

BIOFILM ALLIANCE
Regulatory Science Network

Biofilm Alliance Conference 2025

21 October 2025, Birmingham, UK

CONFERENCE REPORT





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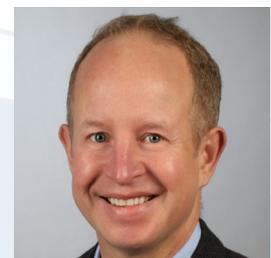
Foreword from the Biofilm Alliance Advisory Board

Dr Markus Busch, LANXESS

Biofilms can result in operational problems, cleaning, asset damage (i.e., microbially induced corrosion), production outages, and even raise health concerns like the release of toxic hydrogen sulfide gas and proliferation of pathogenic *Legionella bacteria*. Effective biofilm mitigation needs versatile oxidative and non-oxidative, as well as preventive and curative strategies. These concerns can be prevented by specialised fast-acting and material-compatible non-oxidative biocide technologies such as glutaraldehyde, DBNPA, CMIT/MIT and bronopol.

A key discussion point at the Biofilm Alliance Conference was the need to connect regulators, science and industry, to help overcome significant hurdles to biofilm mitigation technologies. Conference participants noted the increasing loss of biofilm mitigation technologies due to regulatory hurdles. Connecting and aligning regulators, science and industry could play a significant role to sustain existing technology options against evolving regulatory hurdles.

A variety of promising innovations were presented at the conference. Unfortunately, the regulatory framework requires excessive investment; the number of 20 million GBP for introduction and maintenance of a biocide technology was repeatedly mentioned. This huge investment, long approval and commercialisation periods, limited data protection, uncertainty and low chance of success pose too high hurdles that can't be overcome by most innovation. If early adoption schemes for innovation were developed (i.e., aligning regulatory hurdles to magnitude of risk and early, limited use volumes), this could be a significant catalyst to enable new and expanding technology solutions to address this important and evolving need.



Professor Colum Dunne, University of Limerick

Chair of the Biofilm Alliance Advisory Board

The Biofilm Alliance brings together both expertise and curiosity.

In Birmingham, at the Aston University, this was apparent in presentations that emphasised the experiences of those working with microbial biofilms in practical settings along with academic opinions and regulatory perspectives.

In essence, the meeting epitomised the diversity evident in microbial communities with a rich dialogue led by those who delivered keynote presentations along with contributions from attendees of the conference who were not slow to generate discussion.

For me, two elements were especially apparent: i) that the investment by Innovate UK in this initiative would generate transfer of expert knowledge from academic settings to industry and that ii) leveraging this advancement should ideally involve follow-on investment to deliver on the impetus and obvious potential of this successful Alliance.

There are clear education, training, public health and industrial benefits to understanding biofilms. The leadership of the Biofilm Alliance has delivered and the next phase is both exciting and important to the UK Life Sciences sector and commercial exploitation of these advances to enable innovation and competitiveness.



Michael Davies, Health and Safety Executive

I found the Biofilm Alliance Conference incredibly insightful. As a regulator it was particularly productive to be able to offer direct advice to people in the industry facing regulatory challenges.

The talks covered a wide range of biofilm related topics which broadened my understanding of current and future issues as well as offered practical knowledge. As a result of discussions I had during the conference I have multiple follow up meetings and made numerous new connections in the industry.



Executive summary

The Biofilm Alliance Conference 2025 was held on 21 October at Conference Aston, Birmingham. It brought together leading voices from academia, industry, and regulatory bodies to explore the intersection of cutting-edge biofilm research, technological innovation, and regulatory science. The event provided a platform to showcase recent advances in biofilm management and regulation, while promoting cross-sector collaboration. Participants shared insights, aligned strategies, and explored how to accelerate the translation of research into practical, market-ready solutions - developing a shared vision for the future of biofilm management and regulation.

The programme featured a comprehensive overview of contemporary biofilm research and its practical applications, through oral and poster presentations, discussions, and networking sessions that enabled exchange of knowledge, debate, and the identification of collaborative opportunities.

