Guarding Against Antimicrobial Resistance: Towards Responsible Biocide Use in Consumer Goods

Policy Brief

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Contents

Explanation of Terms

Biocides

Substances with antimicrobial properties, the ability to kill or inhibit the growth of microorganisms such as bacteria, archaea, viruses and fungi.

Microbiome

A community of microorganisms living in a specific environment. For example, the human microbiome refers to the vast collection of these microorganisms that naturally live on and inside our bodies, playing vital roles in supporting health, digestion, immunity, and overall well-being.

Microbiotoxicity

This term refers to the damage that antimicrobial substances can cause to a microbiome, disrupting the delicate balance of microorganisms that are essential for maintaining health in the affected environment – whether within a human or animal body, or in an ecosystem like soil.

Antimicrobial resistance (AMR)

This refers to how microorganisms, like bacteria, viruses and fungi, can continue to survive or even grow despite the presence of drugs or substances that are specifically designed to kill them or stop their growth. This means that drugs become less effective at treating infections caused by these resistant microorganisms.

AMR can develop through various mechanisms, which are explained in the following terms:

○ Resistance genes

Refers to specific pieces of DNA in microorganisms that encode for resistance mechanisms enabling their survival following treatments meant to kill or stop their growth.

- Horizontal gene transfer

Refers to the ability of microorganisms share genetic material with each other (e.g. resistance genes). This process allows microorganisms to quickly gain new traits, which can make treating infections more difficult.

- Selection

This is a process resulting in a type of resistant microorganism becoming more common because it can survive in the presence of a particular substance that kills other microorganisms. This happens because the substance slows growth or kills the microorganisms that are not resistant, selecting the resistant ones to multiply and spread.

- Co-selection

Co-selection describes the phenomenon where microorganisms acquire multiple resistance traits simultaneously. This can occur due to genetic links between resistance genes (co-resistance) or shared biological mechanisms (cross-resistance). As a result, resistance to one substance may also confer resistance to other substances.

- Cross-resistance

Cross-resistance is a type of co-selection that occurs when a single resistance trait enables a microorganism to withstand multiple antimicrobial agents, for example because the agents target the same biological mechanism.

- Heavy metals and resistance

Exposure to heavy metals can lead to resistance in bacteria. Co-resistance happens when heavy metal exposure inadvertently promotes resistance to other substances, like antibiotics, because the resistance genes are often linked together. Cross-resistance occurs when bacteria develop resistance to multiple substances, such as both heavy metals and antibiotics, due to shared mechanisms of resistance.

Summary

This policy brief supports a Private Members' Bill aimed at addressing the emerging public health threats posed by the use of biocides—substances with antimicrobial properties—in consumer products.[1] Biocides may not only present direct safety risks to individuals but also contribute to environmental degradation and the rise of antimicrobial resistance (AMR). This paper advocates for the exclusion of unnecessary biocides from consumer products intended for human use, including cosmetics, personal care items, and treated articles (e.g. clothing).

Environmental contamination including biocides can disrupt ecosystems, promoting the proliferation of resistance genes and organisms in nature. Human and animal exposure to environmental AMR risks making many infections even harder to treat. The complexity of biocide risks calls for a precautionary approach. The precautionary principle involves proactive measures, preventing harm when dealing with complex risks that cannot be precisely quantified, particularly in cases where risks outweigh benefits.

When biocides are used in personal care products, cosmetics, or clothing, they expose users to their antimicrobial effects, disrupting the human microbiome, which is crucial for health and well-being.[2-4] This is known as "microbiotoxicity" and is an emerging concern in human health. Many biocide-containing products, like period underwear, are marketed to women, adding a gendered aspect to the risk. Given that the risks often outweigh the benefits, which in some cases are nil relative to biocide-free alternatives, we propose new legislation to ban biocides in specific consumer products.

To inform this new legislation, our paper incorporates insights from a consultation with experts across academia, industry, government, civil society, and the health sector. The findings emphasise the necessity of implementing policy measures to address the public health risks linked to biocide exposure. The proposed measures underscore the importance of adopting a precautionary approach and raising political awareness about the direct and indirect threats posed by biocides to human and environmental health.

Foreword: Baroness Bennett of Manor Castle

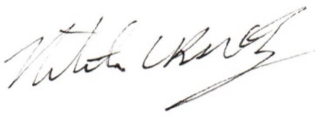
What was your morning like? Maybe, singing cheerfully, you jumped into the shower, reaching for the antibacterial body wash, on special this week, with its loud label claiming “kills 99 per cent of bacteria”. Afterwards you brushed your teeth with the heavily advertised new antibacterial toothpaste and used chlorhexidine-containing mouthwash. On your face, moisturiser. You’ve had that tube for several months, but it contains preservatives, so is still fresh. You pulled on some new socks you got for Christmas, promising “extra antibacterial freshness” from silver-infused material. You reached for a menstrual product promising to prevent odour and “guarantee freshness”, which also contains silver.

