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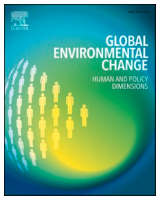

Rethinking the science-policy interface for chemicals, waste, and pollution: Challenging core assumptions

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ABSTRACT

Negotiations are ongoing but fraught for designing a new global science-policy panel for chemicals and waste pollution. In this *Perspectives* article, we challenge three assumptions guiding these negotiations. First, the new panel should resemble the existing panels of the Inter-governmental Panel on Climate Change (IPCC) and the Inter-governmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). Second, the creation of a new panel will automatically carry authority within policymaking. Third, the participation of industry is crucial without special consideration for its interests. Further, we identify three steps to enhance the panel's relevance and influence.

1. Introduction

Pollution from chemicals and waste significantly harms human health and the environment (Naidu et al, 2021; Landrigan et al, 2018; UNEP, 2019). Many of these risks are only partially understood, including how they vary by geographic location, gender, ethnicity, class, and other socioeconomic factors. The production capacity of the global chemical industry doubled between 2007 and 2017 to approximately 2.3 billion tonnes, with the largest increases in the Global South, and sales have been projected to nearly double from 2017 to 2030 (UNEP, 2019). In this context, the UN Environment Assembly (UNEA) established an ad hoc Open-Ended Working Group (OEWG) to negotiate a science-policy panel to contribute further to the sound management of chemicals and waste and to prevent pollution (UNEA, 2022). The goal is to design a panel that, like the Inter-governmental Panel on Climate Change (IPCC) and the Inter-governmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), will create a shared knowledge base to inform collective responses.

Throughout the OEWG's work, negotiators have considered five functions of the future panel: undertake horizon scanning, conduct assessments, provide information and identify research gaps, facilitate information sharing, and capacity building (ENB, 2023; UNEA, 2022). Countries, however, failed to meet the deadline to finish work by the end of 2024, leaving nearly all issues related to the panel's design undecided.

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As of early 2025, there is no agreement on the panel's name, scope, outputs, and structure, among other design features that could enable the panel to meet its five functions. Much of the negotiation's impasse is due to different visions of this panel. Petroleum and chemical-producing states, in particular, opposed several aspects of the panel, from including pollution prevention in its mandate to linking to international bodies involved in health or "non-environmental" issues (ENB, 2024).

We welcome the panel's establishment and the transparency of the OEWG process. Yet, in following these negotiations,[1] we identify three assumptions taken for granted but guiding the negotiations over the panel's design in ways that may make it ill-suited to assess chemicals and waste problems. We suggest that questioning these assumptions is fundamental to designing a panel responsive to the unique aspects of chemicals and waste pollution. These assumptions are: first, that the panel should mimic the IPCC and IPBES models, which could impede a solutions-oriented approach relevant to the full range of stakeholders. Second, creating this panel will automatically achieve policy relevance, which underestimates the institutional complexity and fragmentation of the chemicals and waste governance landscape. And third, industry is just another stakeholder, which might inhibit scrutiny and undermine the legitimacy of the panel's outputs. Appropriate participation mechanisms and conflict of interest policies are central to addressing all these assumptions: those who participates in the panel at the outset will shape its work and legitimize particular forms of knowledge for years to come (Hughes, 2024).

2. Assumption 1 It should operate like the IPCC and IPBES

Following the slogan "the wheel doesn't need to be re-invented," OEWG participants have regularly invoked the IPCC and IPBES as models (ENB 2023). Drawing from an existing model can be useful, but different environmental issue areas have unique characteristics. Moreover, the debate and design of expert panels change over time. During IPBES negotiations, the IPCC was used as a template, prompting concerns that it was a poor fit for biodiversity (Kohler 2019). Adjusting the new panel's design to the specificities of chemicals and waste is critical. Table 1 outlines relevant features of the IPCC and IPBES, based in part on the substantial literature on these bodies (including Borie et al 2021). The table also includes suggestions for the new panel.

A recurring theme is that the new panel should regularly synthesize models and data on a designated set of chemicals. This approach would mimic the IPCC Working Group I assessments of the physical science basis of climate change, which analyses the issue as a "global" problem and response (Allan 2018; Miller 2004). Forging such global kinds of knowledge with iconic concepts, like global mean temperature or ecosystem services, risks losing geographical sensitivities and narrowing response options (Hulme, 2010; Livingston et al. 2018; Turnhout et al. 2016).