The conference was structured around four thematic sessions, addressing distinct but interconnected aspects of biofilm research and management:

- Biofilms Affecting Industry
- Tackling Biofilm Challenges
- Solutions and Cooperative Initiatives
- Regulatory Landscape and Funding

A highlight was the open discussion session “Creating a Unified Framework – Cross-Sector Collaboration for Smarter Biofilm Regulation and Innovation”. The discussion underscored that effective communication and collaboration between academia, industry, and regulators is essential to develop cohesive, evidence-based biofilm standards that foster innovation while mitigating risks.

The conference demonstrated that constructive, cross-sector dialogue between regulators, industry, and academia on biofilm management is not only possible but essential. However, it was widely agreed there is an urgent need for biofilm-specific standards and regulations, evidence-based regulatory guidelines and enhanced collaboration between stakeholders. The Biofilm Alliance Conference 2025 revealed the depth of expertise within the UK biofilm community and the critical role of innovation in strengthening national capability.

By driving knowledge exchange and highlighting regulatory and technological developments alongside emphasizing impressive economic advantages to managing biofilms effectively, the conference reinforced the importance of aligning research, policy, and industrial practice to tackle biofilm challenges more effectively. This alignment is key to advancing biofilm management across UK sectors not only for biosecurity reasons but also to improve economic growth potential and strengthening international collaboration.

This report presents the key discussions, insights, and developments shared during the conference.

Background

Biofilms are present across all natural and engineered environments, influencing processes from healthcare and manufacturing to the environment, with an estimated economic impact of \$5 trillion annually. Their structural resilience and ability to communicate intercellularly mean that biofilm-associated bacteria can be up to 1,000 times more resistant to conventional treatments, e.g. with antibiotics, in comparison to the free-floating cells. This drives persistent contamination, corrosion and infectious disease. Biofilms, however, can also play beneficial roles, including in wastewater treatment, food fermentation or in the development of sustainable biomaterials. This makes effective biofilm management important for both health and economic benefits. Academia and industrial communities are increasingly collaborating to develop innovative approaches to biofilm control, recognising that effective biofilm management relies on integrating biological insight with technological and regulatory innovation.

Regulatory guidelines for biofilms in the UK are limited, with most existing frameworks adapted from general hygiene and microbial safety legislation (rather than being biofilm specific) or adopted from the EU frameworks such as the Biocidal Products Regulation. The problem is intensified by the general absence of harmonised biofilm standards and methodologies, which leads to inconsistent detection, cleaning, and reporting practices across multiple industry sectors. This also creates difficulties in comparing data, validating new technologies, and ensuring effective biofilm management. As a result, infection outbreaks, material degradation, or antimicrobial resistance often persist despite existing health and safety protocols. There are national initiatives being opened to bridge these gaps by connecting research, industry practice and regulation, and to inform standardised testing, monitoring, and management methods. Establishing clear, evidence-based biofilm standards and guidelines would enhance safety, sustainability, and innovation, positioning the UK as a global leader in coordinated biofilm management.

The Biofilm Alliance is a partnership between the National Biofilms Innovation Centre, Manchester Metropolitan University, Swansea University and Industrial Microbiological Services Limited. Funded by Innovate UK, the network is dedicated to advancing regulatory science and improving evidence-based decision-making in industry sectors affected by biofilms, including the built environment, food, industrial processes, and water sectors. Biofilm Alliance aims to enhance multi-sector collaboration across academia, industry, and regulatory bodies, to promote innovation in detection and mitigation, and to support the development of biofilm policies. Central to this mission is the creation of a structured framework for biofilm regulatory science, ensuring that the UK remains at the forefront of research, innovation, and regulatory leadership in this critical field.

Biofilm Alliance Conference 2025

CONFERENCE AIMS

The Biofilm Alliance conference was designed to bring together stakeholders from diverse backgrounds that had a vested interest in improving biofilm management, standards and regulations within the UK industrial, environmental and healthcare sectors. The conference aimed to create a collaborative platform where researchers, industry leaders, and regulatory authorities could exchange insights, confront persistent challenges in establishing robust biofilm standards, and explore strategies to enhance innovation in biofilm technologies and management.

