



NERC-EMHH Environmental Microbiological Risk Symposium

Industry session - discussion

14th March 2018

The aim was to discuss the current research in environmental risk assessment, identify knowledge gaps and priorities. The discussion addressed microbial contamination of environmental waters with primary focus on antibiotic resistant microbes (AMR) and human enteric viruses (EV).

1. Understanding microbial contamination in the environment

There is a need from both authorities and industry to better understand the transport of potentially harmful microbes in the environment. The primary objective is to see how microbes can reach recreational and drinking water reservoirs and contaminate aquatic animals, e.g. shellfish for human consumption.

a. Surveillance

Monitoring is essential to understand microbial behaviour and transport in the environment.

The **in situ monitoring** would be the best option because it allows risk-based decisions, hence, better protect public health with less impact on industry. It would allow a precise monitoring of events (e.g. the effect of heavy rainfall).

What should be monitored?

- Quantitative monitoring: flow meters/smart sensors on wastewater effluent pipes and combined sewer outflows.
- Qualitative/quantitative monitoring: microbiology sensors
 - o Difficult to develop and not necessarily feasible for field applications.
 - o Field applications are not well studied as funding is usually limited to development. More funding needs to be given to assess the usefulness of sensors in situ.
- **Indicators:** Instead of pathogens, indicator organisms are often used for monitoring. Traditionally used indicators (e.g. coliform bacteria) are not able to mimic the behaviour of many pathogens (e.g. viruses, protozoa) and hence a range of indicators should be used and linked to pathogens.

b. Modelling

An accurate and reliable model can inform on risks and can be a very good decision support tool. It can also inform on where and when sampling for monitoring should take place. On the other hand, it requires a huge amount of data and hence the development of accurate models is expensive and time consuming. However, in the long term, models should prove extremely useful for risk assessment.

Combined approach: modelling and monitoring should support each other in order to get the best possible outcomes.

c. Integration

Integrative approach is essential to address such a complex issue as microbial risk assessment.

- **Integrative research:** Research groups with similar goals should work closely together even if the funding bodies are different. The benefits would include:



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- Forum for the discussion of research focus and requirements
- Sharing results and hence avoid duplication
- Identify gaps

Funding should be designed around a common theme to allow researchers to work in one community and maximise efficiency.

- **Regular idea exchange:** A platform for researchers, industrial partners, funding councils and authorities for regular discussion and updates is essential to effectively address the issues in microbial risk assessment and public health protection.

2. AMR-related discussion

- AMR is an **emerging issue**: There are not many cases in the UK yet, however, there are in developing countries (e.g. India) due to non-official use of antibiotics. Rapid worldwide dissemination of AMR is expected primarily due to frequent overseas travel. If the issue is addressed now, a solution may be available by the time AMR emerges in the UK.
- **Anthropogenic and environmental sources:** Via wastewater discharge, AMR is found in the environment. Furthermore, resistance genes may be derived from bacteria naturally occurring in the environment. That route is often overlooked, however, needs to be considered further.
- **Current research** focuses on the **spread of AMR** and resistance genes and the usefulness of **gene editing** (i.e. cutting out of the resistance gene) to hinder environmental distribution.

3. EV-related discussion

- Integrative approach is missing from current research. **Interaction** among research groups is needed.
- The key point is to identify those viruses that can be transmitted via the environment. This is getting easier with novel molecular-based detection methods (e.g. PCR, metagenomics).
- **Emerging viruses** are not well studied and hence research focusing on novel viruses or viruses with changing territory due to **global warming** should be funded.