Water Resources

Objective

To improve the integrated management of water resources, geothermal resources and specific water supply infrastructures through the use of isotope technology.

Isotope Methodologies for the Protection and Management of Water Resources

A crucial factor in development is access to safe drinking water — a basic necessity unavailable to more than one sixth of the world's population (Fig. 1). Over 80 technical cooperation projects in water resources development and management were implemented in Africa, the Middle East, Asia and Latin America, substantially expanding their capacity to map underground aquifers, detect and control pollution, and monitor the safety of dams. Twelve training courses, workshops and seminars were organized for developing Member States within the framework of various technical cooperation projects.

Using isotopic methods and tools, hydrogeological maps of the Zarumilla Aquifer, shared by Ecuador and Peru, were developed to assist in the sustainable management of this transboundary resource. In Namibia, isotopic investigations were undertaken to determine the source of recharge of the Oshivelo Aquifer, a water source that is being developed to meet the growing demand for water.

Isotope data for Africa were compiled and synthesized to develop an atlas of isotope hydrology, which will be published in 2006. The atlas is aimed at improving the use of isotopes by Member States and facilitating the integration of isotopic techniques in hydrological investigations and research.

A CRP was completed on the application of isotope techniques to understand the migration of agricultural or other contaminants to groundwater. It provided a methodology to determine the best means of studying the movement of water and pollutants from the surface to groundwater systems. As an additional outcome, the study site — at a research farm in India — was developed with a variety of instrumentation, such as thermal sensors, soil moisture and gas sampling devices, as well as small diameter wells for water sampling.

The use of isotopes for characterizing submarine groundwater discharge was the subject of a CRP that was completed in 2005. Field studies were conducted in Brazil, Italy and Mauritius, which demonstrated the role of isotopes in identifying and quantifying groundwater discharge in coastal areas as well as its impact on coastal zone pollution. The results will form the basis of technical cooperation or interagency projects on coastal zone management.

As part of its Analytical Quality Control and Services, the Agency made available a number of isotope reference materials for use in hydrological, biological, ecological and agricultural studies. Annual requests for reference materials increased from 450 units to 820 units in 2005, and were supplied to 250 laboratories in Member States.

Communication and public outreach were significant areas of focus for the Agency's water resources programme in 2005. Several information brochures were prepared in response to increasing media interest in the Agency's activities in water resources management.

Partnerships for Better Water Management

The Agency places great emphasis on fostering partnerships with national counterparts and international organizations in order to maximize the impact of its activities in water resources management. In 2005, cooperation with the Global Environment Facility (GEF) and related partners

FIG. 1. Groundwater contributes more than half of the drinking water supply around the world and is a particularly important resource for rural development in many Member States.

Use of Isotopes to Reduce the Cost of Providing Arsenic-free Drinking Water in Bangladesh

Groundwater with high arsenic concentrations from naturally occurring sources is the primary source of drinking water for millions of people in Bangladesh. Exposure to elevated arsenic concentrations has resulted in a major public health crisis. Expanding on past cooperation, the Agency has teamed with the World Bank to optimize investment decisions for mitigating the impact of arsenic poisoning in Bangladesh. The main focus is on providing a piped water supply with a centralized water treatment plant to rural communities.

Chapai Nawabganj, in northwestern Bangladesh, is one village where high arsenic concentrations have been detected. The Agency and its counterpart, the Bangladesh Atomic Energy Commission, together with the World Bank conducted an isotope investigation of groundwater in this village in March 2005. The results of this study, which used stable oxygen and hydrogen isotopes and tritium, identified an arsenic-free aquifer in the eastern part of the village with a source of recharge different from the arsenic contaminated aquifer in the western part of the village. These results led to a fresh review of the geological and hydrological data, which then were re-interpreted, resulting in the discovery of two aquifers with little groundwater flow between them. Thus, the eastern aquifer could be used to supply arsenic-free water to Chapai Nawabganj. This will eliminate the need for a separate water treatment plant, thereby saving millions of dollars needed to build and run the plant.

(such as UNDP and the World Bank) expanded with the approval and establishment of new joint initiatives. These included the final approval of UNDP/GEF funding of $1 million for a joint project on the management of the Nubian Aquifer. At a joint meeting involving the Agency, FAO, UNDP–GEF, UNESCO and the World Bank, the World Commission on Groundwater was created. In addition, preparatory work was initiated on a larger scale joint activity to assess groundwater in the Nile Basin. The Agency also began providing technical expertise to the GEF Scientific and Technology Panel, starting with support for the theme of "Managing Aquifer Recharge". This theme, which includes activities related to the artificial recharge of groundwater, is important for Member States in arid and semi-arid climates.

The Agency co-sponsored a workshop on the governance and management of groundwater in arid and semi-arid zones, organized by WMO in Cairo in collaboration with UNESCO, UNEP and the Government of Egypt. Other interagency work included preparation of a chapter in the second edition of the United Nations *World Water Development Report,* co-authored with UNESCO and WMO. A chapter on the application of isotope techniques for delineating protection zones around public groundwater supply wells was contributed for a guidebook on this topic to be published by UNESCO. And special sessions on the use of isotopes in river basin studies and on recent advances in groundwater pollution studies using isotope tools were organized and co-sponsored by the Agency at the European Geosciences Union meeting in Vienna.

In recognition of the increased level of collaboration, the Agency concluded a Memorandum of Understanding (MoU) with the United States Geological Survey. The MoU is expected to provide a structured framework for joint activities, such as a training course on groundwater assessment for African countries, and streamline administrative processes. The US Government also provided extrabudgetary funds to test and adapt a recently developed laser based machine for isotope analysis.

Two programmes for improved training and education in isotope hydrology were established within the framework of the IAEA–UNESCO/Joint International Isotopes in Hydrology Programme

(JIIHP). A graduate degree programme in isotope hydrology was established at the UNESCO–Infrastructural, Hydraulic and Environmental Engineering Institute for Water Education in Delft, Netherlands. And a one-month isotope hydrology training programme for Latin American water professionals was held at the University of Montevideo; the course will be offered on a yearly basis under the technical guidance and sponsorship of the Agency. ■