Before you got to breakfast, you have subjected your microbiome – the tens of thousands of species of microbes that make you a holobiont – to a barrage of biocides, in other words poisons. We know that the microbiome is essential to life; our gut microbiome, about which we know most (although still very little) has significant impacts on mental and physical health. Exactly what impact that barrage has on it we have little information, yet, but it cannot be good.

The impact, however, is not just on the individual. Down the drain, into the sewer, all of those biocides are now joining the morning rush of water that will, treated (or all too often not treated), end up in our rivers and seas. In that water too are microplastics, pesticides, and residues from medicines including antibiotics and antifungals. All of those substances will be encouraging antimicrobial resistance, the ability of disease-causing bacteria and fungi to resist drug treatment. It is a problem so serious, such a threat, that a high-level meeting on the issue has just been held at the UN General Assembly.

Researchers recently concluded that the spreading of antibiotic resistance genes around the world is a major human impact. A study this year found that urban birds' microbiomes contain three times as many antimicrobial genes conferring resistance as non-urban.[5] We don't know what the impact is on the birds, but it is certainly risky for us.

None of the products used in the hypothetical case I outlined above are necessary. They confer no benefit over non-biocidal products, yet they are damaging One Health – human, animal and environmental health. It is time to adopt a new approach. Instead of persisting with the harmful mindset of eradicating unwanted microorganisms, as *The Probiotic Planet*[6] advocates, we must work with natural processes to restore biomes and rebalance ecosystems, benefiting both human and environmental health. My proposed Consumer Products (Control of Biocides Bill) covers cosmetic and personal care products and treated articles designed for human use. The aim is to reduce the resistance pressure on microbes; to put the UK at the forefront of tackling environmental drivers of AMR; and to curb this urgent health threat. As then-Prime Minister David Cameron acknowledged back in 2014, "if we fail to act we are looking at an almost unthinkable scenario where antibiotics no longer work and we are cast back into the dark ages of medicine."



Introduction

Antimicrobial resistance (AMR) represents a profound and escalating threat to health, posing significant challenges to both human and animal populations. This threat is recognised by both the UK 20-year vision for AMR[7] and the UK 5-year national action plan for AMR[8] and was discussed at the UN General Assembly High-Level Meeting on AMR in September 2024.[9] While increasing attention has been directed towards the appropriate stewardship of antimicrobials in medical, veterinary, and agricultural settings, a critical yet often underappreciated aspect of this issue lies in broader environmental concerns. The pervasive and, at times, unnecessary presence of biocides in consumer products, and the risks they pose to health both directly to users and indirectly by driving AMR, necessitate urgent and comprehensive policy intervention.

This policy paper, which accompanies a Private Members' Bill,[1] proposes targeted interventions to address these issues. The recommended interventions outlined in this paper were informed by a comprehensive consultation that brought together a diverse array of stakeholders from academia, industry, government, civil society, and the health sector. This consultation aimed to gather diverse perspectives and expertise on the environmental and personal safety concerns of biocides in consumer products. Participants discussed the latest scientific findings, shared industry perspectives, and evaluated current regulatory frameworks.

Guided by the precautionary principle, which advocates for taking preventive measures in the face of scientific uncertainty, this paper underscores the necessity of minimising exposure to biocides where there is risk for harm. Given the impacts of biocides on AMR, this principle underscores the need to minimise exposure to biocides where the benefits do not clearly outweigh the risks. Consequently, and considering expert advice and emerging evidence, we propose the exclusion of unnecessary biocides in consumer products intended for human use; incorporation of AMR into environmental risk assessments; and increased research into, and monitoring of, the environmental impact of biocides.

This policy paper outlines the intricate relationship between environmental contamination by biocides and their contribution to the development and dissemination of AMR. It also highlights the potential impact of biocides on the human microbiome and the associated safety concerns for consumers arising from this biocidal "microbiotoxicity".[10] By examining these issues, the paper provides evidence-based recommendations for the responsible use of biocides in consumer products to safeguard public health and mitigate AMR risk.

