Environmental Science & Technology Letters
Open Access

pubs.acs.org/journal/estlcu
Global Perspective

Exploring Outputs of the Intergovernmental Science-Policy Panel on Chemicals, Waste, and Pollution Prevention

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Cite This: Environ. Sci. Technol. Lett. 2024, 11, 664−672
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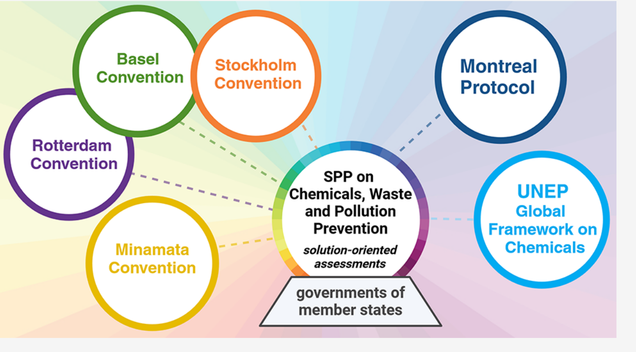
ABSTRACT: The Science-Policy Panel (SPP) on Chemicals, Waste, and Pollution Prevention, now being established under a mandate of the United Nations Environment Assembly, will address chemical pollution, one element of the triple planetary crises along with climate change and biodiversity loss. The SPP should provide governments with consensual, authoritative, and holistic solution-oriented assessments, particularly relevant to low- and middle-income countries (LMICs) and, we suggest, to issues regarding the global commons. The assessments should be flexible in scope and breadth, and address existing issues retrospectively and prospectively to minimize the high costs to human and environment health that come from delayed, slow, and/or fragmented policy responses. Two examples of assessments are presented here. The retrospective example is pharmaceutical pollution, which is of increasing importance, especially in LMICs. The SPP's assessment could identify data gaps, develop regionally attuned policy options for mitigation, promote "benign-by-design" chemistry, explore educational and capacity-building activities, and investigate financial mechanisms for implementation. The prospective example is on risks posed by chemicals and waste release from critical technological infrastructure and waste sites vulnerable to sea level rise and extreme weather events. Multisectoral and multidisciplinary inputs are needed to map and develop "disaster-proofing" responses, along with financing mechanisms. The new SPP offers the ambition and mechanisms for enabling much-needed assessments explicitly framed as inputs to policy-making, to protect, and support the recovery of, local to global human and environmental health.



KEYWORDS: *science-policy interface, international chemicals management, chemicals and waste, pollution prevention, multilateral environmental agreements, solution-oriented assessment*

INTRODUCTION

The international community is within reach of establishing the third pillar to address the triple planetary crises of climate change, biodiversity loss, and chemical pollution:[1] a new Intergovernmental Panel on Chemicals, Waste, and Pollution Prevention. This Science-Policy Panel (SPP) was first identified as a need in 2019 and then mandated in 2022 by the United Nations Environment Assembly (UNEA) to fill knowledge gaps by delivering timely, comprehensive, and policy-relevant scientific information provided by the scientific community in response to the needs of global policy-makers.[2,3] The 2022 UNEA resolution stated that the SPP should be established to "contribute further to the sound management of chemicals and waste and prevent pollution" (UNEP/EA.5/Res.8).[3] Thereby, the SPP is intended to contribute to safeguarding biophysical systems on Earth critical to maintaining a liveable planet upon which the world collectively depends (the "planetary commons").[4] Unlike the science-policy interfaces established for climate change (Intergovernmental Panel on Climate Change or IPCC) and biodiversity (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services or IPBES), the SPP is not tied to an agreement (e.g., the Paris Accord for Climate Change or the Convention on Biological Diversity).

