

Using isotope techniques to improve groundwater management and support land planning and remediation in Argentina

The challenge

Argentina has an annual average water supply of more than 22.6 m³ per capita, and distribution is very irregular. Eighty-five per cent of Argentina's total surface water is concentrated in the El Plata Basin. However, two-thirds of the country has an arid or semi-arid climate, and has less than 1% of national water resources. Key water management problems facing the country include an insufficient supply of potable water; limited water for productive activities (e.g. industrial, agricultural and mining activities) and for urban and rural sanitation; threats to water sustainability due to pollution and over exploitation; and the degradation of water resources overall. In Argentina, most groundwater consumption is through irrigation for agricultural production.

For effective water resource management that can address environmental problems before they occur, it is essential to understand the dynamics

of hydrological systems. Isotope hydrology uses stable and radioactive environmental isotopes to trace the movement of water inside the hydrologic cycle. Isotope techniques provide a key tool for environmental managers, as they enable the evaluation of the quality and quantity of groundwater resources.

The project

Through the technical cooperation programme, the IAEA provided support to Argentina to introduce isotope techniques for water resource management that would enable the evaluation of water quality and its availability for all possible uses. Fellowships and scientific visits to isotope hydrology laboratories in Austria, Canada, Germany and the United States of America helped to build national capacity, and workshops supported the implementation of hydrodynamic, hydro-chemical and isotopic campaigns.



Uspallata-Yalguaraz study site: Project team taking water samples from wells for noble gases analysis used in dating groundwater. (Photo: Delfina Di Lorenzo/CNEA)

As part of the project, two study sites were selected at Los Gigantes, Córdoba (a former uranium mine presently under remediation), and Uspallata-Yalguaraz, Mendoza (two basins with potential for new productive uses, depending on the availability of water). These sites were used for training activities in applying isotopic techniques that contributed to the development of improved hydrogeological conceptual models of them.

The impact

The project has had concrete impact in three specific areas: remediation of mining sites with environmental liabilities, spatial planning, and the implementation of new tools for water resource management.

At Los Gigantes, data collected through the project is providing new information on the source of recharge, water age and transit time in the site, groundwater-surface water interactions, and dam leakages. This is contributing to engineering designs for the remediation of the site, a former uranium mine.

In the Uspallata-Yalguaraz basins, improved water resource modelling is supporting spatial planning for new activities in the region, including real estate development, agriculture, tourism and mining, by providing new information on the recharge source of the basins and discharge areas, and groundwater-surface water interactions with other basins.

Argentina is also benefiting from new tools for water resource management. A new isotope laboratory equipped with two isotope ratio mass spectrometers and accessories for the measurement of isotope ratios of hydrogen, oxygen, carbon, nitrogen, sulphur and silicon was developed. This facility is enabling the training of staff in sampling and measuring of isotope ratios in water bodies, interpretation of hydrodynamic, hydrochemical and isotopic data, and in modelling. As a result, isotope hydrology capacity is available for Argentina's water management sector.

PROJECT INFORMATION

Project No: ARG7008

Project title: Improving Management and Evaluation of Quality and Availability of Water Resources in Certain Regions using Isotopic Techniques

Duration: 2016-2017 (2 years)

Budget: €199 100

Contributing to:



Partnerships and counterparts

The National Atomic Energy Commission of Argentina (Counterpart of the project) concluded agreements with academic institutions (National University of Cuyo, Central National University and the National University of Mar del Plata), the science and technology sector (National Scientific and Technical Research Council, Scientific Research Commission of the Province of Buenos Aires and the National Water Institute), as well as with the environmental management sector (General Department of Irrigation).

The science

Isotope hydrology is a nuclear technique that uses stable and radioactive environmental isotopes to trace the movement of water within the hydrological cycle. Isotopes are atoms of an element that are chemically identical, but physically different: for example, deuterium and tritium are isotopes of hydrogen. The technique, combined with classic hydrogeological and hydrochemical studies, enables the assessment of groundwater-surface water interactions, groundwater vulnerability to pollution and over-exploitation, the determination of groundwater recharge areas, and water origin and age.