Our position on
Pharmaceuticals in the Environment

What is the issue?

Pharmaceuticals help treat disease but, like many foods and nutritional supplements, they are not always completely absorbed or broken down by the body. Pharmaceutical residues can pass into the environment as part of the normal biological process following patient use and sewage treatment systems do not always completely remove these substances, meaning that residues may sometimes pass into the environment. To a lesser extent, pharmaceuticals can also enter the environment from unused medical products or factory discharges.[i,ii]

Some pharmaceutical residues have been detected in the environment at very low levels but published studies, including ones from the World Health Organization (WHO), have concluded that pharmaceuticals in drinking water are very unlikely to affect human health at the levels detected.[iii]

It is generally agreed that the levels of pharmaceuticals in the environment (PiE) are significantly below those which would result in acute (short-term) effects in environmental species. There are concerns that long-term exposure to pharmaceuticals in the environment can pose a risk to environmental species, including aquatic life, and this continues to be explored through scientific research.[ivv]

This paper sets out how we are addressing potential risks of pharmaceuticals which may enter the environment.

What is GSK's view?

- We are committed to ensuring our medicines and vaccines do not adversely affect people, biodiversity and ecosystems.
- We perform environmental risk assessments to meet current regulatory requirements for all new pharmaceutical products before they are launched. We submit the resulting data to regulatory authorities as formal Environment Risk Assessment (ERA) reports.[vi]
- We make information on the environmental hazards and impacts of our products (including Safety Data Sheets and Product ERAs) accessible on our website. We also publish environmental data, assessments, and related topics in scientific literature.
- We use our assessments to seek to understand any public health and environmental risks from GSK pharmaceuticals released during manufacturing in accordance with applicable regulations and post-patient use. We continue to work with industry groups, environmental scientists and regulators to develop the science and methodologies to evaluate our products and management practices.
- If our ERAs were to indicate any areas of concerns, we would work with appropriate stakeholders, such as regulators and patient groups; and look for solutions that help protect patient access to products, while safeguarding the environment. Any decision to limit release of a medicine on environmental grounds needs to be carefully assessed and balanced against the public health implications of restricting access for patients.
- We have implemented an ERA programme across all our manufacturing sites and our key active pharmaceutical ingredient (API) supplier sites.
- GSK is committed to all its manufacturing sites and key suppliers having API discharges below Predicted No-Effect Concentration (PNEC) levels, as defined by the AMR Industry Alliance and API Wastewater Discharge limits. This means working to keep any API manufacturing emissions below levels that may negatively impact human health or the environment.

- As part of our strategy to get ahead of antimicrobial resistance, we have committed to minimise antibiotic discharge in our supply chain. At the same time, we will seek to ensure that factory discharges from our key suppliers manufacturing antibiotics and our own sites conform to the antimicrobial resistance (AMR) Industry Alliance Standard and wastewater discharge limits.
- We support voluntary and responsible programmes dealing with safe disposal of unused medicines.

Background

With growing awareness and scientific investigation into pharmaceuticals in the environment, it is crucial to understand their implications on both human health, species and ecosystems. The presence of APIs in the environment is increasingly reported in peer-reviewed scientific literature by scientists around the world. Improvements in analytical capabilities now allow extremely low levels of these materials to be detected. Some API residues are being detected in drinking water, surface waters (such as rivers and lakes), ground waters, sediments, and soils.

PiE and human health: Current PNECs for humans indicate that levels of PiE are very unlikely to pose any short-term (acute) or long-term (chronic) risk to people. Specifically, the WHO's 2012 Technical Report on Pharmaceuticals in Drinking Water concludes that concentrations of pharmaceuticals in treated drinking water are at trace levels, typically well below 50 ng/L (50 parts per trillion).