A global assessment approach under the new panel would require political agreement to prioritize some substances and wastes. The potential scope is immense. An estimated 350,000 chemicals and chemical mixtures are registered in regional and national inventories (Wang et al., 2020); 6000 industrial chemicals account for more than 99 % of the volume of chemicals used commercially (UNEP 2019). For waste streams, the picture is less clear. Due to a lack of common methodologies and data-gathering capacity, knowledge of volumes, movement, and risks is incomplete and potentially inaccurate (UNEP 2024). Moreover, many risks associated with wastes also depend on the contexts of how they are stored or are exposed to living organisms.

An assumption that a global assessment is necessary could undermine the relevance of the panel's work. It would require data to identify the "worst" substances based on health and environmental risks. However, these data are often lacking especially in the Global South, and scientists and policymakers know the most about already regulated chemicals. Lead would undoubtedly rank highly in a risk-based prioritization exercise. It is responsible for half of the one million annual deaths attributed to chemical exposure (UNEP 2019). However, despite no global lead treaty, almost all sources are domestically regulated. Therefore, there may be little added policy value to continually assessing its global presence.

Rather than adopting a global assessment approach, solutions-oriented assessments focusing on specific problems and potential solutions may help the new panel scope and engage stakeholders in the unique context of chemicals and waste. Such assessmens could provide a menu of solutions perhaps alleviating concerns about remaining policy relevant, not prescriptive. Solutions-oriented assessments are, at best, nascent within the IPCC and IPBES (Beck et al 2022). Their designs pose barriers, including relying on global systems approaches to environmental risk and disproportionately engaging with Global North governments and experts (Hughes, 2024; Vadrot 2020).

Solutions-oriented approaches focus on how potentially hazardous chemicals might result in distinct problems and can be global or regional, as appropriate, complemented with local knowledge to capture the diversity of health and environmental risks. Such an approach provides space to reflect on the assumptions often made when defining problems, which is particularly important given the many ways and contexts in which exposure occurs. Focusing on solutions would narrow the scope of a report to a policy-relevant size. For example, an assessment focused on chemical and waste pollution related to highly hazardous pesticides could identify mitigation strategies while recognizing differences in exposure and capacities across groups and communities.

Such assessments would still promote the inclusion of varied knowledge systems and stakeholders. They draw from a range of disciplines and include local knowledge and "grey" literature on the risks experienced in various socioeconomic and political contexts (Kowarsch et al 2017; Castree et al. 2021: Beck et al. 2022). IPBES has mechanisms for including diverse knowledge systems, which could prove useful given the evidence communities collected, such as Indigenous Peoples' work around the Canadian oil sands.

Environmental racism, a term borne from the disproportionate exposure of North American black, Hispanic, and Indigenous communities to chemical and waste pollution, is still present both within countries and across regions (Bullard 2018). Solutions-oriented assessments could render these concerns and worldviews visible. Stakeholders could suggest report topics and provide "grey" literature relevant to their experiences.

3. Assumption 2 If we build it, policymakers will come

The ultimate aim of an science-policy panel is to inform policymaking. Thus, assessments need to align with policy cycles and needs. Policy relevance is not guaranteed and can depend on who participates to ensure buy-in for the results. Global inequities and negotiations shape information production, publication, and synthesis (Hughes 2024). Whereas the IPCC and IPBES have prominent "client" forums in the United Nations Framework Convention on Climate Change and the Convention on Biological Diversity together with other treaties, the new panel on chemicals and wastes lacks a direct line to a main treaty-based forum designed to negotiate a collective response.

Global chemicals and wastes regulations and their underlying knowledge bases are fragmented. Several legally independent multilateral treaties and regional efforts cover specific pollutants (e.g. mercury) or life-cycle stages (e.g. waste) (Cowan et al., 2025; Selin, 2010), but no overarching chemicals or waste treaty exists. A voluntary, multi-stakeholder Global Framework for Chemicals sets out goals and targets

[1] Two authors participated with the Earth Negotiations Bulletin and one author is an observer with the Scientific and Technological Community Major Group. Four have participated in expert dialogues on the panel's design, organized by UNEP. Other authors follow the negotiations as part of their research agendas.

Table 1
Comparing the IPCC, IPBES, and the proposed panel for chemical and waste pollution.

