistry innovation and sustainable consumption and production. They also cover

commitments, already agreed internationally, which require urgent attention and renewed commitment due to implementation gaps. Examples include implementation of the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) and the strengthening of basic chemicals and waste management systems.

1. Develop effective management systems



Address prevailing capacity gaps across countries, strengthen national and regional legislation using a life cycle approach, and further strengthen institutions and programmes by:

- › promulgating, aligning and enforcing legislation and policies, including full implementation of the GHS, promulgating legislation for industrial and consumer products, and taking measures to address illegal international traffic;
- › developing national and regional chemicals and waste management action plans and programmes, linked to globally agreed targets and priorities; and
- › integrating chemicals and waste considerations into national and sectoral policies (e.g. agriculture, housing, transport and energy) to implement specific SDG targets.

2. Mobilize resources



Scale up adequate¹ resources and innovative financing for effective legislation, implementation and enforcement, particularly in developing countries and economies in transition, by:

- › scaling up efforts to integrate chemicals and waste management into national and sectoral budgets;
- › facilitating adequate external technical assistance, financial support and technology transfer to address issues causing greatest harm, including through new and innovative financing (e.g. fiscal incentives, cost recovery instruments, green bonds, venture capital); and
- › strengthening the integrated approach to financing through assessing its effectiveness and renewed commitment across all three components (mainstreaming, industry involvement, and dedicated external financing).

3. Assess and communicate hazards



Fill global data and knowledge gaps, and enhance international collaboration to advance chemical hazard assessments, classifications and communication by:

- › sharing existing hazard data and assessments globally, and increasing the mutual acceptance of testing data and hazard assessments across countries based on accepted methods and scientific criteria;
- › developing a global database of assessed and classified chemicals for information-sharing and promoting harmonization of classifications; and
- › setting targets to fill data gaps in order to fully understand globally the hazards of substances in commerce, and assessing progress.

¹ To facilitate better understanding of the term “adequate” in this context, further analysis and international dialogue are needed on certain topics such as sustainability of funding.

4. Assess and manage risks

Refine and share chemical risk assessment and risk management approaches globally to promote safe and sustainable use of chemicals and address emerging issues throughout the life cycle by:



- › sharing knowledge on existing risk assessment and management approaches and tools (e.g. exposure scenarios) more widely;
- › further developing and refining exposure, risk assessment and life cycle assessment (LCA) methods; and
- › taking into account and benefiting from opportunities for accelerated and effective risk management, such as placing the burden of proof on producers, advancing informed and non-regrettable substitution of chemicals of high concern, and using generic risk-based approaches, when possible.

5. Use life cycle approaches

Advance widespread implementation of sustainable supply chain management, full material disclosure, transparency and sustainable product design by:



- › promoting wide implementation of corporate sustainability and sustainable procurement policies;
- › developing harmonized approaches across sectors to share chemical information and to advance full material disclosure across supply chains, including chemical-intensive industry sectors and the recycling/waste sector;
- › strengthening collaboration by all actors in the supply chain in designing and using safer chemicals and sustainable products; and
- › promoting the integration of chemicals and waste considerations into corporate sustainability metrics and reporting.

6. Strengthen corporate governance

Enable and strengthen chemicals and waste management aspects of corporate sustainability policies, sustainable business models, and reporting by:



- › encouraging private sector frontrunner action to further develop voluntary standards that exceed basic compliance, and reviewing their effectiveness through interested stakeholders;
- › promoting sustainable business models, such as Chemical Leasing and eco-industrial parks; and
- › enhancing systematic use by investors of corporate sustainability and chemical footprint reporting, covering chemicals and waste management performance.

7. Educate and innovate

Integrate green and sustainable chemistry in education, research, and innovation policies and programmes by:



- › reforming chemistry curricula in tertiary, secondary, primary and professional education;
- › scaling up research initiatives, and technology innovation policies and programmes, that advance green and sustainable chemistry, particularly for start-up companies; and
- › facilitating a better global understanding of green and sustainable chemistry concepts.

