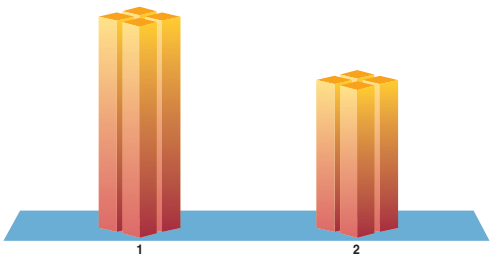
Water Resources

Objective

To increase the capability of Member States to improve the integrated management of water resources and geothermal resources, as well as specific water supply infrastructures, through the use of isotope technology.

Regular budget expenditure: $2 695 023



1. Isotope Methodologies for the Protection and Management of Surface Water, Groundwater and Geothermal Resources: $1 579 712
2. Reference Isotope Data and Analysis for Hydrologic Applications: $1 115 311

Key Issues and Highlights

- On behalf of the UN system, the Agency celebrated World Water Day 2002 with the theme of "Water for Development".
- The Agency moderated interagency events on water resources at Preparatory Committee meetings of the World Summit on Sustainable Development (WSSD), and at the Summit itself in Johannesburg.
- A new CRP on isotope monitoring of river discharge attracted a large number of proposals from both developed and developing Member States, reaffirming the relevance of the research topics undertaken and the role of the Agency in international research.
- A new age-dating capability for young groundwater using helium-3 and tritium was developed by the Agency to provide improved services to Member States for groundwater age assessment.

Isotope Methodologies for the Protection and Management of Surface Water, Groundwater and Geothermal Resources

The role of the Agency in water resources management was substantially enlarged through its promotion of the use of isotope hydrology. The Agency's presentation at a panel discussion on water at the WSSD in Johannesburg emphasized the part that science and technology can play in meeting the goals for sustainable development of water resources. Two interagency 'side events' on water resources management highlighted the *World Water Development Report* (WWDR) to which the Agency contributed. The document is being produced as an interagency synthesis report on the state of freshwater resources around the world.

The potential impact of climate change on water resources is an issue of concern that is being investigated by many international scientific programmes. Characterization of moisture sources in local precipitation is of importance to better understand climatic relationships. The Agency maintains the database of the IAEA–WMO Global Network for Isotopes in Precipitation (GNIP). The Internet site for this database *(www.isohis.iaea.org)* has graphical representations of data as well as animations of monthly maps which have been developed to provide a visual evaluation of spatial and seasonal variations in isotope data. The role of global isotope data from GNIP was highlighted at a meeting of the Global Energy and Water Cycle Experiment (GEWEX) project, which is managed by WMO and focuses on international efforts in hydrology and meteorology to develop an understanding of the Earth's energy and water cycle. In addition, a joint project is being formulated to use isotope data from GNIP for improved modelling of moisture sources in precipitation. One of the benefits of this project is a strengthening of GNIP.

A Memorandum of Understanding was signed between the Agency and UNESCO to launch the Joint International Isotopes in Hydrology Programme (JIIHP). The first meeting of the JIIHP steering

"Water for Development": Celebration of World Water Day 2002

The Agency launched the World Water Day 2002 celebrations, at its headquarters in Vienna, by stressing the role of science and technology in the use and management of water resources. As the lead organization for this event on behalf of the UN system organizations, the Agency initiated and co-ordinated a number of activities and events. Among the highlights were:

- A press release — distributed worldwide — that underlined the challenges of water for development;
- An art exhibition by children from schools in Uganda and Austria on 'Water for Development';
- A dialogue on water for development, with distinguished speakers from governments, non-governmental organizations and intergovernmental agencies.

Nearly 3000 copies of promotional materials were distributed, and a summary report on the celebrations was produced.