PiE and environmental health: Current scientific research suggests that the release of pharmaceuticals for human use into the environment does not appear to have a significant impact on wildlife populations or ecosystems,[vii] except for:

- **Endocrine active substances:** The endocrine system is important for human and animal health because it regulates and controls the release of hormones. Humans and animals may be exposed to a wide range of endocrine active substances through the diet as well as other sources. Overall, the impact of human pharmaceutical products with endocrine activity appears to be relatively small compared to naturally sourced oestrogens from the human and animal population. However the contribution of pharmaceuticals continues to be researched. Therefore where appropriate, GSK conducts bespoke studies to understand the impact of potentially endocrine active medical products.
- **Antimicrobial resistance:** The presence of antibiotics in the environment, and its impact on driving antibiotic resistance, is a growing concern and an active area of research. While clinical and agricultural practices which lead to widespread use of antibiotics are generally recognised as the dominant sources of antibiotics entering the environment, unregulated manufacturing practices may also act as a potential hotspot for local development of resistance.

Regulatory oversight

In recent years, regulatory agencies have increased their scrutiny and activity in this area:

- Since 1977, the US FDA has addressed PiE through its environmental review process for new drugs.
- In Europe, guidelines for ERAs that accompany Marketing Authorisation Approval Applications for new drugs have been available since 2006. The most recent update in September 2024 recognises the increasing importance of PiE and the need to generate comprehensive and robust environmental data to ensure up to date and scientifically rigorous ERAs. The Guideline aims to

close ERA data gaps for legacy APIs, clarify that generic pharmaceuticals are not exempted and recommends scientific literature as a potential source of data, subject to quality review.

- The Water Framework Directive (WFD) is the European Commission's legislative instrument for achieving good water quality status throughout the EU. Currently, pharmaceuticals are not on the priority substance list, which identifies chemical substances that present a risk to the aquatic environment. But some pharmaceuticals have been put on the WATCH list, where substances of possible concern are monitored EU-wide. Should a risk be identified, substances can become a candidate priority substance and subject to regulation. The pharmaceutical industry is working with the European Commission to make sure the development of safe water levels, known as Environmental Quality Standards (EQS), are based on scientifically robust data.
- The revised EU Urban Wastewater Treatment Directive (UWWTD) which came into force in 2025, aims to protect the environment from the adverse effects of urban wastewater discharges containing micropollutants, including pharmaceuticals. It requires the pharmaceutical and cosmetics sectors to cover collectively at least 80% of the cost of upgrading in-scope urban wastewater treatment centres. As an industry we are working to understand how this will be implemented.

Environmental Risk Assessments

Medicine regulatory bodies have mandated that all prescription drug submissions in the US and EU require an ERA of the API. This involves studies to evaluate the environmental fate of the API and assess its potential toxicity to relevant environmental species. The findings from these assessments are captured in the ERA expert reports, which accompany our regulatory submissions in the US and EU.

Our portfolio

We routinely test our products according to currently recognised and established procedures. The results of these tests are used to calculate PNECs which are compared to Predicted or Measured Environmental Concentrations (PECs or MECs) to assess risk. Our PEC calculations are based on very conservative worst-case scenarios in order to be protective of the environment.

Manufacturing discharge

Compared to other factors such as patient use and excretion through normal biological processes, factory discharges are generally recognised as a minimal route for pharmaceuticals to enter the environment. GSK routinely conducts effluent risk assessments of its products, supported by training and web-based tools, which provide PNEC values against which effluents from our manufacturing sites are assessed.

As a multinational organisation, we have a role to play in driving best practice in areas such as environmental protection. So, we expect our suppliers to adopt similar environmental standards as GSK in their operations. The process for embedding our environmental standards across our supply chain will take time and will be subject to a risk-based approach, initially focussing on antibiotics suppliers.

In 2023, the AMR Industry Alliance worked with the British Standards Institution (BSI) to create an AMR Certification system. This system allows companies to transparently and simply showcase that their antibiotics are produced responsibly, as verified by independent third-party experts, in line with the AMR Standard's requirements. This certification has the potential to revolutionise the antibiotic supply chain. GSK is keen to adopt this rigorous international certification process across our API manufacturing sites,

underscoring our commitment to the responsible manufacturing of antibiotics. The WHO has released a similar set of guidelines, and the AMR Industry Alliance is exploring areas of alignment.

Our ambition is to have all GSK antibiotics manufacturing sites worldwide certified to the AMR Alliance standard by the end of 2026.