Evidence and Rationale for Intervention

AMR and the environment

The environment itself is directly implicated in the development and proliferation of AMR, acting as a reservoir where resistance genes can evolve and ultimately spread to humans and animals.[11,12] A wide range of agents other than antibiotics are capable of indirectly selecting for resistance through a process known as co-selection.[13,14] Many such agents, including biocides, are released into the environment through pollution. Examples of how individuals can be exposed to AMR from the environment include through consuming water and food, exposure to irrigation water, and recreational use of lakes, rivers and beaches (see Figure 1 for examples)[15,16] Direct transmission of AMR from the environment to humans has been observed, with examples including significant increases in colonisation by resistant pathogens between surfers and non-surfers (four times more likely)[17] and between irrigation workers and office workers (32% vs 4%).[18] Additionally, we must consider the "triple jeopardy" faced by certain workers, particularly women, who may be exposed to biocides across multiple fronts-through their occupation, in lower-paid jobs with fewer health and safety protections, in personal care products at home, and in the environment-leading to much higher cumulative exposure that is rarely accounted for in hazard assessments.[19] Risks extend beyond human health: the spread of AMR in the environment is a clear example of the “One Health” paradigm at work. Evidence in the Governmental “Third UK One Health Report” describes a seal infected with a human pathogen carrying resistance genes “spread in human waste and [...] acquired by the seal through sewage pollution of the marine environment”.[20]

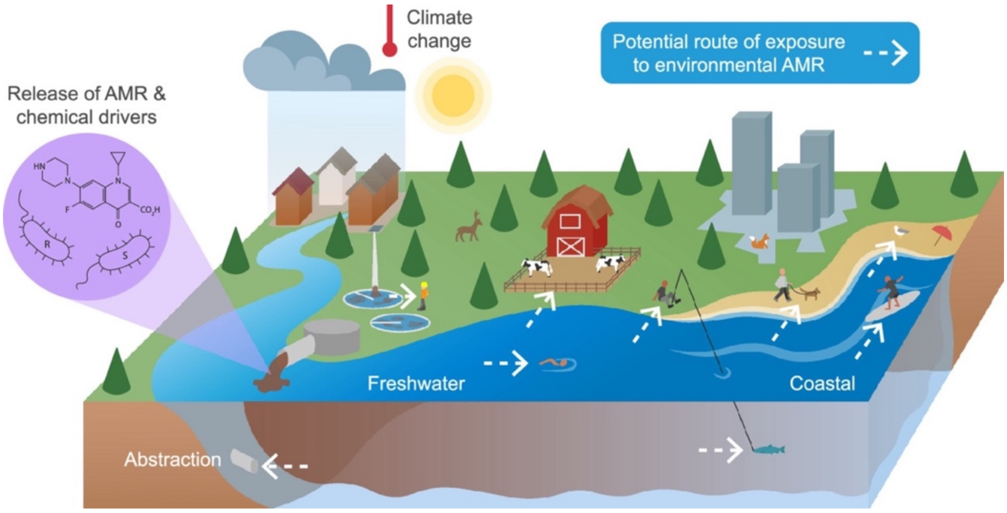


Figure 1. Potential exposure routes to AMR in the environment
Source: Tipper HJ, Stanton IC, Payne RA, Read DS, Singer AC, 2024, Do storm overflows influence AMR in the environment and is this relevant to human health? A UK perspective on a global issue, Water Research, 260.

Researchers have suggested that the increased number of resistance genes in the environment is itself a factor of human-caused global environmental change, as it is clearly linked to human activity, global in scale, and affecting biota and ecosystems.[21] Research highlights that not only is increased human and veterinary use of antibiotics driving increases in resistance genes in the environment, but also pollution by other non-antibiotic substances, such as chemical biocides, biocidal heavy metals[22] and microplastics, which can co-select for resistance.[23,24]

The complexity and scale of the environment make studying AMR’s drivers, spread, and effects uniquely challenging. The environment encompasses land, air, waterways and seas, each harbouring diverse and evolving mixtures of compounds and microorganisms, which contribute to a wide range of AMR sources. This diversity makes it difficult to generate comprehensive evidence linking environmental AMR to clinical resistance genes and identifying causal relationships between exposure and human health outcomes remains profoundly difficult. There is an urgent need for more data and research on exposure pathways, colonization, and the risk of resistant infections.[16,25] Without a precautionary approach, we risk wasting valuable time waiting for comprehensive evidence—which is difficult to generate—while urgent action is needed to prevent further harm and protect our future ability to treat diseases effectively.

Biocides in consumer products, pollution, and AMR

Biocides are substances with antimicrobial activity. They are used in a wide range of consumer products intended for human use for purposes directly related to their antimicrobial properties, such as in some hand sanitizers and mouthwashes, as well as for indirect purposes, such as preservatives in skincare products and anti-odour agents in clothing.