The proposed functions of the SPP are (a) horizon scanning, (b) conducting assessments, (c) providing up-to-date and relevant information, as well as identifying critical gaps in information, and (d) information sharing.[3] One more

Received: April 17, 2024
Revised: May 29, 2024
Accepted: May 30, 2024
Published: June 6, 2024

https://doi.org/10.1021/acs.estlett.4c00294
Environ. Sci. Technol. Lett. 2024, 11, 664−672

function—capacity building—has emerged during the negotiations on the establishment of the SPP and continues to be discussed.[5] In particular, the second function under the UNEA resolution is "conducting assessments of current issues and identifying potential evidence-based options to address, where possible, those issues, in particular those relevant to developing countries".[6] Those assessments should be policy-relevant, but not policy-prescriptive,[3] and must not be influenced by vested interests in material gain.[7] Below, we explore general principles that would guide the selection of assessment topics by the panel[8] and present two case studies as examples of what these assessments might consider. This discussion and the accompanying case studies are intended to contribute to discussions about the SPP's outputs, which to date have been subject to widely differing interpretations, spanning from the least to the most potentially impactful assessments.

Before examining the SPP dedicated to chemicals, waste, and pollution prevention, we note that the intention of science-policy panels in general is to develop "consensual knowledge" recommendations for governments, enabling them to develop policies and practices consistent with collectively negotiated goals. Science-policy panels aim to achieve their mission of social influence through the use of science, with its trusted authority, particularly in matters involving uncertainty.[9] What distinguishes science-policy panels from other international bodies, such as multilateral environmental agreements and the new Global Framework on Chemicals (Box 1), is the goal of providing a wide range of assessments explicitly framed as inputs to policy-making.

THE PURPOSE OF THE SCIENCE-POLICY PANEL (SPP) ON CHEMICALS, WASTE, AND POLLUTION PREVENTION

The SPP on Chemicals, Waste and Pollution Prevention will be the only ongoing science-policy interface body addressing the broad chemicals and waste sphere, with the intent of providing consensual knowledge to governments. It holds a unique position among other regional and international legal and policy instruments focused on chemicals and waste. Consequently, the Basel, Rotterdam, Stockholm, and Minamata Conventions, the Montreal Protocol, and the Global Framework on Chemicals should consider outcomes from the SPP (Para 73(i))[10] (see Box 1, Figure 1). Each of these bodies has a specific, narrower mandate within the broad field of chemicals and waste. Further, the conventions and protocols oblige the ratifying countries to comply with the negotiated terms. These bodies do not undertake horizon scanning or prospective policy-relevant assessments of, broadly, chemicals and waste. In contrast, the SPP should aim to consider all issues related to chemicals, waste, and pollution prevention, and to integrate related science into policy-relevant syntheses. Thus, the SPP has the potential to become an integrative body by bringing together topics that may be common to, but not addressed by, existing organizations as well as issues that fall between existing bodies, as illustrated by the case studies presented here. Further, existing conventions, protocols, and the framework address past and current issues, typically working toward mitigation, phase-out, or ban of specific chemicals, but without the capacity to work proactively. Here, the SPP can address these challenges and anticipate future challenges by undertaking horizon scanning and interdisciplinary, solution-oriented assessments. The establishment of the SPP will enable a new era of science-based policy assessment to prospectively develop solutions to potential problems before they cause substantial harm.

Box 1. Examples of international instruments aimed at mitigating past and present chemicals and waste issues

