Department of Science &Technology

UK-India Water Quality Scoping Meeting

Meeting report

New Delhi, India

17 – 18 November 2016

Background

This meeting brought together leading experts, academics and policy makers from the UK and India to define the scope of a potential new UK-India interdisciplinary programme focussed on research contributing to improved water quality, and through this support socio-economic development and improve quality of life. Day 1 focused on identifying the key research priorities and Day 2 included a site visit to a local Water Treatment Plant.

This proposed programme will support research to improve understanding of the transport, transformation, interactions and fate of natural and manmade pollutants in the environment and determine the risks they pose to people and the environment. It will also develop new management strategies and technologies to clean-up water courses and enable the better monitoring of pollution levels in water.

The potential scope of the research was broadly identified before the workshop. The workshop enabled discussion on the broad challenges identified below:

- Improving understanding of the transport, transformation, interactions and fate of natural and man-made pollutants (pharmaceuticals, personal care products, metals, organic particles and plastics) in the environment;
- Determining the risks of natural and man-made pollutants pose to people and the environment;
- Improving understanding of the risks from naturally occurring pollution, such as arsenic and fluoride from geological sources;
- Developing management strategies and technologies to enable better measurement and monitoring pollution levels;
- Developing management strategies and technologies that will support the reduction pollution levels;
- Assessing the impact of pollution mitigation approaches, including timescales for clean-up measures to take effect and exploring the applicability of approaches to other areas.

Up to £4.2m is available for the UK contribution to the India-UK Water Quality Research Programme, which will be match funded by India's Department of Science and Technology (DST) in terms of research effort. The programme is part of the Newton-Bhabha Initiative,

established by the Governments of the UK and India to provide a framework for increasing research and innovation collaborations that support sustainable economic growth.

Given the wide range of potential research challenges further scoping was needed to determine the priorities for the planned research call. The primary aim of the workshop was to bring the UK and Indian academic communities together with policy and industry experts to discuss what the priorities should be, how best to address them given the scale and type of funding available and how to ensure that the outcomes of the research support long-term sustainable growth.

Meeting format

Presentations

Dr Rajiv Sharma (Adviser & Head, Technology Missions Division, TMD, DST) opened the meeting and welcomed the attendees. Dr Sharma emphasised the importance of Indo-UK cooperation on this topic and informed delegates that the research programme on water quality had been mentioned in the joint Prime Ministerial statement following the UK Prime Minister's visit to India during the 6 to 8 November 2016. The output of the meeting should be a number of themes around which collaborative research projects can be developed.

Sukanya Kumar-Sinha (Acting Director, RCUK India) provided a broad overview of the UK-India research partnership and an introduction to the Newton-Bhabha Fund. Following this, Dr Ruth Kelman (Head of Water, NERC) & Dr Sanjay Bajpai (Adviser & Associate Head, TMD, DST) presented the background and an overview of the aims and objectives of the meeting on behalf of the funders: DST, NERC and EPSRC. The funders noted that the outputs of the meeting will inform the development of a joint Announcement of Opportunity for research proposals which will be issued in early 2017. It is envisaged that the programme budget of £4.2m from the UK funders, matched by DST in terms of research effort will support a suite of 8 to 10 projects.

Following the introductory presentations, a number of invited presentations provided the participants with an overview of the Indian and UK context and policy scenes.

- Shri. Sanjay Kundu (Joint Secretary, Ministry of Water Resources, River Development and Ganga Rejuvenation) began by describing the interests and responsibilities of the Ministry of Water Resources (MoWR).
- Shri. R. M. Bhardwaj (Scientist E, Central Pollution Control Board, CPCB) presented the water quality monitoring interests of the CPCB which is part of the Ministry of Environment & Forests.
- Dr Neelima Alam (Scientist E, TMD, DST) presented examples of water quality research interventions that have been supported by DST.
- Dr Ruth Kelman (NERC) provided the overview of water quality interests in the UK including the policy context and examples of related research funded by NERC and EPSRC.

Copies of each of the presentations are available on the NERC Water Quality in India scoping meeting event page and the DST website and will also appear on the new programme webpages in due course.

Meeting discussions

Following the formal presentations, there were two breakout discussions.

The first session was designed to develop a mutual understanding of the water quality interests of the environmental and engineering research communities in both India and the UK. Participants summarised their personal water research interests and priorities and explored the commonalities and themes.

In the afternoon session the breakout groups were challenged to suggest the research priorities for the water quality research programme. The groups discussed how best to combine the expertise of the environmental and engineering research communities to tackle the issues raised and to identify which areas should be the priority for the three year joint India-UK research programme.

After the breakout discussions, each group reported their priorities to the plenary session. During this process, similar or linked ideas were grouped together where appropriate and three main themes emerged. The complete list of clustered suggested priorities can be found in Annex A and these are summarised below:

- Sensor development and monitoring networks. There is a need to strengthen monitoring techniques to include emerging contaminants. New techniques should be integrated and calibrated with existing systems.

- Understanding of the sources, transport, transformation, interactions and fate of pollutants including both established and emerging contaminants. This will require new empirical approaches to studying water quality and the development of water quality models.