Irresponsible Marketing and Its Consequences

Modern life is saturated with commercial messages promoting antibacterial products, from hand sanitizers, to wipes, to fabrics. These marketing campaigns often exaggerate the benefits of antibacterial claims, or in some cases, present them despite being entirely unfounded. For instance, when comparing 'plain' soap to antibacterial soap, research has demonstrated that the mechanical activity of handwashing with soap is capable of removing dirt and pathogens from hands, preventing diseases, where "Incidence of disease did not differ significantly between households given plain soap compared with those given antibacterial soap". [26] A separate study found that there was no significant difference in hand disinfection when comparing hand sanitiser with liquid soap and water.[27] Despite these findings, aggressive marketing has significantly influenced consumer behaviour, affecting not only product choices but also worldviews, instilling irrational fears around cleanliness. Consumer research from 2016 found that 48% of US consumers believed that bar soaps were "covered in germs".[28]

This trend extends beyond hand hygiene, with biocides increasingly incorporated into products as a selling point, such as in anti-odour socks and even menstrual products.[29] The very existence of the problems these products are intended to address, as well as the legitimacy of the claims regarding their effectiveness, has come under scrutiny. These practices raise important questions about the validity of these products' purported benefits and the potential risks they pose to both consumers and the environment.

Biocide pollution

As has been previously described for pharmaceuticals (and specifically antibiotics), biocides in everyday products are eventually discarded and may reach the environment through various pathways, including through household waste and wastewater. Unlike pharmaceuticals, these products are rarely ingested, their components are not metabolised, and they may be discarded unaltered. In the environment, these substances may continue to exhibit antimicrobial activity, depending on their chemical makeup and surrounding matrix. There remains much to be understood as to the extent of this activity, especially at dilute concentrations, and its impact on environmental and human health. Despite the need for improved surveillance and further investigation, existing research indicates and warns of the serious risks posed by current biocide use and their environmental levels. This issue is timely, as the biocide market is growing, forecasted to increase by 4.5% across Europe between 2024 and 2029.[30] If left unchecked, environmental levels will continue to rise, exacerbating an already critical problem.

When assessing the evidence relating to the impact of biocide use it is important to consider two aspects:

1. Do biocides reach the environment in measurable, maintained concentrations?
2. Are biocides capable of driving AMR and does this pose increased risk to human and animal health?

1. Do biocides reach the environment in measurable, maintained concentrations?

Yes. Although the data concerning environmental concentrations of biocides varies among the broad category of compounds, several reviews have reported the presence of biocides used in consumer products in air and different water bodies.[31-33] Studies have shown that while wastewater treatment can remove some biocides, measurable concentrations often remain in treated water, with removal rates varying significantly from 15% to 95% depending on the specific biocide.[34,35] As highlighted in a recent review, storm and sewer overflows are a particular source of concern, exacerbated by the frequency of this discharge across the UK's wastewater network.[16] Such overflows lead to the release of untreated water, which could contain pathogens, antimicrobial resistance genes, and AMR selective and co-selective substances, such as biocides. For example, concerning waste discarded to landfill, recent evidence highlights that organic chemicals, metals, and microplastics are among many pollutants emanating from landfill sites.[36]

2. Are biocides capable of driving AMR and does this pose increased risk to human and animal health?

Yes. There is a growing body of evidence from both laboratory and field-based research that points to the role of biocides as environmental co-selectors for AMR. As highlighted above, evidence directly linking biocides to clinical resistance is limited due to the range and scale of use of biocidal substances, the many combinations they occur in, and the wider complexities of different environmental instances. It is essential to assess the available evidence in light of these considerations.

Laboratory studies have demonstrated that environmental concentrations of biocides can lead to bacterial resistance and horizontal gene transfer (the sharing of genes, including resistance genes, among pathogens), as highlighted in a recent review.[37] Examples include but are not limited to: quaternary ammonium compounds (disinfectants found in cosmetics);[38] triclosan (a disinfectant already banned from soap in many countries, though not the UK);[39] and parabens (common preservatives).[40]

Field research specifically targeting biocides originating from consumer products is lacking. However, we can consider the wider research in light of the laboratory evidence. For example, a study investigating wastewater effluent releases (containing household waste) found increased AMR abundance in sediments and waters downstream of release.[41,42] Although it is not possible to attribute these findings directly or solely to biocides from consumer products, they were likely part of the complex mix of chemicals and microbes, an environment conducive to the development of AMR.

Biocides in environmental pollution have the potential to drive AMR in the environment, which humans, wildlife, and livestock can be exposed to. Also, although research into the effects of chemical pollution on the microbiomes of wildlife in affected ecosystems is less studied, it is considered to be a factor in the known negative impacts of chemical pollution on animal health.[43]

Biocides in consumer products and personal safety

When biocides are used in products such cosmetics, clothing, or personal care products, the user/wearer is necessarily exposed to their antimicrobial activity. The human microbiome is essential to health and well-being, raising concerns about the use of biocides, given their microbiotoxicity, and the potential negative health impacts resulting from their interactions with the microbiome.