Working in partnership

GSK is a member of the governance team for the European based industry-wide Inter-Association Initiative (IAI), comprising the Association of the European Self-Medication Industry (AESGP), the European Federation of Pharmaceutical Industries and Associations (EFPIA), and Medicines for Europe, to address issues relating to PiE. The resulting Eco-Pharmaco-Stewardship (EPS) framework is working towards the following objectives:

- A research programme for developing a methodology to prioritise legacy compounds based on risk
- An evaluation of how to assess and control the potential impact of API residues in manufacturing effluents
- An extended ERA model to help address PiE throughout the lifecycle of a medicine

Scientific collaboration

The science underpinning PiE concerns is still in active development. In addition to GSK's regulatory and product stewardship obligations, we work with external stakeholders, including leading universities, to develop and understand the scientific basis of PiE, to fill critical knowledge gaps.

We have worked with industry colleagues in the AMR Industry Alliance (AMRIA) to share environmental data of our pharmaceuticals and generate safe discharge standards for 120 antibiotics, which have been published in the scientific literature and the AMRIA website.

In Europe, GSK has been an active contributor to the ground-breaking iPiE project (2015-2019) under the Innovative Medicines Initiative (IMI), Europe's largest public-private initiative, aimed at speeding up the development of better and safer medicines for patients and the environment. The focus of the project has been on developing in silico tools to predict environmental risks of pharmaceuticals in our developmental pipeline. These tools are intended to help to evaluate the risk of legacy APIs which have been on the market for a long time and prioritise these for further evaluation where warranted.

Building on this work, we are now a partner in a project with IMI, focused on the Prioritisation and Risk Evaluation of Medicines in the EnviRonment (PREMIER, 2020-2026). The project, which includes other pharmaceutical companies, regulators and research institutes, aims to deliver an innovative framework for assessing and characterising the environmental risks of APIs. This information may then be used to:

- Develop tools and models to identify potential environmental hazards and risks associated with APIs earlier in development
- Screen and prioritise legacy APIs authorised for use prior to 2006 for a tailored environmental assessment
- Explore the feasibility and practicality of greener drug design

- Make environmental data on APIs more visible and accessible to all stakeholders

Good progress has been made on the design and development of greener drugs where for the first time environmental scientists and Industry Drug Discoverers have worked together to understand the complexity of designing drugs with characteristics that are good for the patient and for the environment. This project presents many challenges but nonetheless PREMIER has delivered two important papers on this complex topic which will hopefully provide a sound foundation for further development[viii,ix].

Transparency

GSK is committed to transparency by disclosing environmental data, including:

- Safety Data Sheets (SDS): A Safety Data Sheet is a legally required document that provides information on the hazardous properties of any chemicals and potential effects on human health and the environment. Environmental fate and effects test results on all GSK APIs are detailed in our SDS and are available on gsk.com.
- ERAs: Since 2014, GSK has posted summaries of its Environmental Risk Assessments for prescription medicines on gsk.com. Globally, we were the second pharmaceutical company to do so.
- Fass.se ERAs: GSK is an active participant in the voluntary Swedish Classification Scheme for pharmaceuticals where Healthcare Professionals and members of the Swedish public can access environmental data on all our medicines.

Unused medicines

Husbandry and patient excretion are recognised as the primary sources of pharmaceutical residues in the environment but, improper disposal of unused or expired medicines may also be a contributing source. GSK encourages proper and safe disposal by patients and supports the use of approved voluntary 'take-back' programmes in the communities and countries where they are available.

We support the US Federal Guidelines on the Proper Disposal of Prescription Pharmaceuticals developed by the White House Office of National Drug Control Policy. We also support the SMARxT Disposal standard developed by the US Environmental Protection Agency (EPA), US Health and Human Services (HHS) and US FDA which is being promoted by leading US pharmaceutical and OTC industry trade associations. This is a public awareness campaign for safe disposal guidelines and is a unique public-private partnership between the US Fish and Wildlife Service, the American Association of Pharmacists and the Pharmaceutical Research and Manufacturers of America.

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