The Basel Convention (signed in 1989, entered into force in 1992) aims to control the transboundary movements of hazardous waste and its disposal. The Rotterdam Convention (signed in 1998, entered into force in 2004) promotes the informed import/export of hazardous pesticides and industrial chemicals. The Stockholm Convention (signed in 2001 and entered into force in 2004) aims to protect human health and the environment from persistent organic pollutants (POPs). The goal of the Minamata Convention (signed in 2013 and entered into force in 2017) is to protect human health and the environment from anthropogenic emissions and releases of mercury and its compounds. The Vienna Convention (signed in 1985 and entered into force in 1988) and the Montreal Protocol (signed in 1987 and entered into force in 1989) focus on sharing information and controlling the consumption and production of ozone-depleting substances, respectively. More recently, the Global Framework on Chemicals (GFC) was established in 2023 by the International Conference on Chemicals Management as the successor to the Strategic Approach to International Chemicals Management (SAICM). This framework lists 28 targets developed through a consensus process, aiming "to guide countries and stakeholders in jointly addressing the lifecycle of chemicals, including products and waste".[10] The Conventions and the Montreal Protocol work toward compliance by all signatory governments, as each government introduces legislation to comply with their terms. The GFC is a nonbinding set of objectives and targets endorsed by participating governments, international technical agencies, civil society groups, and the private sector. One activity agreed to in the Framework is "providing up-to-date and relevant information, as well as identifying critical gaps in information, and information sharing".[10]

PROSPECTIVE AND RETROSPECTIVE ANALYSES

There is no shortage of issues that must be addressed by SPP assessments. For example, Wang et al. (2020)[11] estimated that 350,000 substances have been registered for use globally, with 70,000 registered between 2010 and 2020 and nearly 30,000 registered in low- and middle-income countries (LMICs). Up to 16,000 substances are potentially used in plastics, of which 3,400 are chemicals of concern, and about 100,000 formulations of plastics have been registered.[12,13] In this regard, Persson et al. (2022)[14] noted that the sheer number of substances registered far exceeds the capacity of regulatory authorities to conduct hazard and risk assessments, especially in LMICs. Adding to the challenge, Kristiansson et al. (2021)[15] and Muir et al. (2023)[16] have shown that research has drilled down to understand a lot about very few substances, but not the broad range of chemicals on the market, let alone mixtures. Further, the chemical industry has released insufficient data on the production and consumption of chemicals in commerce to enable assessment. As well, data are insufficient to show the generation and movement of chemicals and waste around the globe, including movement through complex supply chains.[17]

We suggest that the SPP should not provide chemical-by-chemical assessments, which are conducted by regulatory

https://doi.org/10.1021/acs.estlett.4c00294
Environ. Sci. Technol. Lett. 2024, 11, 664−672

