IOMC WORKING TOGETHER TO END CHEMICAL POLLUTION

UN environment programme | Global Framework on Chemicals

ISC3

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Webinar #2

Prescription for Change: Safe and Sustainable Chemistry in Global Pharmaceutical Systems

Series "Implementing the Global Framework on Chemicals (GFC) through Safe and Sustainable Innovation: Global Perspectives and Practice"

Webinar Report
23 July 2026

Introduction

The Global Framework on Chemicals (GFC), adopted in 2023, represents a comprehensive multi-stakeholder commitment to prevent or minimize harm from chemicals and waste while supporting sustainable development. A key dimension of the GFC is its emphasis on innovation—particularly the need to integrate safety and sustainability considerations across the entire lifecycle of chemicals, materials, and products.

In this context, the International Sustainable Chemistry Collaborative Centre (ISC3), the Inter-Organization Programme for the Sound Management of Chemicals (IOMC), and the United Nations Institute for Training and Research (UNITAR) launched a webinar series aimed at translating high-level policy commitments into practical implementation pathways.

The series focuses on Safe and Sustainable by Design (SSbD) and related global approaches as key enablers of GFC implementation. These approaches promote early-stage decision-making to reduce hazardous substances, improve resource efficiency, and avoid regrettable substitutions, particularly in high-impact sectors such as consumer electronics.

Webinar #2 focused on the pharmaceutical sector, linking GFC priorities on pharmaceuticals in the environment with practical approaches to safer and more sustainable innovation. The session combined a global policy perspective, "benign by design" approaches, and an industry case from India. Specifically, the session aimed to:

- Explore opportunities to address environmentally persistent pharmaceutical pollutants through a life-cycle approach;
- Demonstrate how benign by design can operationalize GFC targets by embedding safety, sustainability, and environmental fate considerations into pharmaceutical development;
- Identify enabling conditions and remaining gaps for scaling safe and sustainable pharmaceutical innovation;
- Examine practical trade-offs involving performance, cost, regulatory compliance, and environmental considerations;
- Showcase how sustainability principles can be translated into pharmaceutical research and development and production practices.

Summary

The 1h 30min session took place on 23 July 2026 and brought together international policy, academic, and industry perspectives to examine how safer and more sustainable approaches can be applied across the pharmaceutical life cycle—from molecular design and manufacturing to use, wastewater management, and disposal. The webinar was structured to connect GFC implementation with scientific innovation and practical industrial experience.

The opening remarks highlighted the dual role of pharmaceuticals as essential to human and animal health while also representing a growing environmental concern when their residues enter the environment. Christian KOLBE (ISC3) stressed the need to rethink how pharmaceuticals are designed, produced, and used so that effectiveness is accompanied by greater sustainability. He emphasized that

transformation requires collaboration among policymakers, industry, academia, and civil society, and framed the webinar as an opportunity to move from identifying problems toward practical solutions that participants could apply in their own work.

The global policy perspective presented by Stéphanie LARUELLE (United Nations Environment Programme), addressed pharmaceuticals in the environment as an issue of concern under the GFC and emphasized the need for action across the full life cycle. Pharmaceutical residues may enter the environment through manufacturing, healthcare facilities, households, agriculture and aquaculture, wastewater, and improper disposal, making coordinated action across sectors essential. The presentation highlighted opportunities for prevention at multiple stages, including responsible use, improved design and production, take-back systems, safe disposal, awareness raising, and policy measures. It also presented ongoing UNEP work, including guidance on unused medicines, and outlined proposals under the GFC to continue international work on environmentally persistent pharmaceutical pollutants (EPPPs).

