

Case Study: Arsenic Exposure

Research develops understanding of origins and raises international public awareness

The challenge

In many parts of the world groundwater is used for drinking, cooking and irrigating crops, and the level of arsenic it contains is a major health risk. Continual exposure to high concentrations of arsenic in water can result in people developing cancers, ischaemic heart disease and compromised immune systems. This is particularly marked in Bangladesh, where it is estimated that 10,000s of people die prematurely each year because of chronic exposure to this carcinogenic hazard.



Engaging with Manchester has opened doors to the many national and international partners working on this increasingly important topic, with huge added value to both the University and ourselves. Many new avenues are being explored for development into significant projects of mutual benefit.



*Dr. Giovanni Leonardi
Environmental Public Health Tracking Group,
Public Health England*

- **Collaboration:** A unique culture of successful collaborative working across disciplines and specialist expertise in the field meant that The University of Manchester was exceptionally well positioned to address this problem. Funding from Natural Environment Research Council (NERC) and Engineering and Physical Sciences Research Council (EPSRC) allowed the University to bring together geochemists and microbiologists on various research projects to better understand the extent and origins of this problem.
- **Impact:** Manchester's ground breaking research has potential for direct impact at many levels. Novel findings are informing how policy makers worldwide consider future regulations regarding groundwater abstraction and rice irrigation. Their research has informed current thinking in Europe on the extent of arsenic exposure from private water supplies.
- **Going Forward:** The research has strengthened the University's partnerships with various agencies, such as Public Health England (PHE). Given the breadth of potential impact to health and life expectancy in affected areas, the results have helped leverage £4.5M funding to conduct follow on research to address the problem of arsenic origins and exposure.



Public Health
England

Public Health England (PHE) works with national and local government, industry and the NHS to protect and improve the nation's health and support healthier choices. It employs 5,500 staff, mostly scientists, researchers and public health professionals, to bring together specialists from more than 70 organisations into a single public health service.

www.gov.uk/phe

Case Studies



Arsenic in groundwater

Objective: To understand how arsenic enters well water for prediction of arsenic concentrations and informed remediation.

Research: Carefully sourced sediment samples were treated under different conditions to explore how various factors affect arsenic release from sediment into groundwater. The research team discovered that indigenous metal-reducing bacteria are critical to the processes, driving the transfer of arsenic into groundwater, where they can represent a significant health risk to those drinking or cooking with contaminated water.

Benefits: Manchester researchers were the first in the scientific literature to publish data on arsenic hazard in Cambodian groundwater. They developed predictive groundwater arsenic hazard maps. Local partner, Resource Development International, an American NGO, use such maps to help advise Cambodians on alternative water sources for impacted populations. The research has initiated consideration of certain bioremediation technologies based upon reversing the processes of arsenic mobilisation. It is hoped that this principle can be exploited at a later stage for widespread adoption.

Arsenic in rice

Objective: To investigate the extent of arsenic exposure through consumption of rice in Bengal.

Research: Humans can become exposed to arsenic by eating rice from fields irrigated with contaminated water. The research team analysed arsenic concentration in local rice and average levels of consumption to calculate typical exposure. They discovered that rice is a major exposure route for arsenic in humans in some affected areas. The extent of the problem in impacted areas is such that the calculated lifetime cancer risk for those consuming rice as staple food with typical levels of arsenic concentrations, exceed those from drinking water with arsenic at the provisional guide value.

Benefits: The research has contributed to an increasing awareness of the importance of rice as a significant arsenic exposure route. This is reflected in changes to Food & Agricultural Organisation (FAO) recommendations on provisional weekly tolerable intake, as well as explicit acknowledgement of the importance of rice as an arsenic exposure route by the European Food Safety Authority (EFSA).



Arsenic risk in the UK

Objective: To investigate whether arsenic poses a significant risk to citizens of the UK.

Research: Estimates of arsenic exposure from rice indicate potentially significant health concerns in groups with high rice diets. Further work is being carried out to investigate risk from private water supplies. To this end, The University of Manchester has formed a collaborative partnership with the British Geological Survey (BGS) and PHE to conduct NERC supported research into UK Arsenic Risk. This builds upon previous work by BGS and Health Protection Agency (HPA) which revealed that over 5% of tested private water supplies in a trial area of South West England contained arsenic at levels higher than the World Health Organisation (WHO) provisional guide value and UK regulatory limit of 10 µg/L.

Benefits: The discovery of high arsenic levels in private water supplies has helped inform PHE on arsenic exposure in the UK and the risk of arsenic exposure via various routes is now publicly acknowledged. Further funding has been secured for a three year biomonitoring survey conducted by the University, BGS and PHE to investigate the extent of overall arsenic exposure in South West England.