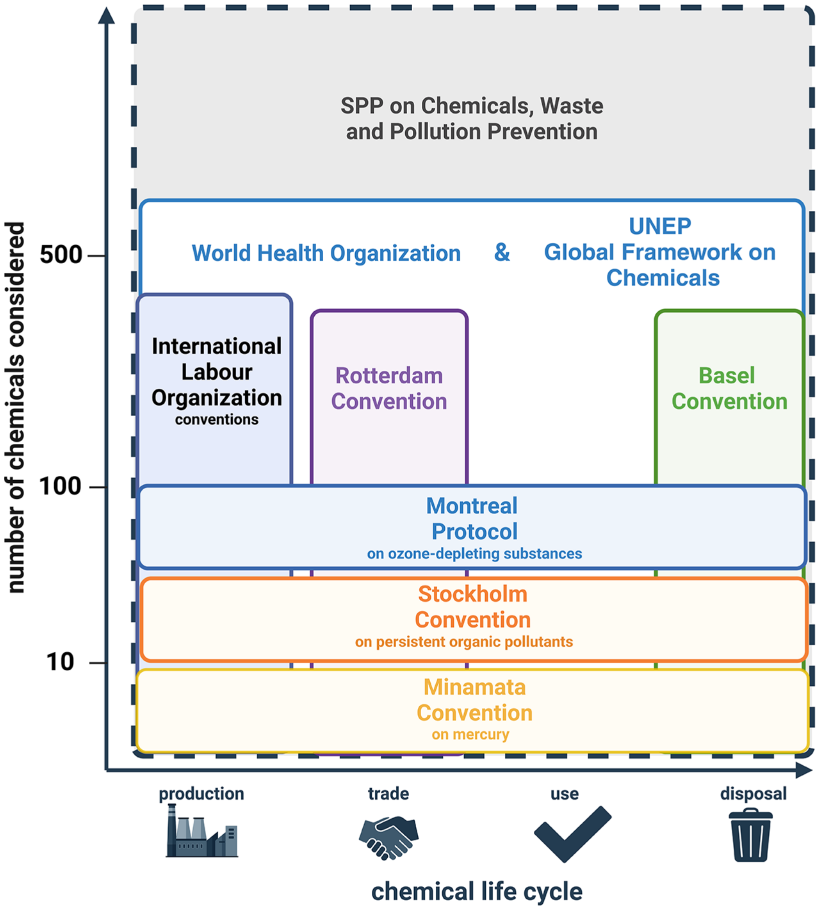


Figure 1. Integrative position of the Science-Policy Panel on Chemicals, Waste, and Pollution Prevention (SPP) in relation to major international legal/policy instruments on chemicals and waste illustrated according to different life-cycle stages and the number of chemicals covered. Climate change- and biodiversity-related instruments (not shown here) also have links to the future SPP.

authorities, particularly in several high-income countries (HICs), or by regional bodies. Given the diverse universe of substances and mixtures, and that priorities expressed by the public and experts may differ,[18,19] how might the SPP select issues for consideration? Fuller et al. (2023)[20] have recommended that topics be prioritized on the basis of impact—the damage caused or expected to be caused by a stressor, guided by the impact on human health, the loss of biodiversity, the ability of the stressor to "undercut" societal stability, and the degree of irreversibility. This approach to prioritization is necessary to avert large-scale impacts with associated costs to human and ecosystem integrity. Such assessments are necessarily retrospective since a stressor must have grown to such a magnitude that it has caused a widespread impact. Retrospective, impact-based assessments are necessary to stem impacts and are useful since they provide valuable insights from "lessons learned". However, we suggest that they are insufficient. As prevention (proactive attention) is far more efficient and cost-effective than treatment (reactive attention), the SPP should also be directed to conduct prospective assessments.[21]

Ample and well-documented evidence shows the enormous costs of failing to respond in a timely and precautionary manner to early warnings of harm. Many examples can be cited, such as the impacts on human health of lead in gasoline and paint, insecticides on pollinators, and chlorinated solvents and per- and polyfluoroalkyl substances (PFAS) as drinking water contaminants.[21−23] Indeed, the authors of "Late Lessons from Early Warnings" concluded that "false positives" (a concern that was not justified and did not materialize as a negative impact) were relatively rare compared to "false negatives" (where concerns were justified but preventive actions were not taken).[21] The inefficiency and additional costs of reactive action or action delayed until an issue has grown to cause a major impact[21] are due to the deep entrenchment or "lock-in" of the practices underlying the issue. "Lock-in" refers to complex interactions of technological, economic, social, and political factors that present seemingly insurmountable barriers to transformative change.[24] The idea of lock-in was developed to explain the continued production and consumption of fossil fuels causing climate change despite ample evidence of its impact. Lock-in provides an analytical framework for understanding how to unlock the system.[25] Similarly to fossil fuels, patterns of production and use of some hazardous chemicals that cause widespread harm are or were also locked-in, e.g., the use of highly hazardous pesticides such as paraquat, lead in gasoline, paints, and metal alloys, and persistent chlorinated compounds in dielectric fluids. Significant harm could have been avoided by the transparent sharing of information by the chemical industry followed by early action by authorities, so that the extensive use of these chemicals, including the proliferation of uses beyond those

https://doi.org/10.1021/acs.estlett.4c00294
Environ. Sci. Technol. Lett. 2024, 11, 664−672

originally intended, could have been avoided, e.g., in the cases of polychlorinated biphenyls (PCBs), PFAS, triclosan.[26,27]

We suggest that an important function of the SPP is to conduct prospective assessments, especially those relevant to LMICs, before deeply entrenched practices thwart effective and efficient action. The horizon-scanning activities of the SPP can guide the choice of emerging issues to be addressed in such prospective assessments. The choice of which emerging issue to address could also be governed by the criteria used to select the retrospective impacts issues listed by Fuller et al.,[20] namely those affecting human health, biodiversity loss, climate change, threats to societal stability, and irreversibility, noting that priorities vary widely by geographic region and country income level.