The keynote presentation on "Benign by Design," delivered by Prof. Klaus KÜMMERER, shifted the discussion upstream to the molecular design stage. He distinguished green pharmacy from the broader concept of sustainable pharmacy and stressed that greener solutions are not automatically more sustainable without life-cycle and systems thinking. The presentation demonstrated that pharmaceutical efficacy and environmental biodegradability do not necessarily conflict by showing how molecular structures can be designed to retain their intended function while degrading more readily after use. Examples involving active pharmaceutical ingredients and excipients illustrated how environmental performance can be incorporated into research and development, while also creating opportunities for innovation, new patentable compounds, and potentially lower end-of-life costs.

The industry contribution, presented by Nitesh MEHTA, provided practical examples from the pharmaceutical sector in India. One case demonstrated how redesigning an active pharmaceutical ingredient manufacturing process replaced hazardous solvents, high-pressure hydrogenation, and a pyrophoric catalyst with a safer process using water as the reaction medium, while improving yield and enabling extensive water reuse. A second example explored recovery of valuable materials from a highly contaminated pharmaceutical wastewater stream, linking waste reduction with circular economy and resource-efficiency objectives. The presentation also highlighted significant implementation barriers. At the same time, opportunities were identified in biocatalysis, flow chemistry, electrochemistry and photochemistry, improved process efficiency, and the integration of green chemistry principles earlier in medicinal chemistry and product development.

The panel discussion explored the main barriers and enabling conditions for reducing pharmaceutical pollution. Participants identified regulation and policy as the most frequently cited barrier, followed by collection and disposal, while responses overall pointed to the need for a combination of interventions rather than a single solution. Speakers highlighted upstream prevention, education, financing and market incentives, environmental criteria in authorization processes, sustainable procurement, extended producer responsibility, and stronger cross-sectoral coordination. The discussion also stressed the importance of shifting from end-of-pipe thinking toward systems approaches that create incentives for safer products and processes from the outset.

Agenda

The session followed a structured agenda with the following segments:

2:00 – 2.05 PM	Welcome and Opening Remarks	Delena Indar (UNITAR) Christian Kolbe (International Sustainable Chemistry Collaborative Centre, ISC3)
2:05 – 2:20 PM	Global Policy Perspective: "Pharmaceuticals in the Environment and the GFC"	Stéphanie Laurelle (UNEP)
2:20 – 2:45 PM	Key Note: "Benign by Design: Rethinking Pharmaceuticals from the Molecule Up"	Prof. Klaus Kümmerer ("Evaluation and Design of Chemicals" Kenzingen, Germany)
2:45 – 2:55 PM	Interactive activity	All
2:55 – 3:10 PM	Moderated discussion and Open Q&A: From policy ambition to molecular design – what is still missing?	Delena Indar (UNITAR)
3:10 – 3:25 PM	Industry Case Study: "Establishing Sustainable Pharmaceuticals in India: Opportunities and Challenges"	Mr. Nitesh Mehta (ChemisTree Foundation)
3:25 – 3:30 PM	Questions and Answers	All
3:30 PM	Final Remarks	Delena Indar (UNITAR)

Resources

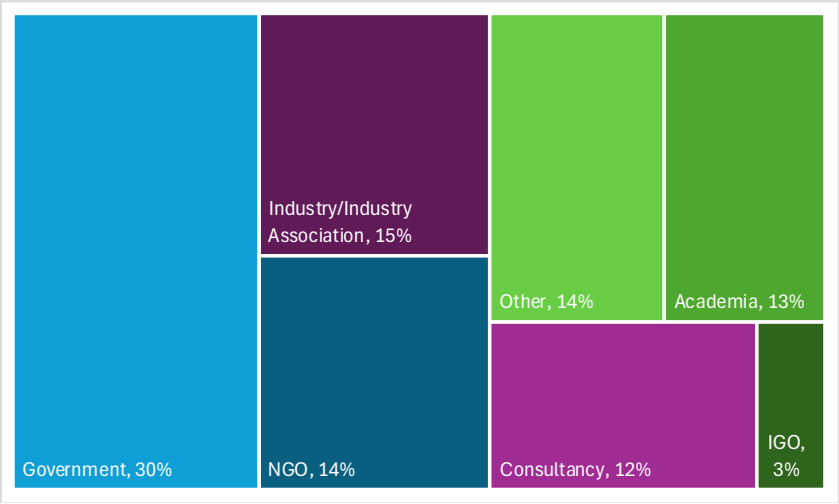
The resources for this session (flyer, presentations, satisfaction Survey, recording) are available in the IOMC Website.