A key focus area of the conference was to advance biofilm regulatory science by promoting discussion on how best to develop evidence-based tools and standardised methodologies, to ensure more robust biofilm management and regulatory decision-making. The event comprised presentations from 14 expert speakers, 6 flash talks and 14 poster presentations. The conference concluded in an open discussion between attendees, held to further disseminate and foster communication between delegates.

The main aims of the day were to:

- Discuss challenges in the current regulatory landscape for biofilm-related products and propose actions to align standard development with biofilm-specific needs
- Foster communication amongst stakeholders across academia, industry, metrology and regulatory bodies in line with a shared vision to address biofilm challenges and promote cross-sector solutions.
- Showcase cutting-edge research and innovative solutions from academia and industry alongside regulatory insights, to help drive the next generation of regulatory science, biofilm innovation and technology development.



Session Summaries

SESSION 1 - BIOFILMS AFFECTING INDUSTRY

Biofilms Affecting Industry focused on the implications that biofilms pose across different sectors. Katie Laird presented research from De Montfort University on adaptive bioindicators that accurately capture microbial survival during laundering and finishing, with emphasis on the textile industry. This talk highlighted the importance of supporting industry and regulatory bodies in ensuring safe, effective and sustainable textile processing. Sharing his expertise in the chemical supply to the water sector, James Lee presented the advancements that Hydro Finesse has made in biofilm management within the wet leisure industry. James Lee presented over 40 years of experience in water treatment, including achieving one of the UK's first BPR approvals for a copper-based algaecide (PT2). Session 1 also included a talk from Matthew Gilmour from the Quadram Institute about the Food Safety Research Network. Matthew shared his expertise on food safety risks in agrifood systems. The talk included insights from recent work on refining management strategies to improve food safety culture. This research highlighted how combining the use of computational tools (including metagenomics and multi-species biofilm models) with existing hygiene frameworks can aid in delivering practical problem-solving tools to improve food safety. Session 1 also included poster flash talk presentations from across academia and industry.





SESSION 2 - TACKLING BIOFILM CHALLENGES

Tackling biofilm challenges centred on strategies to overcome obstacles posed by biofilms. This session included a presentation by Giovanni Pavanella from Alvim Srl- Biofilm Monitoring Technologies. Giovanni's talk covered the importance of biofilm monitoring in civil and industrial applications, with their new technology exploiting the electrochemical activity of natural biofilms proportional to the surface area covered by bacteria. Paul Lavender discussed the technical challenges and initial findings from efforts by BEWISE to reduce greenhouse gas in wastewater treatments using a trickling filter system. This is a collaborative project between Haskoning and the National Biofilms Innovation Centre. Regulatory challenges were covered by Richard Hammond, from Remora, who presented a synthetically optimised molecule that inhibits multispecies biofilms by disrupting quorum sensing. This talk highlighted the limited status of existing standards and regulatory frameworks, alongside the commercial challenges encountered in bringing innovative technology to market. The final talk in this session was delivered by Markus Busch from LANXESS. Markus discussed strategies to mitigate biofilm development in the industrial water sector, including oil and gas processes. Markus highlighted the diversity of industrial biofilms and the importance of regulatory compliance under BPR.

SESSION 3 - SOLUTIONS AND INITIATIVES

Solutions and initiatives showcased four talks covering biofilm management strategies across multiple sectors. Aday Shay, from Residual Barrier Technology, presented a talk on tackling biofilms in poultry water systems to reduce mortality and AMR risks. This talk also highlighted that restrictive regulatory frameworks hinder innovation in biofilm control. Adam's talk is an example of how biofilm management strategies can be applied to have a positive economic and health effect across sectors, in this case, the agriculture and water sectors. Peter Askew from IMSL discussed the impact of biofilms on industrial processes and determining the activity of biocides on these biofilms. Peter showcased the efforts of the International Biodeterioration Research Group (IBRG) on developing test methods for biofilm growth on either surfaces immersed in industrial fluids or on surface coatings and building products. David Ashworth, from KlarusConsulting and the British Chemical Association, explored the interaction between biocidal products, their claimed effects, the scope of regulation, and the role of methods chosen to support efficacy. Closing the session, Darla Goeres from the Center for Biofilm Engineering in Montana discussed key parameters to consider when navigating the regulatory pipeline and regulatory decision-making involved in biofilm product cycles. This included considering product impact on human health and the environment.