Case study: Heavy Metals

A recent study by the US Food and Drug Administration found that nano-silver (used in period products for odour reduction) can kill a certain type of 'protective' healthy bacteria found in the vagina.[44] This could lead to increased incidence of bacterial infections among wearers. In addition, research indicates that silver particles demonstrate endocrine disrupting effects.[45] Despite this, silver treated products are frequently marketed to women, including by trusted organisations such as the cancer surgery bra from Cancer Research UK.[2] As well as an example of inherent exposure risk, this can also be seen as exemplifying the worrying trend of the unnecessary incorporation of additives. This has been highlighted a recent report from the Women's Environmental Network which raises several relevant points.[29] Firstly, menstrual odour is a construct leveraged to sell products. Secondly, even accepting the premise of menstrual odour, silver additives have been shown to wash out of clothing, with reductions of up to 72% in the first 10 washes.[46] We argue that it is not justifiable, given the risks, to use biocides in this way, where there are clear risks and no demonstrable benefits.

We observe a similar trend in silver-treated clothing, where consumers are drawn in by promises of odour-free wear. However, studies show that up to 90% of the silver responsible for these claims is washed out over time.[47] In contrast, there are more effective and sustainable alternatives to both synthetic fibres and antimicrobial treatments. For instance, natural fibres like merino wool offer inherent anti-odour properties, thanks to their ability to wick moisture and naturally inhibit bacterial growth.[48] Given the environmental and health concerns associated with silver, especially its potential to wash out and contaminate water sources, the use of such alternatives is not only more sustainable but also potentially safer for both consumers and the environment.

Case study: Chlorhexidine

Chlorhexidine is frequently used in cosmetics and personal care products and is the most widely studied biocide used in over-the-counter mouthwashes. In 2020 research was published demonstrating that mouthwash containing chlorhexidine led to major disruption of the oral microbiome.[49] This disruption is understood to be mediated by the enterosalivary nitrate-nitrite pathway. Simply put, biocides harm the nitrate-reducing bacteria which play a key role in maintaining availability of the critical compound nitric oxide.[50] Human studies found significant reductions in salivary and plasma nitrite levels, further associating these reductions with increases in systolic blood pressure sufficient to raise the risk of cardiovascular disease.[51,52] While there are questions regarding the balance of these known impacts against the benefits of plaque reduction in certain individuals, the risks to the general population do not justify the use of chlorhexidine in direct-to-consumer products.

In addition to chlorhexidine demonstrating microbiotoxicity, studies have also shown that chlorhexidine exposure can lead to cross-resistance to antibiotics.[53-55] Research on *Klebsiella pneumoniae*, an opportunistic pathogen known for its multidrug resistance, revealed that exposure to low but increasing concentrations of chlorhexidine resulted in these isolates showing increased resistance to colistin—an antibiotic of last-resort.[53] That exposure to the biocide chlorhexidine drives resistance to key antibiotics in pathogens like *Klebsiella pneumoniae* underscores the potentially significant clinical implications of its widespread use, illustrating how exposure to biocides can directly undermine antibiotic efficacy in the clinic.

The Role of the Precautionary Principle in Biocide Regulation

As stated in the UK government's Environmental Principles Policy Statement, 'The precautionary principle is applicable where there is plausible evidence of a risk that a particular policy could cause serious or irreversible damage to the environment' and aims to help policymakers in handling risks which are not precisely calculable.[56]

In the context of biocide regulation, the precautionary principle is particularly pertinent given the evolving and complex nature of AMR. While the full extent of the environmental and health impacts of biocides, especially their contribution to AMR, is still being understood, there is sufficient evidence to warrant caution in their use. The precautionary principle thus advocates for the proactive minimisation of biocide use in consumer products where their necessity is not clearly established, to prevent potentially irreversible harm to public health and the environment.

The application of the precautionary principle in biocide regulation means that even in the absence of complete scientific consensus on the precise risks posed by biocides, especially regarding their role in promoting AMR, regulatory actions should err on the side of caution. The rapid spread of resistant organisms will further exacerbate the incidence of infections becoming untreatable, posing a severe threat to public health.

In practice, this principle would guide policymakers to prioritise preventive measures, such as limiting the use of biocides to situations where their direct benefits are clear and outweigh potential risks. It also calls for the thorough evaluation of alternative solutions, such as promoting non-chemical means of disinfection and hygiene and ensuring that biocides are only employed when absolutely necessary. Additionally, the precautionary principle supports the inclusion of AMR considerations in environmental risk assessments, ensuring that the potential long-term impacts on both the environment and public health are fully accounted for in decision-making processes.

