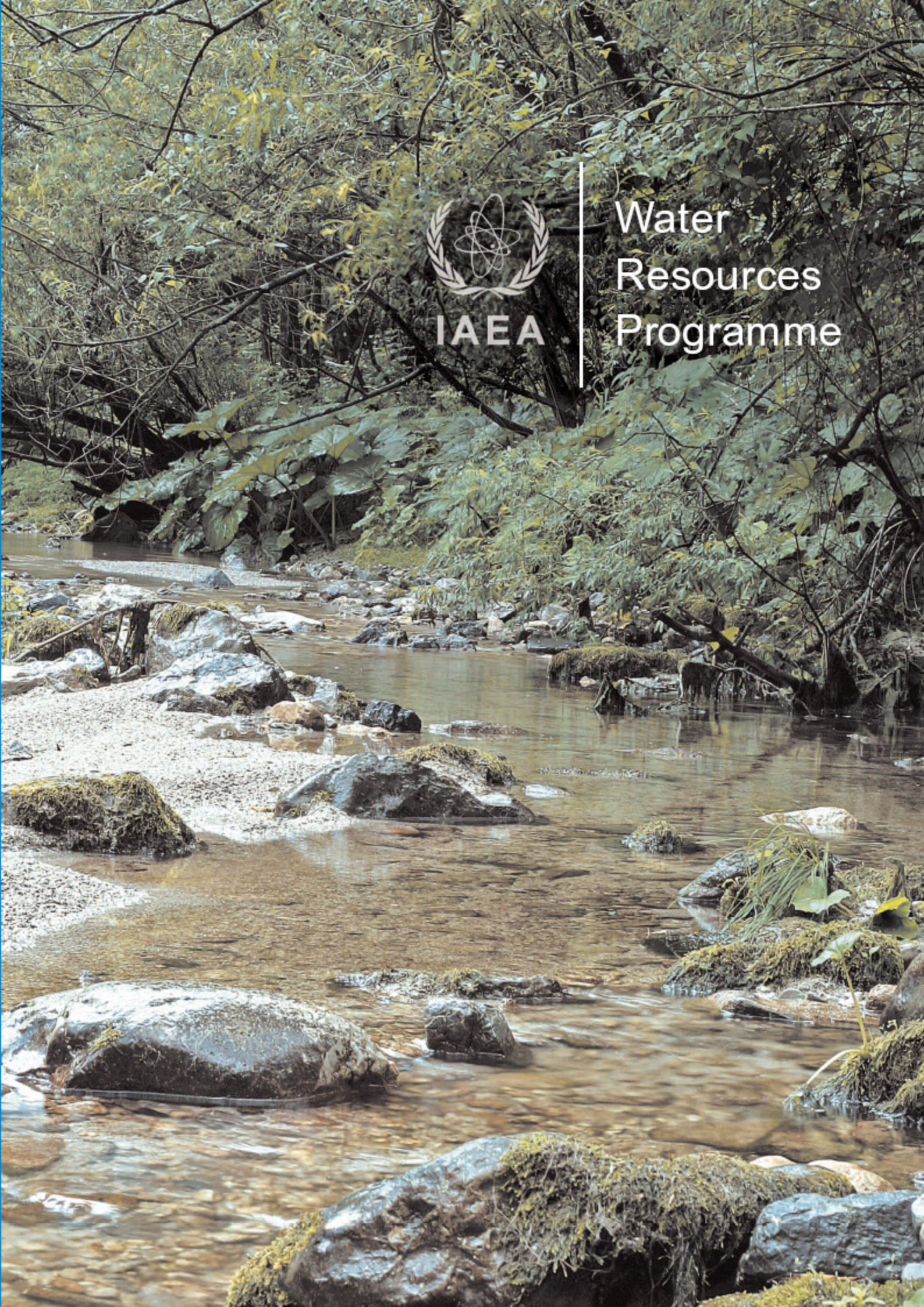




Water
Resources
Programme





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“The simple fact is that there is a limited amount of water on the planet, and we cannot afford to be negligent in its use. Science and technology have a crucial role to play in improving water resource management policies and practices.”

– Mohamed ElBaradei

Director General, International Atomic Energy Agency

THE IAEA WATER RESOURCES PROGRAMME: MEETING THE CHALLENGE

Aspirations for development in many parts of the world are intricately linked to water. Whether concerning issues of health, food and agriculture, sanitation, the environment, industry, or energy production, a paramount issue in the 21st century is water — its availability, quality and management.

The IAEA, through its Water Resources Programme, is one of the UN agencies responding to its Member States by providing science based information and technical skills to improve understanding and management of their water resources.