	IPCC	IPBES	Our proposals for the panel for chemical & wastes
Scope and framing	Universal risk. Focuses on emissions and atmospheric concentrations of greenhouse gases, but also covers other substances such as short-lived climate forcers. A dual focus on mitigation and adaptation, including how a warmer climate impacts Earth systems and societal systems.	A broad focus on the relationship between biodiversity, ecosystem services and human well-being across global, regional, and sub-regional scales.	Context-specific framing. Focus on specific problems and solutions to narrow the potentially enormous scope (hundreds of thousands of chemicals currently in use and many different kinds of wastes).
Outputs	Regular global assessments on the physical science basis; impacts, vulnerability and adaptation; and mitigation. Produces special reports on specific topics. Offers methodological guidance on national greenhouse gas inventories.	Produces global, regional, and thematic assessments. Offers methodological guidance on models and scenarios, monitoring, and valuation/values. Supports capacity-building, knowledge integration, and inclusion of traditional knowledge from local communities and indigenous people.	Global and regional assessments, synthesis reports and horizon scans. Produce guidelines to support chemical and waste inventory development. Support capacity-building.
Role of governments	Inter-governmental panel. Governments approve report outlines, nominate authors, review and approve reports and the SPMs. Decide about the rules of procedures	Inter-governmental platform. Governments approve report outlines, nominate experts, review and adopt assessment reports. Decide about the rules of procedures	Inter-governmental panel. Governments approve report outlines, nominate (a majority of) authors, and adopt reports.
Parent/hosting organisations	WMO and UNEP	UNEP	UNEP and WHO
Expert selection process and criteria	Governments and observer organisations nominate experts. Selection of authors and editors by the IPCC's scientific governing body and Bureau	Governments and observer organisations nominate experts. Final selection by the Management Committee of the respective IPBES assessment.	Nomination by governments and stakeholders. Final selection by a committee established for a specific assessment.
Role of Industry	Hold observer status. Conflict of interest policy applies to IPCC leadership and authors with responsibilities for report content.	Hold observer status. Conflict of interest policy applies to IPCC leadership and authors with responsibilities for report content.	Hold observer status. Conflict of interest policy applies to leadership and all authors. Declarations to be public.
Main treaties and forums	United Nations Framework Convention on Climate Change and the Paris Agreement.	Conventions on Biological Diversity and associated protocols, and Global Biodiversity Framework. To a lesser extent, other biodiversity-related treaties.	Basel Convention (trade in wastes), Rotterdam Convention (trade in chemicals), Stockholm Convention (POPs), Minamata Convention (mercury), Global Framework for Chemicals, Plastics Treaty (when complete), FAO, WHO, International Labour Organization
Evidentiary rules and standards	Numerical knowledge, built on scientific peer-reviewed sources and some grey literature.	Wider knowledge base, drawing from scientific peer-reviewed sources, grey literature, and Indigenous and local knowledge.	Outputs draw on data and information from scientific peer-reviewed sources, grey literature, and Indigenous and local knowledge.

related to chemical pollution. National regulation happens in siloed agriculture, health, environment, and industry-related departments. There is a real risk that assessment reports on chemicals and wastes would fall outside the mandates of the various organizations and bodies that could act upon their recommendations. Assessment reports could be ignored because of a lack of coordination as issues fall across multiple treaties and forums.

International experts relevant to chemicals and wastes reside in a veritable alphabet soup of inter-governmental organizations: the World Health Organization (WHO), the Food and Agriculture Organization (FAO), and UN Environment Programme (UNEP). There are also experts in the various multilateral treaty bodies, academic institutions, and government departments. International capacity-building may help unlock the potential of national government engagement, particularly by experts from the Global South who have insights into the contextual factors influencing human and environmental exposure. For example, there are context-specific incentives and exploitative practices in the illegal trade of chemicals and waste.

The new panel needs tailor-made mechanisms to engage effectively with those in a position to act. Proposals for reports or common methodologies could be co-sponsored by international organizations. The FAO, for example, may welcome additional work on pesticide use in various contexts, or the Stockholm Convention could request a report on alternatives to specific persistent organic pollutants (POPs) to help avoid regrettable substitutions. This might limit the panel to existing organizations' fragmented mandates. For this reason, the ability to report to the UN Environment Assembly, link to the Global Framework on Chemicals, and engage with the WHO will be critical to inform actions outside existing treaties' mandates.

The WHO was, until recently, largely absent from the OEWG negotiations. It houses considerable expertise and can take up the panel's health-related findings. Creating linkages between the panel and environmental and human health concerns requires strong, institutionalized links between the WHO and UNEP. Co-hosting the Secretariat is an option like the IPCC, a shared endeavour of the World Meteorological Organization and UNEP. A co-hosting arrangement between the WHO and UNEP could add gravitas to the panel's outputs and help ensure that health bodies are potential clients for the panel's recommendations in addition to those governing environmental risks.