A key need for the SPP is addressing issues comprehensively and in an interdisciplinary fashion within a global forum. This offers the opportunity to explore unintended consequences in which a well-intentioned action may cause the intended benefit but could be accompanied by unintended negative (and/or positive) consequences elsewhere. One example is burden shifting, namely solving a problem in one place by shifting it to another, which has too often occurred in the direction of HICs to LMICs.[28,29] Another example is regrettable substitution, where a known harmful chemical is banned and replaced with a less well-studied substance, as has occurred with halogenated flame retardants (i.e., the switch from polybrominated diphenyl ethers (PBDEs) to halogenated and nonhalogenated organophosphate esters) or the proliferation of just slightly different chemicals in the case of PFAS.[30−32] The establishment of the global SPP provides an opportunity to consider issues and solutions in an integrative and comprehensive manner, accounting for intended and unintended consequences and building on previous lessons learned with the intent to aid well-informed decision-making. Such an approach necessarily integrates input from multiple disciplines of Western science, including social, physical and applied sciences, and from Local and Indigenous Knowledge Systems.[5] The scope and breadth of assessments should be flexible, ranging from those relevant to a specific issue within a specific geography, to more comprehensive and expansive assessments.

CONDUCTING AN ASSESSMENT

The process by which the SPP will set priorities is now being determined, with precedents from other science-policy panels being considered, namely IPBES and IPCC.[33] The process of identifying topics and issues for the SPP's consideration is likely to start with a call for requests for topics and issues for the SPP's consideration from the future SPP Secretariat, followed by suggestions from governments, multilateral environmental agreements such as the Stockholm and Basel Conventions, and possibly other rights holders.

Below, we provide two case studies of assessments offering issues that might be considered as well as ideas of what might be covered under each issue. The first is a retrospective analysis of pollution from pharmaceuticals, a growing issue that has yet to be recognized and addressed globally but for which an SPP assessment could provide policy-relevant options for mitigation. The second is an emerging issue requiring a prospective analysis: preventing chemicals and waste release from technological infrastructure and waste disposed in locations vulnerable to increasingly unpredictable extreme weather events such as an increased frequency of flooding and fires. These two case studies are to be understood as illustrative examples chosen from an extensive list of issues and emerging questions that the SPP may tackle, such as addressing hazards associated with substances of high concern, including lead and arsenic, characterizing concentrations of hazardous chemicals in the water cycle affected by climate change, identifying impediments to circular resource use, and providing guidance on pesticide production and use to avoid burden shifting, among others.

RETROSPECTIVE CASE STUDY: POLLUTION FROM PHARMACEUTICALS

While the pharmaceutical industry has contributed to improving health outcomes globally, it is of utmost importance that this service be provided without serious human and ecological harm due to inadequate management of active pharmaceutical ingredients (APIs), especially in LMICs that may lack management capacity. In this regard, discharges to the environment during the production, use, and disposal of pharmaceuticals have resulted in APIs becoming widespread in ecosystems.[34−36] This poses a serious and growing threat to biodiversity, ecosystem services, and public health around the globe,[17,37,38] including the growing threat of antimicrobial resistance.[39] Due to their constant discharge to aquatic environments, many APIs are ubiquitous and cause continuous exposure.[40] Moreover, some pharmaceuticals are designed to have additional uses, such as biocides, and/or are organofluorine pharmaceuticals, which can pose particularly complex environmental hazards and regulatory impediments.[41,42]

The impacts of API pollution have been the subject of substantial research in recent decades, although mostly in HICs.[37,43] Data on API pollution and antibiotic resistance from LMICs are scarce, and the capacity to collect such data is limited.[44] SAICM identified this as an "emerging policy issue" because of the global nature of the issue.[36]

