# Do field-based interventions to reduce arsenic contamination in ground water in developing countries work?

## What did we find?

- Although there was a lot of research available on several different technologies it was mostly poorly conducted.
- Adsorption and zero-valent iron interventions such as Activated alumina and sono/three-Kolshi/pitcher filters seemed to be more effective (although still mixed) in reducing arsenic in ground water to meet national guideline levels.
- Effectiveness of other methods to remove arsenic such as oxidation and filtration interventions is poor and of coagulation, co-precipitation and filtration, subterranean and membrane and electrolytic interventions is mixed.
- The effectiveness of each intervention was highly dependent on contextual factors such as the acceptability to users, a sense of ownership and expectations of women's role in society.

## Why did we do this review?

Arsenic is one of the world's top environmental hazards, threatening the lives of millions of people, being both toxic and cancerous. Ground water (water that is pumped up to the surface from underground) is used as an alternative to drinking polluted surface water (rivers and lakes). However, as arsenic is colourless, odourless and tasteless the contamination of this water has historically been undetected, today 21 countries are recognised as experiencing ground water contamination.

Long term exposure to elevated levels of arsenic can lead to muscular weakness, loss of appetite and nausea as well as neurological and circulatory disorders, and several cancers (Skin, lung, bladder and kidney). The effectiveness of interventions to reduce arsenic in groundwater in communities (as opposed to clinical trial conditions) is unknown.

## How did we do this review?

The research was a systematic review. This brings together all existing research on a particular question. To find studies that might help us to answer the question we searched the relevant academic literature.

We found 51 studies from across 6 countries (Bangladesh, Vietnam, Cambodia, India, Nepal and China). Interventions were classified into eight groups: Oxidation and filtration, coagulation, co-precipitation and filtration, adsorption, ion exchange, zero valent iron, membrane, electrolytic and arsenic removal in situ.

*'Review Bytes' are the plain language summaries of published systematic reviews from the EST team based at the National Institute for Health Research (NIHR) Collaboration for Leadership in Applied Health Research and Care South West Peninsula (PenCLAHRC). Please see overleaf for contact details should you require more information.*

## Quality of the research and cautionary notes

All studies were appraised as weak in quality with only one study appraised as strong and most studies suffered from poor and inconsistent reporting. Population sample sizes were often small and other sample characteristics were unclear or not reported making it difficult to understand how widely the results could be applicable for other communities. Very few studies reported the level of arsenic in human tissue or bodily fluids. There was no research on the effectiveness of lime softening and phytofiltration interventions to reduce arsenic in groundwater.

Location and maintenance of the interventions as well as cultural beliefs about arsenic contamination and the interventions played an important part in their appropriate use in the community. Qualitative research was not inckuded in this review but could play an important part in any future research and intervention development.

## What next?

Funding of future arsenic removal interventions should consider the following as key factors affecting their effectiveness in real world settings: acceptability to users, sense of community ownership, the perception of arsenic contamination as a problem and the perception of women's role in society.

Future research should: collect an adequate number of water samples using reliable tools, report the number of samples meeting WHO (World Health Organization) guidelines, and achieve good reporting standards.

## Contact details and further information about the published paper:

The PenCLAHRC EST is part of Evidence Synthesis and Modelling for Health Improvement (ESMI), at the University of Exeter Medical School. Further information about this research is available on the University of Exeter Medical School website: **http://medicine.exeter.ac.uk/esmi/workstreams/**

The full version of the systematic review of these findings is published in the journal Environmental Evidence. You can access the paper here: **https://environmentalevidencejournal.biomedcentral.com/articles/10.1186/2047-2382-2-11**

If you would like copies, please email the evidence synthesis team on: **evidsynthteam@exeter.ac.uk**

**Follow us to keep in touch with our research on twitter @evidsynthteam**

This research was funded by the National Institute for Health Research (NIHR) Collaboration for Leadership in Applied Health Research and Care South West Peninsula. The views expressed are those of the authors and not necessarily those of the NHS, the NIHR or the Department of Health.