

# Save every drop: isotope hydrology techniques improve Kuwait's water management

By Aabha Dixit

**A**rid countries like Kuwait are increasingly focusing on techniques using stable isotopes to assess their groundwater resources and meet the challenge of managing these in a sustainable way for their growing populations.

“There are no permanent rivers or lakes in Kuwait, and groundwater is our only natural

water resource. We have an average rainfall of just 115 millimetres per year and fresh water streams do not exist,” said Muhammad Al-Rashed, Executive Director of the Water Research Center at the Kuwait Institute for Scientific Research (KISR). Therefore, effective water management policies are vital to ensure the quality and quantity of available water to meet the

**A scientist from KISR uses incubator to prepare water samples for bacteria analysis. Isotopic techniques are key in studying the quality of water.**

(Photo: D. Calma/IAEA)



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*— Khaled Hadi, Director of the Operations Division, Water Research Center, Kuwait Institute for Scientific Research*

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demand of the country's population of more than four million.

Kuwait's groundwater reserves are mainly in the north of the country and have limited recharge, as only a small percentage of rainwater reaches these aquifers.

Isotope hydrology techniques are one of the key scientific methods that experts in Kuwait use to trace fresh water movement and to assess the age of available groundwater. The various isotopes carried in the water act as 'tags', which can be used to determine the source, age, movement and interactions of water both above and below ground (see page 4 to learn more). The data obtained and visualized as hydrological maps enable experts to make evidence-based decisions on sustainable resource management. Al-Rashed and his colleagues have conducted several isotope hydrology studies for the management of groundwater in Kuwait.

Kuwait's water use is among the highest in the world, with a per capita consumption of over 400 litres per day. In Kuwait, the withdrawal rate of groundwater is 255 million cubic metres per year. In contrast, the natural underground inflow to the aquifers is estimated at 67 million cubic metres per year. With limited fresh water resources, Kuwait relies heavily on desalinating seawater, which is an expensive process.

"We have to look at all available areas for potable water, and this is where isotope technology helps with investigations, as it looks at an optimum utilization of all water resources required for sustainable development," said Khaled Hadi, the Director of the Operations Division at the Water Research Center in KISR.

National efforts focus on investigating groundwater resources using isotope hydrology in combination with physicochemical methods, evaluating precipitation recharge, establishing an optimum water production strategy and evaluating the feasibility of artificial recharge of aquifers, said Nader Al-Awadi, KISR's Executive Commissioner for International Cooperation.

## Water-related studies, lab support

The IAEA has been supporting Kuwait since 2000 through various technical cooperation projects, leading to the understanding of available groundwater resources and corrective actions to enhance water management policies.

For example, an IAEA-supported technical cooperation project on isotope investigations to evaluate groundwater hydrology in Kuwait focused on the collection of isotopic data of groundwater that were later integrated with data collected during previous studies for the isotopic mapping of groundwater covering the entire country. The application of isotope techniques helped in interpreting the origin, age and movement of groundwater, which are essential for the sustainable management of water resources.

Another project focused on the evaluation of potential contamination sources of nitrate and sulphate in the groundwater fields of Kuwait through isotopic characterization. It included studying the levels of naturally occurring radioactive materials in the groundwater. Researchers found that the major source of sulphate and nitrate in the groundwater is natural rather than a result of human activity.

Some of the water samples are sent to the IAEA Isotope Hydrology Laboratory in Vienna, Austria, for assessment.

The IAEA has also supported the establishment of Kuwait's Isotope Hydrology Laboratory with state-of-the-art instruments provided through IAEA technical cooperation projects. Other areas of capacity building assistance included training scientists and conducting research on a range of groundwater issues.

"The Government of Kuwait highly values the instrumental role the IAEA plays through its activities and support to Member States in promoting throughout the world capacity building, networking, knowledge sharing and partnership development in various aspects of the peaceful uses of nuclear science and technology," said Samira A. S. Omar, Director General of KISR.