Moreover, the precautionary principle underscores the importance of ongoing research and monitoring. As the science of AMR evolves, continuous assessment and adaptation of biocide regulations are essential to respond effectively to new evidence. This approach helps to mitigate the risk of biocides contributing to AMR and ensures that public health and environmental protection remain at the forefront of regulatory efforts.

By embedding the precautionary principle into biocide regulation, policymakers can take a more responsible and forward-thinking approach, balancing the need for biocides with the imperative to protect the environment and human health from the potentially catastrophic consequences of AMR.

Tackling biocides in consumer products is just one step of many that need to be taken to curb the pressing issue of AMR. Many significant other measures are needed. These include improving antimicrobial drug stewardship in human and veterinary medicine, consideration of what extra management is needed for unavoidable waste resulting from responsible antimicrobial use, and better understanding the role that non-antibiotic chemicals such as metals and pesticides, and products, such as plastics, play in the development and spread of AMR. Eliminating the use of unnecessary biocides in consumer products, however, would mean fewer ingredients in the cocktail of AMR-inducing products present in the environment.

Policy Context

What Has Been Done and Why

Over the years, different efforts have been made to regulate and manage the use of harmful chemicals (including biocides) in consumer products, driven by mounting evidence of negative impacts on human health and the environment. These regulatory strategies have ranged from targeted bans on specific biocides to broader frameworks like the Polluter Pays Principle (PPP), which imposes financial responsibility on polluters for the environmental damage they cause. The aim of these measures is to reduce the presence of hazardous substances in everyday products and to incentivise manufacturers to adopt safer practices and materials.

Global Regulatory Landscape and Its Pitfalls

Globally, the response to specific biocides has varied, with some countries implementing outright bans, while others have opted for more moderate restrictions. In places where biocides have been banned, manufacturers have been compelled to find alternative compounds to maintain the antimicrobial properties of their products. However, this has introduced new challenges, particularly the issue of perpetual substitution (sometimes referred to as 'regrettable substitution'[57]). This phenomenon occurs when one harmful chemical is replaced by another that may be equally or even more harmful, undermining the original intent of the ban and perpetuating the cycle of environmental and public health risks. Per- and polyfluoroalkyl substances (PFAS) or 'forever chemicals' are a well-documented example of the perpetual substitution problem in chemical regulation. Originally introduced in the mid-20th Century for attractive properties such as water resistance, research since revealed the substantial environmental and health risks associated with long-chain PFAS compounds like PFOA and PFOS. Regulatory actions then began to phase out their use. In response to these regulations, manufacturers shifted to using shorter-chain PFAS alternatives, which were initially believed to be safer due to their less persistent nature. However, this substitution did not solve the underlying issue. Emerging studies now show that these shorter-chain PFAS compounds also pose significant risks. They remain highly persistent, can still bioaccumulate, and may also have adverse health effects, albeit in ways that are not yet fully understood.[58,59]

The Polluter Pays Principle, while a cornerstone of environmental policy, operates on the assumption that pollution is reversible or can be mitigated through financial compensation, such as paying for environmental remediation efforts like water treatment. However, this approach has limitations. It often fails to provide adequate protection for the environment, as it may allow polluters to view environmental harm as a cost of doing business rather than a fundamental issue to be prevented. There have also been criticisms that fines are tokenistic, used merely as 'pacifiers to public outcry', with costs often being passed on to consumers or service users regardless.[60] Additionally, companies responsible for mitigating pollution, such as those in the water treatment industry, have frequently fallen short of their environmental responsibilities, as demonstrated by the release of untreated sewage into rivers and seas across the UK.[61] As a result, relying solely on the Polluter Pays Principle is not sufficient to ensure meaningful environmental protection.

Case Study: Triclosan

Triclosan, an antimicrobial agent widely used in personal care products, household items, and even medical devices, has been a focal point of targeted regulatory efforts. Concerns about its potential to disrupt hormones, contribute to antibiotic resistance, and harm aquatic life have led to increasing scrutiny from scientists, public health organisations, and policymakers worldwide. In response to these concerns, several countries (not including the UK) and regulatory bodies have moved to limit or ban the use of triclosan. The U.S. Food and Drug Administration (FDA), for instance, banned the use of triclosan in over-the-counter antiseptic wash products in 2016, citing insufficient evidence of its safety and effectiveness.[62,63] Similarly, the European Union has imposed restrictions on its use in cosmetics, and other countries like Canada and Australia have followed suit with varying levels of regulation. These actions have been largely successful in reducing the prevalence of triclosan in everyday products, marking a significant victory for public health advocacy.