SOLUTIONS THROUGH SCIENCE

To address global water challenges, such as water shortage and quality, over-exploitation and impacts of climate change on water resources, Member States need precise information to enable them to make decisions about sustainable water resource management. The journey of water from the ocean through the atmosphere, biosphere, to the Earth and back, is commonly known as the hydrological or water cycle. A comprehensive understanding of this as well as that of hydrological systems such as river basins, lakes, and aquifers is essential to make resource development possible without having an adverse impact on the environment.



Each drop of water has an isotopic fingerprint.

ISOTOPE HYDROLOGY: TOOLS TO UNLOCK WATER'S SECRETS

Nuclear science has developed an array of methodologies and analytical techniques which use various isotopes of water to characterize water masses and trace their history and movement through the hydrological cycle.

The IAEA's Water Resources Programme has been a pioneer in developing isotope hydrology as a powerful and effective scientific approach.

UNDERSTANDING THE BASICS OF WATER

Atoms of an element with different mass are called isotopes. Water consists of isotopes of hydrogen and oxygen, which are distributed by natural processes throughout all segments of the hydrological cycle. The journey made by each drop of water causes it to undergo small but important and measurable changes in the relative abundance of the different isotopes. Therefore, water in different environments develops characteristic isotopic labels or 'fingerprints' that allow it to be distinctly identified from water in other environments. This makes it possible, for example, to trace the source of the water or to estimate how long a body of water has been in the hydrological system.



Coastal communities are more vulnerable in a changing climate.

By tracking the isotopes of water, scientists can quickly obtain valuable information which otherwise may require decades of hydrological data collection. Isotope techniques can help determine the origin, age and renewal rate of groundwater, and whether it is at risk of salt water intrusion or contamination. It also permits the rapid and reliable mapping of non-renewable

groundwater resources, the majority of which are transboundary aquifers, so that they can be abstracted rationally for equitable use.

Isotope techniques are important tools to understand surface water movement and interaction with groundwater, dam leakages, and the impact of climate change on water resources development and management.

“Isotope hydrology allows one to rapidly understand the origin and distribution of water resources – and therefore contribute to their sustainable management.”

– Pradeep Aggarwal, IAEA Water Resources Programme Manager

THE IAEA AND WATER RESOURCES MANAGEMENT



Managing water resources in arid areas poses unique challenges.

“You may ask why is the IAEA involved with water resources management.

Our mandate includes the promotion of practical applications for peaceful purposes, and the use of isotopes in water resources management forms part of it.”

– Werner Burkart, Deputy Director General and Head of the Department of Nuclear Sciences and Applications, International Atomic Energy Agency



Over 1 billion people lack access to safe drinking water.

WATER: KEY FOR HUMAN DEVELOPMENT

The United Nations proclaimed the period 2005–2015 as the International Decade for Action, ‘Water for Life’, to place a greater focus on water. It recommitments countries to achieve the water-related targets of the Johannesburg Plan of Implementation from the 2002 World Summit on Sustainable Development, as well as the United Nations Millennium Development Goals set in 2000.

Through the sustainable use of water, we can begin to meet basic needs, reduce vulnerabilities, and empower people to develop and to control the resources upon which they depend.

“We resolve to halve, by the year 2015, the proportion of the world’s people whose income is less than one dollar a day and the proportion of people who suffer from hunger and, by the same date, to halve the proportion of people who are unable to reach or to afford safe drinking water.”

FROM THE DECLARATION OF
THE MILLENNIUM DEVELOPMENT GOALS.

The nations of the world have promised to fulfil the Millennium Development Goals by 2015, and the IAEA, as part of the family of UN organizations, is committed to helping its Member States achieve them.

The IAEA is an active member of the UN interagency group — UN Water — that seeks to coordinate responses to achieve global water targets.

The Water Resources Programme actively contributes to the World Water Forums and the UN World Water Development Reports as well as to other international initiatives.

THE IAEA WATER RESOURCES PROGRAMME

– WORKING FOR MEMBER STATES

The IAEA works with Member States to adapt and apply isotope techniques to the needs of each country. From technical advice and analysis to capacity building and expert services, the Water Resources Programme is ready to support Member States in addressing their water resource management issues. While helping to test and adapt various techniques under a variety of hydrogeological conditions, the experts from the Water Resources Programme strive to develop the scientific approaches through applied research.

TECHNICAL COOPERATION PROJECTS: CAPACITY BUILDING FOR PROBLEM SOLVING

The IAEA has spearheaded efforts for the use and application of isotope techniques by national institutions in the Member States to address priority water issues through its Technical Cooperation projects. By supporting training, technical expertise and infrastructure development, the IAEA has been working to meet the needs and requests of Member States for capacity building to address their practical problems. For example, the IAEA provides training for young ‘water’ professionals and helps Member States set up laboratories to undertake isotope measurement.