Attendance breakdown and representation

Attendees in total: **172**[1].

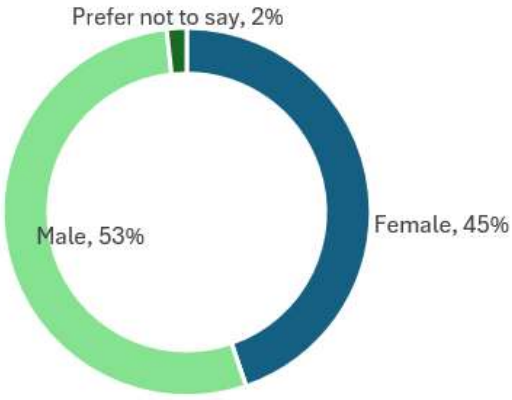
[1] 91stayed for more than 60 minutes.

SECTORS

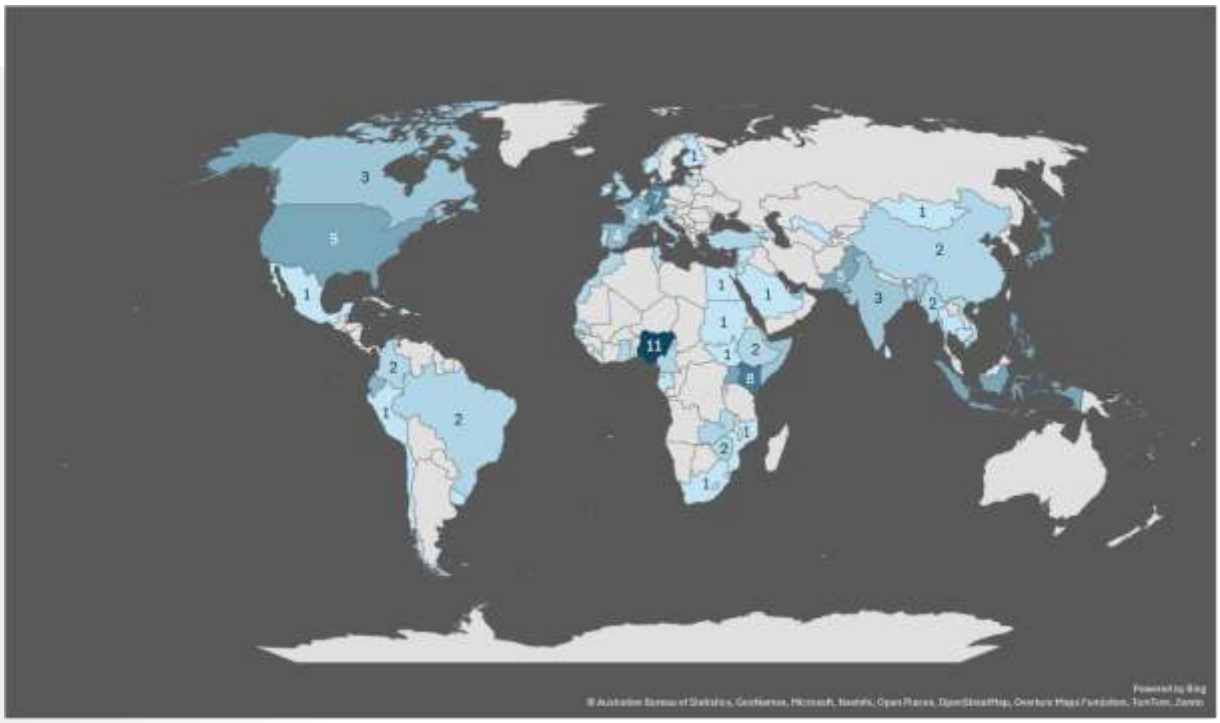


Participants represented a highly diverse and multidisciplinary audience: policymakers, regulators, industry leaders, consultants, researchers, and academics, alongside students and early-career professionals.