- Water treatment especially decentralised approaches in urban and rural settings. New technologies should be scalable, usable and affordable. There should be consideration of what happens to an environment following treatment; what is the impact of removing a contaminant? What energy and nutrients could be recovered?

- Assessment and mitigation of microbial and chemical risk to drinking and bathing water.

A number of other general points were raised in discussion:

- It is essential that the researchers engage with users and that the projects are designed to address user requirements, for example so the outputs can be used to develop legislation and regulatory frameworks

- There was agreement that the scope should include both established pollutants and emerging threats as there are water quality issues associated with biological, chemical, arsenic, fluoride, nitrates and microbial agents.

DST, NERC and EPSRC thank the meeting delegates for fully engaging in the discussions. In particular, we are grateful to those who acted as session Chairs and facilitators. The inputs over the two days were excellent and will be incorporated into the upcoming call for proposals. The Announcement of Opportunity for the call is expected to be issued in early 2017.

Site visit

On the second day of the meeting, the Delhi Jal Board hosted a site visit to the Sonia Vihar Water Treatment Plant. The delegates met with the plant director and engineer in charge and were given a tour of the site. Discussions focussed around the challenges of treating water from different sources and the technology employed at the site as compared to that used in the UK.

DST, NERC and EPSRC would like to express their sincere thanks to the staff at the Sonia Vihar Treatment Plant for hosting the visit, and to Dr R. K. Sharma for organising the trip.

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Appendix A

Priority research topics arising from breakout group discussions. Similar or linked ideas were grouped during the afternoon plenary session.

Sensor development and monitoring networks

- Development of sensors and remote sensing based technologies (e.g. hyperspectral imaging for water quality monitoring and biological indicators.
- Real time monitoring and modelling of water quality in catchments (including assessment of existing systems and appropriate calibration).
- Sensor based water quality monitoring for rivers and other waterbodies.
- Data collection using citizen science approaches.
- Monitoring
    - development and application of a range of methodologies adopting a tiered approach to monitor the aquatic environment
    - to show relevance to both human and environmental health.
    - Challenge – harmonisation and translation of techniques to the field.
- New approaches to monitoring – capturing spatio-temporal variation and challenges for sensors.
- Devising appropriate and innovative monitoring and modelling strategies.
    - Technological advances in instrumentation, data and information flow assessment, integration with hydrological data.
- Catchment to consumer – monitoring and modelling of water quality (conventional and emerging contaminants).

Understanding of the sources, transport, transformation, interactions and fate of pollutants

- Identification of sources and pathways of pollutants and their impacts.
- Fate, transport and transformation of emerging contaminants in surface and groundwater.
    - Including organics, plastics, PCPs.
- Understanding key variables that drive water quality (hydrology, point source versus diffuse, land use, etc.) to map main sources of water quality issues.
- Particle-water interactions, physio-chemical behaviour of contaminants in a complex environment.
    - Emerging and persistent contaminants
    - Bioaccumulation and biomagnification (food chain transfer) for hazard and risk assessment.
    - Geochemical mobilisation and modelling.
    - Challenge – identifying and characterising contaminants in a complex mix.
- Characterisation, remediation and removal of emerging contaminants (PPCPs, anti-microbial resistance agents).
- Fate, transport, containment and remediation of geogenic contaminants with special reference to arsenic and fluoride.

    - Mapping and modelling as prognostic approaches
    - Life cycle analysis of existing technologies
- Catchment management for chemical and biological contaminants
    - Understanding sources, pathways and receptors including natural attenuation.
- Advances to modelling to understand the risks to water resources (source, distribution, transport and impacts).

Water treatment approaches

- Exploring the scope for water reuse and recycling.
    - Stormwater (treated effluent use for irrigation/ urban systems, groundwater augmentation)
    - Treatment protocols
    - Training and awareness
- Developing solutions for sustainable treatment and resource recovery.
    - Standalone/hybrid configuration of conventional and emerging/engineered natural systems – considering size and scale.
- In-situ purification technologies for removal of contaminants from ground and surface water including natural optimising natural processes.
- Waste water management:
    - Reuse and recycling
    - Development of value added products from waste water
    - Sludge management
- Water technologies for sustainable recycling and reuse of water, trace elements and nutrients.
    - Integration: Monitor – Change – Monitor
    - Does the engineering solution behave as anticipated?
- Decentralised treatment – system for waste water treatment with resource recovery (scalable, replicable, affordable, socially acceptable).
- ‘Trap’ and ‘recover’ at source – containment at source and recovery of useful elements.
- Low cost technologies for removal of contaminants in rural areas (including source protection).
- Resilience enhancement strategies/solutions for water infrastructure
    - Including hard and soft engineering – sustainable solutions.
- Resource recovery from waste water for environmental sustainability and circular economy.
- Sustainable and affordable water treatment for rural environments.
    - Technological development
    - Natural treatment
    - Mechanical treatment including nanotechnologies.
    - Challenge – developing new technologies. Large scale of application of developed technologies.

Other

- Robustness of measures and assessment of mitigation strategies.
- Assessment and mitigation of microbial and chemical contaminant risks to drinking and bathing waters.
- Long-term goal: to develop better management plans, standards and protocols.