However, the case of triclosan serves as a stark example of 'perpetual substitution' and the complexities involved in chemical regulation. While the initial ban on triclosan was a step forward in protecting public health, the subsequent introduction of potentially more harmful replacements highlights the limitations of current regulatory frameworks. Research recently found that three common replacements to triclosan actually exhibit greater toxicity and increased environmental risks.[64] This situation underscores the need for a more comprehensive approach that not only focuses on banning harmful substances but also ensures that either (1) replacements are thoroughly vetted for safety; (2) that alternative non-chemical approaches are implemented; or (3) that unnecessary additives are eliminated altogether.

As the regulatory landscape continues to evolve, it is crucial for policymakers to learn from the triclosan experience. This involves adopting a more holistic view of chemical safety, where the entire lifecycle of a product and its components are considered, rather than simply addressing one hazardous substance at a time. Only through such a comprehensive approach can we hope to avoid the pitfalls of the 'perpetual substitution' problem and make meaningful progress in protecting public health and the environment.

Recommendations

Tackling antimicrobial resistance requires coordinated cross-sector efforts and comprehensive policy and regulatory frameworks. A critical component of this strategy should be reducing environmental pollution by eliminating the unnecessary use of biocides in consumer products intended for human use, motivated by both environmental concerns and personal safety risks. Implementing these measures could significantly mitigate the impact of biocides on the environment and contribute to the broader fight against AMR.

In support of the proposed Private Members' Bill,[1] the following policy recommendations are outlined to ensure effective implementation and to address the critical issues surrounding biocides in consumer products. In addition, further policy recommendations are suggested which go beyond the scope of the Private Members' Bill, highlighting the need for updated environmental impact assessments and increased environmental monitoring funding and infrastructure. See Appendix 1: Further Policy Considerations.

1. Enactment of Biocide Ban in Consumer Products

Recommendation

Ban the unnecessary use of biocidal products in cosmetics, personal care products, and treated articles for human use (Clause 1), with the ban coming into effect five years after the passing of the Bill.

Rationale

This phased approach allows time for industry to adapt and reformulate products, while addressing public health and environmental concerns related to biocides. The ban is modelled after the Psychoactive Substances Act, which effectively regulates the inclusion of broadly defined substances. This approach will reduce unnecessary exposure to potentially harmful biocides and drive innovation towards safer alternatives. A key concern addressed by this approach is the perpetual substitution problem, where banning one harmful chemical often leads to its replacement by another that may be equally or more dangerous. By implementing a well-structured ban with clear exemption criteria, this approach seeks to prevent such unintended consequences. It ensures that alternatives are thoroughly evaluated to avoid perpetuating or worsening existing problems, thereby better protecting public health and the environment.

2. Establish Exemption Criteria

Recommendation

Incorporate exemptions (Clause 2) to allow continued use of biocidal products under specific conditions:

- **Medical Uses**: Biocides used in medical applications should be exempted, given their critical role in health and safety.
- **Environmental Safety**: Products must be shown to demonstrate environmental safety under real-world conditions, including

consideration of the mixtures that biocides occur in, i.e. the "cocktail effect".

- **Superiority Clause**: Allow exemptions where it can be proven that the biocide significantly enhances product efficacy without undue environmental impact.

Rationale

These exemptions ensure that essential uses are not unduly restricted while maintaining a focus on minimising environmental and health risks. This approach balances the need for biocides in critical applications with the goal of reducing their broader use and impact. This approach requires the demonstration of environmental safety under real-world conditions.

3. Formation of an Advisory Board

Recommendation

Establish an advisory board (Clause 3) to review scientific and social evidence related to biocides and provide recommendations to the government.

Rationale

This advisory board will provide ongoing expert advice on biocidal substances, helping to ensure that regulatory decisions are informed by the latest scientific research and societal considerations.

4. Monitoring and Reporting Requirements

Recommendation

Require the Secretary of State to monitor the impact of biocidal products on the environment and human health, with a biennial report to Parliament (Clause 4).

Rationale

Regular monitoring and reporting will provide transparency and accountability, allowing policymakers to assess the effectiveness of the Bill and make informed adjustments as necessary. This measure ensures that emerging issues are promptly addressed.

5. Regulation of Marketing Claims

Recommendation

Amend advertising regulations (Clause 5) to ban explicit or implicit claims of benefits from biocidal products unless such claims are substantiated by evidence. This regulation should be enforced by the Advertising Standards Authority and be effective one year after the Bill is passed.

Rationale

This measure will prevent misleading marketing practices and ensure that consumers are not misled about the benefits of biocidal products. It promotes transparency and accuracy in advertising, contributing to informed consumer choices.

6. Definition and Exemptions of Biocides

Recommendation

Adopt definitions to classify substances with known or reasonably suspected antimicrobial effects as biocides. Include exemptions for commonly used edible and natural substances, such as salt and tea tree oil.