GENDER DISTRIBUTION



GEOGRAPHICAL REPRESENTATION



Questions received and answered

The moderated discussion and Q&A session provided an opportunity for participants to explore practical pathways for reducing the environmental impacts of pharmaceuticals, with particular attention to upstream prevention, incentives for benign-by-design innovation, and implementation through the GFC. Overall, the discussion emphasized that no single intervention will be sufficient: progress will require a combination of scientific innovation, regulation, economic incentives, education, and coordinated action across the pharmaceutical life cycle.

Q: Main barriers to reducing the environmental impacts of pharmaceuticals: Participants were asked where they saw the greatest current barriers to reducing pharmaceutical pollution. Regulation and policy emerged as the most frequently identified barrier, followed by collection and disposal, while other factors such as financing, manufacturing practices, wastewater treatment, data and monitoring, and coordination between sectors were also considered important.

Speakers emphasized that the diversity of responses reflects the need for a mix of complementary measures. The GFC can help by bringing together governments, industry, healthcare, academia and other stakeholders and acting as a catalyst for coordinated action. Particular emphasis was placed on prevention and upstream interventions rather than relying primarily on end-of-pipe solutions.

Q: Incentives for wider adoption of benign-by-design pharmaceuticals: Participants and the moderator explored what governments, companies, investors and funders could do to make benign-by-design approaches more common.

Potential incentives highlighted included accelerated authorization procedures, longer patent protection or other mechanisms that reward pharmaceutical products with improved environmental performance. Benign by Design was also presented as an innovation and business opportunity, since looking at molecular design from a different perspective may enable the development of new, patentable compounds. Speakers stressed that financial incentives should be accompanied by appropriate regulatory measures.

Q: Policy measures to promote prevention under the GFC: The discussion considered which government measures could create stronger incentives to prevent pharmaceutical pollution before it occurs.

Speakers stressed the importance of combining measures adapted to national circumstances rather than relying on a single instrument. Examples included incorporating environmental criteria into authorization processes, sustainable public procurement, extended producer responsibility, and approaches that internalize end-of-life and wastewater treatment costs. Such measures could strengthen market demand for pharmaceuticals and production processes with improved environmental performance.

Q: Participation in GFC work on pharmaceuticals and access to implementation resources: Participants asked how they could engage with ongoing work on environmentally persistent pharmaceutical pollutants and access resources supporting GFC implementation in the pharmaceutical sector. Participants were encouraged to engage with UNEP and relevant GFC processes dealing with issues of concern. Existing resources are available through GFC and UNEP

platforms, while the ongoing discussions on environmentally persistent pharmaceutical pollutants and pharmaceuticals in the environment are expected to create further opportunities for collaboration and implementation support.

Q: Which pharmaceuticals are most commonly found in the environment? Participants asked whether certain types of pharmaceuticals, particularly over-the-counter medicines, tend to occur at higher concentrations because their use and disposal may be less controlled.

The speaker cautioned that monitoring data are influenced by what compounds researchers measure, the availability of analytical methods, usage patterns, and differences in wastewater treatment and degradation. Frequently used products such as painkillers can occur at relatively high concentrations, while antibiotics are also important in some contexts. However, concentration alone does not determine environmental concern: highly active compounds such as hormones or cytotoxic pharmaceuticals can be relevant even at very low concentrations. Assessments therefore need to consider both occurrence and biological activity.