Pharmaceuticals remain weakly regulated at the international level and in some LMICs, and current preventative and control initiatives are highly fragmented.[45] The challenges are multifaceted and multisectoral, starting with overprescription by health care professionals (in HICs and LMICs) of pharmaceuticals, including antibiotics,[46] incorrect dosing, and availability to the public of pharmaceuticals "over-the-counter", especially in some LMICs.[47,48] Determinations of environmental persistence, mobility, bioaccumulation, and toxicity are often challenging, compounded by many APIs having effects at extremely low exposure levels (e.g., parts per billion to parts per trillion).

Diclofenac is the only example of a pharmaceutical having been banned regionally for its effects on the environment; its veterinary usage was eliminated in the Indian subcontinent due its role in eliminating 95−99% of vulture populations through uric acid poisoning.[49] The ban on the use of diclofenac in India, Pakistan, Nepal, and Bangladesh (in 2006−2010) has slowed or halted the decline and, in some cases has led to the recovery of vulture populations, although it is still thought to be used illegally in some locations.[50] Despite these bans on veterinary usage in Asia, diclofenac was controversially allowed for veterinary use under license in Spain in 2013.[50] This is a cautionary tale of the unintended consequences of pharmaceutical drugs, many of which have widespread and unregulated use in veterinary practice.

The extent and composition of API pollution varies between countries and within a country, according to the socioeconomic characteristics of the human population contributing

https://doi.org/10.1021/acs.estlett.4c00294
Environ. Sci. Technol. Lett. 2024, 11, 664−672

to this pollution.[51] A recent global sampling study found that surface water concentrations of APIs were highest in LMICs,[38] with one reason being lower availability and connectivity to wastewater infrastructure.[52] However, regulating APIs in LMICs is not necessarily a priority issue, given the more basic needs for health care and sanitation infrastructure. In addition, several LMICs are significant producers of pharmaceuticals, with discharges from drug manufacturing plants in India and Pakistan, for example, having been linked to unprecedented levels of pharmaceutical contamination of river sediments, surface, ground, and drinking waters.[53] This issue is only expected to grow, given that the global pharmaceutical industry is projected to expand from a current worth of $1.4 trillion to over $2.4 trillion by the end of 2029.[54]

To move forward, the SPP could gather information and identify data gaps (e.g., API concentrations and composition, emissions, and their sources), which could point to prioritizing efforts. A solutions-oriented assessment could evaluate types and effectiveness of policies and regulations and avenues available for effective implementation that are appropriate for country- and regional-level situations. Such an analysis could start with ongoing efforts for tackling pharmaceutical over-prescription and use, which would have the dual benefits of reducing environmental pollution and in the case of antibiotics, reducing the alarming rise in antibiotic resistance in hospital and nonhospital settings.[48] Discussions of policy options could tie in with nonpharmaceutical interventions such as public health measures of promoting vaccinations, and stressing health prevention measures and hygiene.[48] Moving down the "waste hierarchy" toward treatment, some HICs (e.g., Switzerland) have already committed significant resources to upgrading their wastewater treatment plants (WWTPs) to remove APIs.[55] Similarly, the European Union's new Urban Wastewater Treatment Directive will mandate WWTP upgrades and plans to assign at least 80% of the related costs to the pharmaceutical and cosmetics industries, following the polluter pays principle.[56] A comprehensive and regionally attuned assessment of such wastewater treatment options to remove APIs could prioritize systems that could be deployed in LMICs, prioritize target waters (e.g., hospital wastewater), and consider undesirable consequences such as the transfer of APIs from one phase (e.g., water) to another (e.g., sludge from WWTPs applied to farmland). Other options would need to be evaluated to control the veterinary use of pharmaceuticals since their sources to the environment are highly diffuse and thus not amenable to centralized water treatment systems.