4. Assumption 3 Industry is just another stakeholder

Science-policy interfaces thrive or fall on their work's perceived scientific credibility, policy salience, and political legitimacy (Cash et al 2003). How to engage industry in a way that does not undermine the panel's credibility is a particularly thorny problem because the chemical industry holds a unique role in knowledge production and keeps much of that data confidential. Yet industrial research and development may focus on benefits rather than longer-term and (uncertain) environmental and health risks. Industrial knowledge might also refer to the global properties of chemicals rather than the contexts in which they become hazardous. Structural inequalities in the resources available to industry and affected populations shape the quantity and direction of research (Holman and Bruner 2017). This is not only about "managing stakeholders" but also recognizing and supporting research that reflects the knowledge and concerns of those affected by pollution (Nading 2020).

Time again in the OEWG, countries confirmed the Inter-governmental nature of the panel. Governments will be the decision-makers, which is fundamental to establishing its legitimacy and policy relevance. Industry groups and others highlight that the industry could provide data to the panel, and industry members could serve as experts (ENB 2023). IPCC and IPBES conflict of interest procedures apply to the organizations' leadership, officials, and authors responsible for the report's content. While the IPCC policy was used to inform the new panel's

discussions, the chemicals and waste panel needs to extend the policy to report all authors and ask for further declarations of potential conflicts of interest that would be made public. Working in authorship teams may also be necessary to ward off accusations that industry "authored" an output, as has happened in IPBES in 2014 (Hochkirch et al. 2014).

Industry stakeholders hold valuable data on many chemicals and wastes. However, critics have questioned how far industry makes all relevant data available to regulators or the wider public (Fisher, 2008). Neither the IPCC nor IPBES consider raw data, only peer-reviewed and "credible" grey literature. If the same principle is applied to the new panel, which is reasonable, the industry promise of data would require publication to make it available for the panels' scrutiny alongside other published literature.

Insights and knowledge from the chemicals industry may be important for the horizon scanning function. Chemical firms have insights into their future production and innovation plans. They routinely undertake forecasting exercises. Industry associations could aggregate and anonymize this data and provide it to inform horizon scanning exercises. Yet, even with safeguards, inequities in who produces and holds data may still skew the panel's work because incentives shape knowledge production. For example, there might be little incentive for industry to conduct new research on chemicals no longer used or produced, although they may still be present in products and the environment.

Together, these factors could increase the risk of underestimating the dangers of chemicals and waste pollution. Conflict of interest questions and other challenges related to industry data will likely remain, presenting themselves anew for reports on different issues. Public distrust lingers after specific cases where industry actors withheld evidence, promoted questionable information, or influenced regulatory bodies (Markowitz and Rosner 2013; Michaels 2020).

5. Important next steps

Much work remains to design the new science-policy panel on chemicals and waste to prevent pollution. Based on the above discussion, we identify three important next steps. Each relates to participation and ensuring the panel is responsive and integrates diverse concerns and knowledge in a credible, salient and legitimate way and provides authoritative expertise for decision-making.

First, the panel should adopt a solutions-oriented approach that focuses on regions and communities most affected by chemicals and waste pollution (Beck et al. 2022). This approach can reduce information barriers and embrace various disciplines and knowledge systems. The approach also involves interrogating the assumptions behind how problems are defined. Often, the focus is on chemicals' properties, such as toxicity or persistence. But that represents only one approach to defining the problem because hazards can be amplified by context, inequities, and lived experience.

Second, engagement with global organizations like the WHO, FAO, and UNEP alongside international treaty bodies and national governments should be a priority. Policy relevance and response are not achievable without governance bodies being aware of assessment findings. Given the range of policy bodies and forums and their fragmentation, engagement must be wide-ranging. Many bodies hold crucial expertise valuable to the panel's work.

Third, industry involvement must be carefully managed to safeguard the panel's scientific credibility and political legitimacy. Industry could support horizon scanning efforts and help the panel remain flexible in the face of constant chemical innovation and the creation of new wastes.

Given the many uncertainties and lack of holistic knowledge around chemical and waste pollution, the panel may at least initially raise more questions than it can answer. Yet, we hope that the new panel can help forge and strengthen research communities to better understand the positive and negative roles of chemicals on the environment and society, as well as trade-offs that policymakers face in governing them.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

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