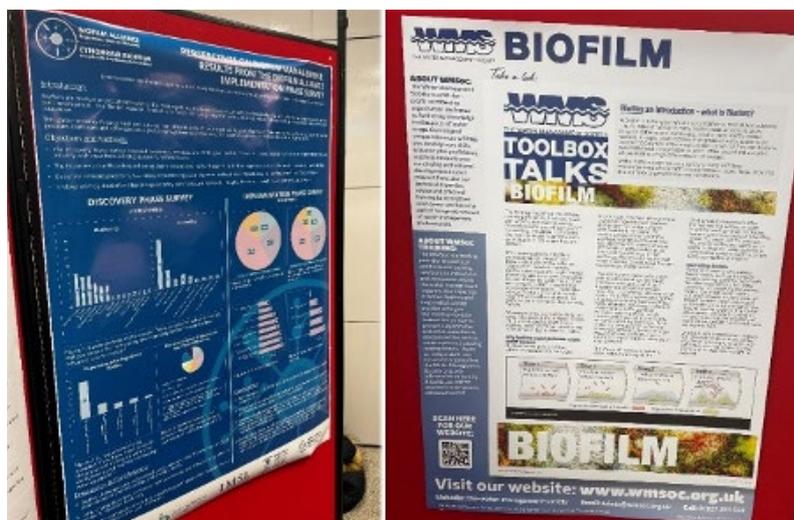
SESSION 4 - REGULATION AND FUNDING

Regulation and Funding concentrated on covering the regulatory and funding landscape. This session consisted of three expert talks and an open discussion. Michael Davies from the Health and Safety Executive opened the session, giving a talk on an introduction to the regulation of biocidal products under the GB Biocidal Products Regulation. This talk also covered how anti-biofilm technologies or interventions fit in and how claims do or do not fit into regulation, as well as challenges in product regulation. The next talk was given by Leanne Cleaver from the Medicines and Healthcare products Regulatory Agency (MHRA). Leanne provided information for innovators on how and when to access different levels of support for anti-biofilm claims at various stages of product development. The final talk of the conference was given by Nick Spickernell from Innovate UK. Nick's talk focused on how regulatory science can transform regulation from a barrier to a catalyst for innovation. Nick also introduced Innovate UK's Regulatory Science and Innovation Networks (RSIN) Programme, which aims to deliver pro-innovation regulatory policy changes, supported by real-world evidence.

Poster Presentations

The conference featured 14 posters across academia and industry, showcasing biofilm research and management from around the world. Flash talks, lasting 3 minutes each, were given by Biofilm Alliance team members Gillian Iredale (IMSL) and Geertje Van Keulen (Swansea University). These presented the advantages of live/dead fluorescence staining of fungal biofilms to determine curative efficacy of biocides in metal Working Fluids (IMSL) and the effects of strain selection, inoculum density, crystal violet concentration and solubilization duration in the crystal violet assay for standardising biofilm quantification (Swansea University). David Childs (Kersia) presented a 5-point control plan on Listeria management and training for improved food safety. Dannielle Cox-Pridmore (UEA/Quadram) presented research on the development of sustainable surface technologies to reduce biofilm formation. Jan Stoepel (Lagotec) showcased the DEPOSENS system, a robust biofilm sensor system with contact-free measurement. Matteo Cese (CEXAL LTD) showcased the company's aptamer-guided fluorescence triage with eDNA confirmation for robust biofilm detection, and Wojciech Tabor (Wroclaw University of Science and Technology) presented work on the Introduction and optimisation of a gravimetric biofilm quantification method, yielding reproducible results in antimicrobial susceptibility testing.

Ellan Allen (The Water Management Society) gave a poster presentation on biofilm management and training within the water sector, including their leading work in Legionella control. Further perspectives on biofilm control and detection in industry were given by Abby Marchant and Haris Ahmad (both representing IMSL), including their work on anaerobic growth in seawater for BPR Product Type 12 oil & gas efficacy testing. Hollie Leighton and Anthony Horlock (The Biofilm Alliance) presented the results from their Discovery and Implementation phase surveys. Further poster presentations from academia included those from Alex Cunliffe (Manchester Metropolitan University) on a novel and validated 3D-printed method for the consistent and reproducible dry transfer of microorganisms for the determination of antimicrobial surface efficacy and Hafsa Abduljalil (Glasgow Caledonian University) on evaluating LACTAM as an anti-fouling component of dental materials.



