Complex Science Saving

Employing a traditional technique, these men dig a shallow tube well. However, since many of Bangladesh's shallow water supplies are affected by arsenic, this water is unsafe to drink.

Bangladesh's arsenic crisis came to light in 1993, after a number of people in villages across the country fell ill, and it was confirmed that their main source of drinking water — groundwater from the deltaic basin — was contaminated with arsenic.

In the early 1970s, most of Bangladesh's rural population got its drinking water from surface ponds and nearly a quarter of a million children died each year from waterborne diseases. The provision of tube well water for 97% of the rural population brought down the high incidence of diarrheal diseases and halved the infant mortality rate. Paradoxically, the same wells that saved so many lives were later found to pose a threat due to the unforeseen hazard of arsenic.

The arsenic contamination in Bangladesh has natural causes: arsenic is mobilized into the groundwater by geological and biological processes, rather than human activity.

Because there is no easy way to remove or stop the pollution, scientists sought to find out where the arsenic is, how it´s getting there, and how old the water is. This way they could identify the arsenic-free aquifers. In collaboration with the Bangladesh Atomic Commission, the IAEA provided the scientific analysis to support the project.

Isotope hydrology, which is used to track the movement of water, played a significant role in understanding and addressing the problem.

Since 1999, the IAEA has supported arsenic mitigation projects at the local and national level by helping institutions use isotope techniques to get accurate information on arsenic contamination much more quickly and cheaply than is possible with non-isotope techniques.

The data also offers a precise assessment of groundwater and aquifer dynamics. Thus helping to determine if deep aquifers will remain

Lives in Bangladesh

by Sasha Henriques

arsenic free over the long term, if they are developed as alternative sources of freshwater, and how other deep aquifers may have been contaminated through mixing of deep and shallow reservoirs.

"When arsenic was identified in Bangladesh's groundwater, the IAEA helped us to start our isotope hydrology project to find solutions to mitigate the arsenic problem," said Nasir Ahmed, head of the Isotope Hydrology Division of the Bangladesh Atomic Energy Commission. "Through this collaboration with the IAEA, we were able to determine where safe water could be found."

To conduct isotopic analysis independently, the IAEA worked with Bangladeshi counterparts to build new laboratory capacity. "Through our IAEA Technical Cooperation project, we have been able to develop the isotope measurement facility here in Bangladesh," said Ahmed.

In the past ten years, 12 scientists/engineers were trained through 7 fellowships, 5 scientific visits and 6 regional training courses.

Isotope hydrology is still being used in Bangladesh to determine the movement of groundwater, where aquifers are being recharged and therefore the rate at which it can be sustainably used, how complex aquifer systems connect and mix with other water bodies, and how vulnerable they are to contamination.

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Photos: Dana Sacchetti, Division of Public Information.

Left: Using training and equipment provided by the IAEA, the Bangladesh Atomic Energy Commission (BAEC) analyzes water samples in its laboratory. Isotope hydrology can help reveal the age, location and movement of safe drinking water.

Right: Nasir Ahmed, head of BAEC's isotope hydrology laboratory, conducts a full analysis of water taken from a well. Ahmed's team works to help decisionmakers find safe drinking water.

Water Fingerprints

Water from different places acquires a distinctive 'fingerprint' that nuclear techniques, so-called isotope hydrology, can make visible. When water evaporates and condenses the concentration of oxygen and hydrogen isotopes in water changes.

Isotopes are naturally occurring atoms of differing atomic weight. Water vapour rising from the oceans carries a lower concentration of heavy isotopes than sea water. When the resulting clouds release water, the heavy isotopes fall out first.

As clouds move inland, their isotopic composition again changes, and the water acquires individual and characteristic 'fingerprints' in different environments. There are other isotopes in rainwater whose concentration decreases with time. These isotopes in surface or groundwater can be measured to determine the "age" or residence time of water within a particular water body.