8. Foster transparency

Empower workers, consumers and citizens to protect themselves and the environment by:



- › disclosing robust and understandable information about hazardous chemicals in the supply chain to workers, consumers, citizens and communities;
- › scaling up innovative programmes and technology applications to facilitate a better understanding by individuals of chemical and waste risks, and engaging citizens in data collection through citizen science;
- › promoting and supporting meaningful and active participation by all actors of civil society, particularly women, workers and indigenous communities, in regulatory and other decision-making processes that relate to chemical safety; and
- › taking action so that citizens have ready access to justice.

9. Bring knowledge to decision-makers

Strengthen the science-policy interface and use of science in monitoring progress, priority-setting (e.g. for emerging issues), and policymaking throughout the life cycle of chemicals and waste by:



- › taking steps to harmonize scientific research protocols (e.g. for biomonitoring);
- › developing science-based criteria to identify emerging issues at the international level, taking into account harm (e.g. using health impact information) and monitoring their implementation;
- › providing research funding to fill identified gaps and priorities; and developing a study on the global costs of inaction, and benefits of action, on chemicals and waste management, comparable to the Stern Review on *The Economics of Climate Change*; and
- › developing and improving institutional mechanisms to improve knowledge generation and management.

10. Enhance global commitment

Establish an ambitious and comprehensive global framework for chemicals and waste beyond 2020, scale up collaborative action, and track progress by:



- › developing an aspirational, overarching and widely owned global framework that encourages engagement by all relevant stakeholders; and developing global targets, milestones and indicators that distinguish between outputs and impacts;
- › providing opportunities for sharing internationally, and for input or peer reviews, action plans and roadmaps by stakeholders under a beyond 2020 framework;
- › considering how corporate sustainability metrics and reporting can play a stronger role in measuring progress in a beyond 2020 framework; and
- › monitoring, tracking and reviewing collective action and progress and making adjustments in regard to ambition, as needed.

Results-based stakeholder roadmaps, mutual reviews and accountability beyond 2020

The period up to the conclusion of the intersessional process, by 2020, provides a brief but critical window in which to develop

an ambitious and comprehensive global framework – as well as to increase engagement by all stakeholders. What mechanisms could facilitate the needed commitment, ownership, mutual accountability and collective monitoring

of progress towards achieving the sound management of chemicals and waste?

To facilitate the success of the global collaborative framework on chemicals and waste, all relevant stakeholders could be challenged to make voluntary yet clear public commitments and pledges, specifying concrete plans and steps to be taken. One option is that countries and all relevant stakeholders could develop, implement and share, internationally, results-based action plans and roadmaps to implement the 2030 Agenda from a chemicals and waste perspective. Action plans and roadmaps could be prepared in a collaborative manner by countries, industry sectors (e.g. the chemicals industry, chemical-intensive downstream sectors, retailers, the recycling industry), civil society organizations, the Inter-Organization Programme for the Sound Management of Chemicals (IOMC), academia and others. They could also be prepared at the thematic level and involve several stakeholders (e.g. for an initiative to fill data gaps in order to understand the hazard potential of chemicals).

There are examples of roadmaps already prepared which address the sound management of chemicals and waste management, or certain aspects of it. They include the World Business Council for Sustainable Development (WBCSD)

Chemical Sector SDG Roadmap and the WHO Chemicals Road Map. This proposed roadmap approach would be compatible with, and take into account, experience gained in other international forums, such as those concerned with climate change. These have evolved to include a more flexible, yet results-oriented and mutually accountable, approach to compiling commitments and action taken, with reviews taking place internationally to track process and adjust ambition levels, as appropriate.

Collectively, these action plans and roadmaps would provide an indication of commitments and allow assessing the extent to which collaborative action succeeds in making the progress needed to achieve the sound management of chemicals and waste. Commitments and progress could be made available to the public in order to monitor progress. Stakeholders could pledge and showcase their action plans and roadmaps within the beyond 2020 framework and benefit from the input of other stakeholders (which might take different forms, such as peer review). Pledges could be reviewed globally against agreed goals and targets, with adjustments made as appropriate. Frontrunners would be rewarded, and space would be given to key actors to step up and provide leadership.