Panel Discussion: Creating a Unified Framework

The open discussion centred around three main subjects, involving education and awareness, complexity of regulatory landscape, and cross-sector collaboration. The following summarises the main findings from the discussion:

Education and awareness around biofilms remain significant hurdles in this field. In your view, what are the most critical barriers, and what practical steps could help overcome them?

- It was highlighted that it is important to engage and communicate with stakeholders in a systematic approach and communicate to improve education and impact. It is important to have clear and agreed definitions, although there are challenges in coming to agreements with biofilms being so dynamic and complex.
- Education and awareness initiatives surrounding biofilms must consider the benefits and applications of biofilms as tools, rather than just focusing on the problems that biofilms cause. This includes the importance of carefully considering any marketing efforts and potential public unrest.
- It was suggested that case studies prepared by the Biofilm Alliance, potentially anonymised, would help communicate the issues that biofilms cause or can help with, which would help with securing funding and progress in management.

Navigating the regulatory landscape for biofilm-related products and interventions is complex. How can we better identify the right regulatory pathways and streamline compliance for innovators in this space?

- Adaptation and adoption of current testing methodologies to employ suitable methods for producing efficacy data for BPR submission, are quicker routes than new claims.
- With regulatory bodies such as the MHRA, it is worth submitting enquiries for products or claims for initial advice, because the more queries that are logged under a particular topic, the more resource can be allocated by the regulator.
- Engaging regulators via non-competitive special interest groups are likely to get better engagement than direct engagement.
- There are significant financial hurdles, where launching and seeing through claims for a new biocide can cost £20 million or more, and these claims can take years to progress with no guarantee for approval at the end. Potential fast-track routes for new products were discussed to ensure innovation is not stifled and those needing antibiofilm interventions can access them readily.
- The Biofilm Alliance is in a good position to help foster relationships between businesses and regulators. Delegates suggested the writing of a position paper.

Despite substantial research into antibiofilm solutions across academia and industry, translating these advances into UK market-ready innovations remains challenging. How do we collaborate to accelerate this process?

- One obstacle for making progress on education and collaboration surrounding biofilm management is the hesitance to acknowledge and share of problems faced from some sectors or parts of sectors. Overcoming this would improve cross-sector solutions being implemented in the problem areas.
- Large industries, such as oil and gas, have significant biofilm-associated problems that they are struggling to deal with. Currently there is disparity between understanding biofilms and the need to manage them. Having cross-sector solutions is a very powerful tool to help, as is communicating how improving biofilm management will help those industries solve problems.
- Different sectors use different terminology, phrasing or definitions for biofilm, leading to missed opportunities to learn from one another and increasing barriers to cross-sector innovation.

Taken together, the panel discussion highlighted that many of the barriers facing biofilm innovation are not rooted in a lack of scientific capability, but rather in fragmentation across terminology, evidence expectations, and regulatory navigation. Improved alignment through shared language, earlier dialogue, and pre-competitive collaboration,

Conclusions

The Biofilm Alliance Conference showcased the strong momentum in UK biofilm research, innovation and regulatory engagement. The event helped foster cross-sector relationships that will accelerate collaboration to develop and implement practical solutions.

The expert speaker list enforced the strong position of the UK in terms of biofilm research, as well as the Biofilm Alliance's position to unite key experts to discuss and disseminate innovative practices in biofilm methods, research and regulation. Talks highlighted shared challenges across the built environment, food, industrial processes and water sectors, which all have real-world impact. The talks demonstrated the advancement and growing importance of monitoring and early detection methods, including sensors, and the integrations of advanced tools i.e. metagenomics and multi-species modelling. The talks also showed that complex biofilm problems cause issues across highly diverse sectors, making compliance and testing challenging, especially in the absence of biofilm-specific regulatory frameworks. Finally, the talks highlighted that regulation is evolving, but is still a consistent barrier for innovators, which slows commercial progress, although method development and standardisation are progressing through groups like IBRG and the British Standards Institute. Regulatory bodies are aware of these challenges and the need for evidence-driven regulatory reform, especially given that anti-biofilm claims are often difficult to place within existing frameworks.