Rationale:

Clear definitions and targeted exemptions will help to focus regulatory efforts on substances that pose significant risks while avoiding unnecessary restrictions on everyday natural products that have established safety profiles.

Summary

The Private Members' Bill provides a balanced approach to regulating biocides in consumer products. By addressing both the need for public health protection and the practicalities of industry adaptation, these measures aim to mitigate the risks associated with biocides while promoting safer alternatives and enhancing regulatory oversight.

Conclusion

This policy paper, in support of the accompanying Private Members' Bill, underscores the urgent need to address the public health and environmental challenges posed by biocides in consumer products intended for human use. Biocides, while intended to provide antimicrobial benefits, may present significant risks, including contributing to antimicrobial resistance (AMR) and disrupting ecosystems. Their use in personal care products, cosmetics, and treated articles not only has the potential to jeopardise individual health by disrupting the human microbiome but also exacerbate broader environmental issues.

The evidence presented justifies the application of the precautionary principle, advocating for proactive measures to mitigate harm when dealing with complex, unquantifiable risks. This principle is crucial in guiding regulatory decisions to ensure that the introduction and use of biocides do not outweigh their perceived benefits.

The consultation with a diverse range of experts has highlighted the critical need for a ban on unnecessary biocides, emphasising that their health risks often outweigh their purported advantages. The proposed policy measures aim to prevent the perpetual substitution of harmful chemicals and ensure that alternatives are genuinely safer.

By implementing the recommended measures, we can better safeguard public health and the environment, moving towards more sustainable and responsible practices. Raising political awareness and adopting a precautionary approach will be key to effectively addressing the threats posed by biocides and advancing towards a healthier and safer future.

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Appendix 1: Further Policy Considerations

In addition to the measures outlined in the Private Members' Bill, the following recommendations aim to address gaps and enhance efforts to mitigate the risks associated with biocides and antimicrobial resistance (AMR). These recommendations focus on improving environmental impact assessments, increasing funding and infrastructure for AMR monitoring, and addressing specific research needs.

1. Integration of AMR Into Environmental Impact Assessments

Recommendation

Integrate AMR considerations into environmental impact assessments (EIAs) to comprehensively evaluate the potential ecological and health impacts of biocides. This integration should involve:

- **Incorporating AMR Metrics:** Include metrics for AMR in the assessment criteria, evaluating how biocides influence the development and spread of resistant microbial strains in various environments.
- **Microbiome Analysis:** Conduct detailed studies on how biocides affect the microbiomes of wildlife and ecosystems. This involves understanding the direct and indirect impacts of chemical pollutants on microbial communities and their functions. Address current knowledge gaps and challenges identified in the scientific literature, such as the interaction between biocides and microbial diversity in natural habitats.[43]
- **Longitudinal Studies:** Implement long-term monitoring to track changes in environmental microbial communities and AMR patterns over time. This will provide insights into the persistent effects of biocides and help in predicting long-term ecological impacts.

Rationale

Integrating AMR into EIAs ensures that potential environmental and health risks are thoroughly evaluated before biocides are introduced or used. This proactive approach will help prevent unforeseen negative impacts and promote more sustainable practices.

2. Increase Funding and Infrastructure for AMR Environmental Monitoring

Recommendation

Enhance funding and infrastructure to support comprehensive AMR environmental monitoring. Key areas for investment include:

- **Resource Allocation**: Increase financial support for monitoring programs that track AMR in various environmental compartments, such as soil, water, and air. This includes upgrading facilities and technology for more accurate and extensive data collection.
- **Data Access and Utilisation:** Improve access to and funding for utilising existing data on biocide usage and its environmental impact. Facilitate the sharing of data between research institutions, government agencies, and other stakeholders to support collaborative research and policy development.
- **Research Expansion:** Address specific research gaps highlighted during consultations, including:
  - **Biocide Usage:** Mandate the availability of sales data for biocides, covering various products and applications. This will provide a clearer understanding of biocide usage patterns and inform risk assessments.
  - **Environmental Distribution:** Investigate where biocides are most commonly found in the environment, including their distribution in different ecosystems and their interactions with other substances.
  - **Concentration Effects:** Research the effects of selective concentrations of biocides, examining how varying levels impact AMR development and environmental health.

Rationale

Enhanced funding and infrastructure for AMR monitoring will enable more effective tracking and management of biocide-related risks. Addressing research gaps and improving data access will support evidence-based decision-making and foster a better understanding of biocide impacts on the environment and public health.

Conclusion

These additional recommendations aim to complement the proposed Private Members' Bill by addressing broader issues related to biocide use and AMR. By integrating AMR into environmental impact assessments and increasing resources for monitoring and research, we can better manage the risks associated with biocides and advance towards a more sustainable and health-conscious approach to chemical regulation.

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