There are currently over 80 water resource projects in the Africa, Asia, Europe and Latin America regions which address a variety of issues related to groundwater and surface water resources. For example, assessing mitigation options for arsenic pollution of drinking water in Bangladesh, determining the relationship of groundwater to water levels in Lake Victoria, delineating the recharge zone of springs to protect water quality in rural Uganda, locating leakages and seepages in dams and reservoirs, augmenting recharge in the arid regions of the Middle East, determining the movement of fluids in geothermal fields to ensure sustainable use in Central America, demarcating sources and pathways of surface water pollution in Mongolia, characterizing and monitoring trans-boundary aquifer systems such as the Nubian, north-western Sahara and Iullemeden aquifer systems in northern Africa and the Guarani aquifer in South America.



Nearly two-thirds of all freshwater consumed is used in agriculture. Isotope techniques can help develop effective water resource management strategies.



ADVANCING THE FIELD THROUGH RESEARCH

The IAEA's Coordinated Research Projects (CRPs) support international research efforts to develop new scientific approaches on relevant themes. Specific CRPs in the water resources sector are developed and supported by the Water Resources Programme, with select teams assembled for each project. Scientists are brought together from developed and developing nations to exchange knowledge and to enhance research capabilities while working on themes of common interest. Some recent examples include the use isotope techniques to assess submarine groundwater discharge, the characterization of pollutant behaviour in the unsaturated zone and the use of isotopes to aid understanding of the effects of long-term exploitation of groundwater.

The IAEA also grants research contracts to universities, research centres and other Member State institutions when innovative research is proposed that will advance the field of isotope hydrology.

The Water Resources Programme organizes technical meetings to bring together Member State institutions and other UN agencies to explore water issues of international concern that are beyond the scope of national research institutions. The IAEA also provides financial support for conferences held in developing countries. These meetings help to educate participants in state-of-the-art practices in the field and provide a forum for scientific discussion.



CREATING GLOBAL NETWORKS



The global distribution of isotopes in precipitation has been mapped since the early 1960s by the IAEA through the Global Network of Isotopes in Precipitation (GNIP) operated jointly with the World Meteorological Organization. The database serves the input requirements of thousands of researchers studying aspects of groundwater recharge, dynamics and sustainability. The other objectives of this network are to investigate past and present climate changes and the response of the hydrological cycle to climatic fluctuations, as well as calibration and validation of global atmospheric circulation models of varying degrees of complexity. For example, isotopes have recently been used to delineate the atmospheric moisture sources and transport patterns in southeast Asia.

The IAEA has built and strengthened this network through the geographical spread of the stations and enhanced integration with the climate change research community. Currently, 183 active stations in 53 countries are participating in the network. The entire GNIP database currently includes over 90000 records from 700 stations located in 101 countries.

The GNIP database is simple to use and information can be freely accessed on <http://www.iaea.org/water>.

The IAEA is also currently working to develop complementary networks, such as the Global Network of Isotopes in Rivers which is used to learn more about the dynamics of water in river basins, and the network for Moisture Isotopes in the Biosphere and Atmosphere which is concerned with gathering information on isotopes in plants, soils and the atmosphere and thereby enhances knowledge of water and carbon cycles.



Many new isotope hydrology laboratories are being established in Member States.

PROVIDING LABORATORY SERVICES

Research and application of isotope techniques are only possible with analytical facilities offering adequate precision and accuracy. The Water Resources Programme's laboratory offers analytical support and services for ensuring the quality of isotope measurements worldwide. The laboratory has played a significant role in developing, refining and communicating analytical techniques for isotope measurement and maintains an extensive analytical capability for isotope analysis used in water resource management. The laboratory infrastructure is continuously augmented to provide better services to the Member States.

An important role of the IAEA is in the preparation, certification and distribution of isotope reference materials used to calibrate measurements in other laboratories. The laboratory distributes IAEA standards for over 40 isotope ratio measurements worldwide. In some cases, the IAEA is the only source of such standards, for example, VSMOW (Vienna Standard Mean Ocean Water) for stable isotopes of oxygen and hydrogen in water. Conducting inter-laboratory comparisons on a regular basis provides participating laboratories with the opportunity to evaluate the accuracy of their own measurements.

WORKING TOGETHER FOR THE FUTURE

To meet the challenges of the world water agenda, countries need information with which to make decisions about integrated water resource management.

The IAEA's Water Resources Programme — providing Member States with science-based information and technical skills to improve understanding and management of their water resources.



Water Resources Programme

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