Q: Fast-track approval and broader approaches to sustainable pharmaceuticals: A participant asked how possible fast-track authorization for benign-by-design pharmaceuticals relates to broader international approaches to greener and more sustainable pharmaceuticals.

Fast-track authorization was described as a potential targeted incentive for the development of benign-by-design compounds, whereas broader sustainable-pharmacy approaches consider the pharmaceutical life cycle and system as a whole. Benign by Design should therefore be understood as one component within a wider sustainability framework rather than as a stand-alone solution.

Q: Role of material flow analysis in Benign by Design: Participants asked how material flow analysis could contribute to the benign-by-design concept.

Material flow analysis was considered particularly relevant for understanding resource inputs, process efficiency, waste generation, and flows associated with pharmaceutical synthesis. Its scope can also be extended to consider the fate of substances after use. In a benign-by-design approach, however, the ultimate objective for compounds expected to enter the environment is effective degradation after they have fulfilled their intended function.

Q: Addressing per- and polyfluoroalkyl substances (PFAS) in pharmaceuticals through a global approach: Participants raised the use of fluorinated substances in pharmaceutical ingredients and manufacturing and asked about opportunities for global action.

Speakers identified several potential entry points under the GFC, including ongoing work on PFAS as an issue of concern and future sectoral implementation activities related to healthcare. From a technical perspective, the discussion stressed the importance of examining where fluorinated groups are genuinely necessary and where non-fluorinated alternatives are already available. Earlier substitution and greater attention to persistence during molecular and process design were highlighted as important opportunities to avoid future environmental problems

Survey results and insights[2]

1. The session was very well received overall, with 93% of respondents rating it **Excellent or Very good**. The remaining 7% rated it Fair. All respondents considered that the speakers presented the relevant information well, with 63% selecting Extremely well. In addition, 96% considered the opportunity for oral/written input a useful addition to the webinar.
2. Survey results indicate a clear **improvement in participants' understanding** of the key elements of the GFC and Benign by Design, as well as the enabling conditions required for safe and sustainable innovation in the pharmaceutical sector. Before the session, responses were distributed across the full range of understanding levels, while post-session responses shifted strongly toward "Somewhat well" and "Very well", with almost no neutral or negative responses. This suggests that the webinar effectively strengthened participants' knowledge of both the conceptual approaches and the conditions needed for their implementation.
3. Participants' intended **follow-up actions** focused strongly on translating the webinar content into practice and sharing it with others. Responses included engaging company management, incorporating sustainability concepts and case studies into education, applying sustainable procurement criteria in health systems, improving management of expired medicines and chemical waste, raising public awareness, and further exploring GSC approaches. A strong majority of respondents (89%) indicated that they are likely to apply or promote at least one Safe and Sustainable Chemistry-related approach in their work or organization during the next 12 months, including 74% who are very likely to do so.
4. **Next suggested topics:** Practical case studies and detailed guidance on applying sustainability tools; chemical waste reduction, effective waste management and chemical recycling; chemical safety management systems and the GHS; sustainable investment and financing opportunities; and stronger exploration of environmental impacts.
5. Shareable link to the survey results: https://forms.cloud.microsoft/Pages/AnalysisPage.aspx?AnalyzerToken=SD26c0q8K3J2Om2v2hTkHU7F0ykBkQyP&id=7rTNQbhFk0aAadzJ3B6UzOjtc7jiKt1MqGoOLsje4u5UMDZPN1RWVDRBNjBLQk9UVzJMSUFKTU1NMC4u

Next steps

- **Future Webinar**: The Webinar #3, to be held in September 2026, will focus on **"Green and Sustainable Chemistry (GSC) in the context of the GFC."**

- **Website Updates**: Resources from the session will be uploaded to the **IOMC Website**, including presentations, the recording, and responses to outstanding questions.

Comments? Questions?
Email us: cwm@unitar.org

[2] 27 responses received