A more "upstream" set of solutions could be explored such as the development and implementation of "benign-by-design" and/or "treatable by design" concepts in pharmaceutical development and production, which eventually could result in APIs that are quickly degraded in the environment after excretion.[57] A second-tier option would encourage the development of pharmaceuticals that can be easily removed from the environment (e.g., via WWTPs). While "benign-by-design" focuses on drug discovery, additional factors for consideration could include cobenefits achieved by reducing the carbon budgets associated with API production, reducing waste generation by improved shelf life, and lock-in effects that are slowing or preventing such initiatives. Advances in the design and widespread adoption of "benign-by-design" solutions also have the benefit of translation to other chemical groups.

Implementation of solutions depends on capacity and funding mechanisms. Here, the SPP could coordinate with ongoing initiatives to improve health care delivery (e.g., promoting public health measures and reducing overprescription) and could scope out financing arrangements for cross-border application of the polluter-pays principle to decrease the burden on LMICs. The SPP could develop guidance for regionally appropriate educational and organizational approaches supported through capacity building. As this discussion illustrates, a holistic assessment by the SPP would require broad and globally representative expertise including, but not restricted to, public health and front-line health care providers and experts in pharmaceutical design and production, waste treatment and infrastructure planning, financial instruments, and science outreach, in addition to environmental chemistry and ecotoxicology.

■ PROSPECTIVE CASE STUDY: CLIMATE CHANGE IMPACTS ON CHEMICAL AND WASTE RELEASE

Among the many impacts triggered by climate change are the increasing likelihood of chemical and waste releases due to sea level rise and the greater frequency and severity of extreme events such as flooding, storm surges, hurricanes, and typhoons. Many of these impacts are most severe in coastal zones, which are home to approximately 37% of the world's population.[58] Coastal zones, which are vulnerable to sea level rise and extreme weather events, are also the locations of technological systems such as chemical production facilities, oil refineries, chemical and fuel storage facilities, transportation hubs for shipping and aviation, water supply and sewage systems, wastewater treatment plants, and electrical conduits. For example, it is estimated that 872 highly hazardous chemical facilities are located within 80 km of the hurricane-prone United States Gulf Coast and within 2.4 km of 4.37 million people, 1,717 schools, and 98 medical facilities.[59] Across the United States, 326 Superfund sites covering 18.1 million ha are vulnerable to rising groundwater levels or changes in groundwater direction as a result of sea level rise.[60] Adding to this list of locations vulnerable to chemical and waste releases are historic landfills and contaminated sites. Indeed, over 1,200 historic landfills in England and Wales alone are located in coastal zones threatened by storm surges and erosion.[61,62] Landfills contain many of the harmful chemical contaminants that have been banned, sometimes decades ago, but still pose a sizable global risk to human and ecosystem health. For example, two-thirds of PCBs ever produced are still thought to be in landfill sites around the world.[63] The third that has been released into the environment continues to cause harm over two decades after their production was banned under the Stockholm Convention in 2001.[64]

Efforts in HICs have been, and continue to be, directed toward managing natural disasters that threaten technological systems, known as "na-tech" events, that cause the release of hazardous materials and waste.[65,66] However, an added dimension is planning for na-tech events triggered by climate change, in coastal zones and other locations vulnerable to extreme weather events such as flooding and fires, particularly in LMICs. Planning is hampered by a lack of coastal zone mapping of locations subject to na-tech risks, again especially in LMICs. Even documentation of hazardous material releases after a na-tech event is often unavailable as public authorities, the media, and the public rush to respond to the disaster.[67] Planning for the mobilization of waste from coastal landfills is

https://doi.org/10.1021/acs.estlett.4c00294
Environ. Sci. Technol. Lett. 2024, 11, 664−672

also hampered by insufficient data, the absence of robust protocols for assessment, and the lack of regulation and funding in all countries.[68,69]