The Honourable Mrs. Bijoya Chakravarty, Minister of State for Water Resources in India, addressing the gathering at the inaugural session of the World Water Day 2002 celebrations on 22 March 2002 at the Vienna International Centre.

committee in June 2002 produced a work plan for 2002–2005 and led to the initiation of training activities. As part of this joint programme, a training course in hydrogeology was organized at the Institute of Fluid Mechanics and Environmental Engineering of the University of Uruguay, in Montevideo, with trainees from the Latin American region.

The development of academic training programmes focusing on the use of isotope techniques for hydrologists is a key requirement for the transfer of water sector skills to developing countries. Isotope hydrology is now included in a post-graduate programme at a university in India; the Agency also assisted the College of Water Resources and Environmental Engineering at Hohai University, Nanjing, China, to establish its new post-graduate semester course.

Stable isotopes of water and radioactive tracers have been used in the regular monitoring programme of geothermal production fields in Central American countries, with the results being used to support decision making on geothermal reservoir

management. This contributed to the improved management of the Miravalles geothermal field in Costa Rica, which had encountered a rapid decline in reservoir pressure over the last eight years of power generation.

Reference Isotope Data and Analysis for Hydrologic Applications

The Agency is developing a tritium–helium isotope measurement capability for the age-dating of young groundwater with the aim of integrating the use of helium isotopes in methodologies for water resources assessment. High tritium concentrations in precipitation resulting from atmospheric nuclear testing provided an easy means for determining the presence of post-1950 groundwater recharge and for estimating travel times to the water table. The atmospheric tritium concentration has, however, been decreasing and is currently almost at its pre-1950 natural level. Tritium–helium dating has been shown to be an effective and powerful tool for obtaining groundwater ages of the order of 1 to 50 years. The expected outcome is an improved ability of Member States to use isotope applications for the assessment and protection of groundwater resources.

A new CRP with 17 research groups worldwide was launched in March 2002 with the aim of developing a methodology and a monitoring network to understand hydrological processes in large river basins. The research will:

- Show the potential of isotope tracers in discerning the underlying causes of variability in the water-cycle of large river basins;
- Develop and test the application and transferability of isotope techniques in a wide range of hydrological settings over the next five years;
- Contribute to a better scientific understanding of water cycling processes on a larger scale, and seek to clarify the potential value and limitations of incorporating isotope techniques in a global network for isotopes in rivers.

Three technical co-operation projects related to aquifer systems were initiated in collaboration with UNESCO and UNDP/GEF. These projects — shared by several countries in northern Africa — focus on investigations of the:

- Nile Basin Aquifer system shared by the Democratic Republic of the Congo, Egypt, Ethiopia, Kenya, Sudan, the United Republic of Tanzania and Uganda.
- Nubian Aquifer system shared by Chad, Egypt, the Libyan Arab Jamahiriya and Sudan.
- Northwestern Sahara Aquifer system shared by Algeria, the Libyan Arab Jamahiriya and Tunisia.
- Iullemeden Aquifer system shared by Mali, Niger and Nigeria.

Isotope techniques will be employed to understand the recharge/discharge processes as well as groundwater dynamics for sustainable development and management of these aquifer systems. Successful implementation is expected to lead to improved socioeconomic development in the regions. A similar project on the Guarani Aquifer in the Latin American region has already been initiated.

Several technical co-operation projects in water resources development and management were implemented in the African, Middle Eastern and Asian regions. In these projects, the application of isotope methods was demonstrated to be a powerful tool to build a scientific basis for policy and management decisions, as shown below:

- In Senegal, the successful contribution of isotope techniques for the determination of aquifer parameters resulted in the formulation of a new World Bank funded programme to prepare the national water management strategy;
- In Morocco, isotope results were used to revise the groundwater flow and transport model developed for the Tadla Plain;
- In Yemen, the isotope investigation of groundwater system in the Sana'a Basin identified the nature and source of recharge to shallow groundwater for understanding the efficacy of artificial recharge measures;
- In the Philippines, a project on the water supply for Davao City on the island of Mindanao provided a scientific basis for judicious groundwater management and protection in the region.