The poster discussions demonstrated that there is a plethora of innovative biofilm research and tools coming out of both academia and industry. There is strong momentum in biofilm detection and quantification, with multiple groups working to improve assays and sensors. Training courses that offer expertise in pathogen control were also demonstrated in the poster presentations and flash talks. These are important in providing education to SMEs in workforce skills, safety and regulatory compliance.

The discussion was an important opportunity to have open communication between regulators and industry stakeholders and gave a platform to discuss practices to tackle current biofilm challenges. It allowed delegates to express their opinion on current affairs, which highlighted that there are still significant hurdles in biofilm-specific standards and regulations, and that many sectors within industry are struggling with these obstacles. It also showed that many sectors have similar concerns, and that it is important to have open dialogue between sectors to implement solutions. Unfortunately, the resistance of certain sectors to embracing openness about such issues limits progress. It was clear from the discussion that biofilm education remains a core barrier due to its complexity, varying definitions, and access to resources. Major gaps in awareness and shared definitions are difficult but were highlighted as a key barrier to overcome to progress. The discussion session also covered the importance of focus on biofilms as useful tools, i.e. in wastewater, rather than just a burden. Case studies on biofilm-associated problems and biofilm-associated benefits were suggested to be desirable. The discussion concluded that networks such as the Biofilm Alliance are essential in uniting stakeholders and facilitating biofilm innovation and the progression of biofilm standards and regulation with regulators by providing a unified voice. This was highlighted as important, considering the high financial burdens, long timelines, and uncertainty around claims and regulatory pathways that all limit innovation.

The Biofilm Alliance Conference highlighted the urgent need for harmonised, biofilm-specific standards and consistent regulatory frameworks to tackle growing issues that biofilms pose and to harness what biofilms offer. Feedback from the event demonstrated that the Biofilm Alliance is well-positioned to aid in uniting stakeholders and assisting in the shaping of the national strategy of biofilm standards and regulation. It also reinforced the UK's opportunity to take global leadership in coordinated biofilm management and regulatory science.



Recommendations

The Biofilm Alliance Conference 2025 highlighted the critical challenges in biofilm management and regulation. Findings from the conference highlight the urgent need for harmonised standards, improved cross-sector collaboration and streamlined /defined regulatory pathways. The following recommendations draw on insights from expert presentations, the open discussion and stakeholder networking, to outline actionable steps to advance biofilm research, innovation and policymaking, positioning the UK as a global leader in biofilm management

Improving education and awareness- The conference attendees highlighted that education is a core barrier due to biofilm complexity, varying definitions and access to information. This is evident across countries, where it was suggested that working groups and networks that work internationally could be of benefit. A key recommendation is to focus on progressing on agreements across sectors as much as possible, and the dissemination of information, particularly on current regulatory pathways/access and biofilm ecology

Promote networking and knowledge exchange- Cross-sector collaboration was consistently brought up as desirable and necessary for driving biofilm management and solutions. This includes improving communication with regulators to aid in biofilm claims and mitigate the hesitancy of sectors that may be hesitant to disclose biofilm-associated problems that may be solved using cross-sector solutions. The Biofilm Alliance Conference was mentioned to be well-positioned to aid in this and praised for uniting stakeholders. Survey feedback included extending networking time, highlighting the importance of networking opportunities for stakeholders.

Updating regulatory pathways- Major hurdles in regulatory pathways include the absence of current frameworks, significant financial and time-sensitive obstacles and inaccessibility to regulators. Recommendations to overcome this included the establishment of non-competitive special interest groups, promoting case studies to highlight the urgent need for biofilm innovation and solutions

These recommendations reflect the collective insight collected at the Biofilm Alliance Conference 2025. The Biofilm Alliance was described as well-positioned to provide meaningful progress in biofilm management. The Biofilm Alliance, therefore, intends to continue collaborating with the wider biofilm community to implement as many of these recommendations as possible to progress towards unified and more effective biofilm solution strategies across sectors.



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