The SPP has the opportunity to address major gaps in data, assessment methods, and regionally appropriate best practices, especially for LMICs, to minimize risks to human and ecosystem health from chemicals and waste released due to slow sea level rise and fast climate-exacerbated natural disasters. The SPP could issue a call to the scientific community and local communities to contribute to the mapping of current and historic locations holding hazardous and/or nonhazardous waste and/or technological facilities vulnerable to sea level rise and extreme weather events. The SPP could also outline best practices for increasing the resilience of technological systems, particularly in coastal zones and managing hazardous materials and waste in the era of extreme weather events and climate change. The need to buttress technological systems in vulnerable locations has, of course, the cobenefit of maintaining the critical functions that they provide, such as ensuring the provision of clean drinking water during extreme floods and maintaining transportation corridors. The assessment could explore the best options for dealing with current and closed landfills/waste heaps and detail policy options on how to minimize the release of chemicals and waste from them. Given the interconnection among biodiversity, climate, environmental, and human health impacts, the SPP could outline benefits and drawbacks of different options available for "disaster-proofing" critical infrastructure, chemical and waste storage facilities, and landfills/open waste collections. The SPP could also explore the critical issue of funding mechanisms to enable LMICs to actually carry out disaster-proofing.

■ LOOKING TO THE FUTURE

Government delegates and observers will deliberate the structure and functions of the SPP to finalize its Terms of Reference in the third meeting of Open-Ended Working Group (OEWG3) in June 2024.[70] We suggest that the discussions also consider the types and nature of the interdisciplinary assessments that will be conducted as one of the key functions. The SPP could conduct solution-oriented[71] assessments for existing and emerging issues, with examples presented here. Tackling the issue of improving the design, use, and management of pharmaceuticals across the globe is one of several pressing issues that illustrate the need for retrospective, solution-oriented assessments. Identifying suitable strategies to mitigate undesirable effects on ecosystems and human health would build on a cross-disciplinary collaboration with experts from IPBES and the World Health Organization (WHO). The issue of chemicals and waste release from critical technological infrastructure and waste-storage sites vulnerable to sea level rise and extreme climate events sits astride the areas of infrastructure management, disaster response, chemicals and waste management, and climate change. Here, the SPP can bridge this gap by bringing together experts from the other science-policy panels, namely, IPCC and IPBES, plus the United Nations Office for Disaster Risk Reduction, International Energy Agency, International Transport Forum, and others, as well as the chemicals and waste sectors.

Our case studies, one retrospective and one prospective, illustrate the need to tackle global issues in an intergovernmental forum with strong provisions to guard against conflict-of-interest. The need for assessments and pragmatic solutions with avenues for implementation is most acute for issues that impact LMICs, which currently lack resources for assessment. The need is also urgent for protecting, and promoting the recovery of, the global commons that are not adequately protected by current governance structures.[4] The SPP is uniquely positioned to fill knowledge gaps on "Chemicals, Waste, and Pollution Prevention", especially related to exploring solutions holistically, by giving voice to all countries and disenfranchised communities, and bringing in a multitude of perspectives and "ways of knowing" that includes Local and Indigenous Knowledge systems.[72,73] This can yield assessment strategies to identify effective solutions to the challenges of today and tomorrow with the potential to reduce impacts on billions of people and large areas of highly productive ecosystems. These benefits can be realized if the assessments are structured to promote effective policy action relevant to LMICs and HICs, and if they consider the global commons. We encourage the broad scientific community, across disciplines, to contribute to the SPP and to build a "community of scholarship" analogous to the involvement of hundreds of academic experts who have contributed to the IPCC's and IPBES' authoritative and influential assessments.

■ KEY MESSAGES

Outcomes from the new Science-Policy Panel on Chemicals and Waste are discussed and illustrated with retrospective and prospective case studies.

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https://doi.org/10.1021/acs.estlett.4c00294
Environ. Sci. Technol. Lett. 2024, 11, 664−672

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https://pubs.acs.org/10.1021/acs.estlett.4c00294

Notes

The authors declare no competing financial interest.

■ ACKNOWLEDGMENTS

Figures were created with BioRender.com.

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