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Preparation Paper

International Atomic Energy Agency (IAEA)

"Ground Water Resource Exploitation through Isotope Techniques"

1. The International Atomic Energy Agency (IAEA)

The *International Atomic Energy Agency* (IAEA) is an international organization that seeks to promote the peaceful use of nuclear energy and to inhibit its use for military purposes. The Organisation was established in 1957 under its own international treaty (the IAEA Statute), but it is still working under the UN umbrella. The IAEA can decide to report to both the General Assembly and the Security Council on matters that concern international peace and security.

The IAEA´s mission is guided by the interests and needs of Member States, strategic plans and the vision embodied in the IAEA Statute. Three main pillars - or areas of work - underpin the IAEA´s mission: Although the IAEA is mainly known for its work in the first two areas - Safety and Security as well as Safeguards and Verification – the agency is very actively promoting their third pillar: Science and Technology. There he IAEA helps countries mobilize peaceful applications of nuclear science and technology. The work contributes to goals of sustainable development in fields of energy, environment, health, and agriculture, among others, and to cooperation in key areas of nuclear science and technology.

The IAEA's founding document is the IAEA's Statute which defines the structure and function of the organisation. The IAEA consists of three main bodies: the Board of Governors, the General Conference, and the Secretariat.

The Board of Governors

The Board of Governors consists of 35 Member States, as designated and elected by the General Conference. During its meetings, the Board examines and makes recommendations to the General Conference on the IAEA´s accounts, programme, and budget and considers applications for membership. It also approves safeguards agreements and the publication of the IAEA´s safety standards and has the responsibility for appointing the Director General of the IAEA with the approval of the General Conference.

Board members each receive one vote. Budget matters require a two-thirds majority. All other matters require only a simple majority. The simple majority also has the power to stipulate issues that will thereafter require a two-thirds majority. Two-thirds of all Board members must be present to call a vote (IAEA Board of Governors 1989).

The current 35-members of the IAEA Board are: Afghanistan, Albania, Algeria, Argentina, Australia, Brazil, Burkina Faso, Canada, China, Cuba, Ecuador, Egypt, Finland, France, Germany, Ghana, India, Iraq, Ireland, Japan, Lithuania, Malaysia, Mexico, New Zealand, Philippines, Romania, Russian Federation, Saudi Arabia, South Africa, Spain, Switzerland, Turkey, United Kingdom, United States of America and Uruguay.

The General Conference

The General Conference is the highest policymaking body of the IAEA. It is comprised of representatives of all 144 Member States of the Agency.

In the course of its annual meeting, typically in September, the agenda is to consider and approve the Agency´s programme and budget and to decide on other matters brought before it by the Board of Governors, the Director General, or Member States.

The General Conference mainly serves as a forum for debate on current policies and issues.

The Secretariat

The IAEA Secretariat is a team of 2200 multi-disciplinary professional and support staff from more than 90 countries. The Agency is led by Director General Mohamed ElBaradei and six Deputy Directors General who head the major departments. The Director General is responsible for enforcement of the actions passed by the Board of Governors and the GC and he oversees six departments that do the actual work in carrying out the policies of the IAEA: Nuclear Energy, Nuclear Safety and Security, Nuclear Sciences and Applications, Safeguards, Technical Cooperation, and Management.

2. Global water crisis

Seventy percent of the earth's surface is covered by water. Ninety-seven of this water is contained in oceans, hence salty and unsuitable for drinking or irrigation. Of the remaining 3 % of freshwater, only 0.3 % is found in rivers and lakes, the rest being frozen. The total usable freshwater supply for ecosystems and humans is less than 1 % of all freshwater resources.
The world's six billion people are appropriating 54 % of all the accessible freshwater contained in rivers, lakes and underground aquifers. About 70 % of the used freshwater is for irrigation, 22 % for industry and about 8 % for domestic use.

Water use has been growing at more than the rate twice of population increase in the last century. Water withdrawals are predicted to increase by 50 % by 2025 in developing countries, and 18 % in developed countries. Over 1.4 billion people currently live in river basins where the use of water exceeds minimum recharge levels, leading to the desiccation of rivers and depletion of groundwater. In 60 % of European cities with more than 100,000 people, groundwater is being used at a faster rate than it can be replenished. By 2025, 1.8 billion people will be living in countries or regions with absolute water scarcity.

The UN suggests that each person needs 20-50 liters of safe freshwater a day to ensure their basic needs for drinking, cooking and cleaning. More than one in six people worldwide - 894 million - don't have access to this amount of safe freshwater. Globally, diarrhoea is the leading cause of illness and death, and 88 per cent of diarrhoeal deaths are due to a lack of access to sanitation facilities, together with inadequate availability of water for hygiene and unsafe drinking water.

Another threat to water security is water pollution. Every day, 2 million tons of human waste are disposed of in water courses. In developing countries, 70 % of industrial wastes are dumped untreated into waters where they pollute the usable water supply. Projected increases in fertilizer use for food production and in wastewater effluents over the next three decades suggest there will be a 10-20 % global increase in river nitrogen flows to coastal ecosystems.

Water scarcity is also having a big impact on food production. The daily drinking water requirement per person is 2-4 liters, but it takes 2 000 to 5 000 liters of water to produce one person's daily food. It takes 1 000-3 000 liters of water to produce just one kilo of rice and 13 000 to 15 000 liters to produce one kilo of grain-fed beef.

Irrigation increases yields of most crops by 100 to 400 %, and irrigated agriculture currently contributes to 40 % of the world's food production. The extent of land under irrigation in the world is 277 million hectares, about 20 % of all cropland. Rain fed agriculture is practiced on the remaining 80 % of the arable land. Steadily increasing demand for agricultural products to satisfy the needs of a growing population, and the desire for a more varied diet, is recognized to be the main driver behind water use.
The Intergovernmental Panel on Climate Change predicts yields from rain-dependent agriculture could be down by 50 % by 2020. Due to climate change, for example Himalayan snow and ice, which provide vast amounts of water for agriculture in Asia, are expected to decline by 20 % by 2030.

Due to all these facts water should be recognized as a great priority. To tackle the mentioned problems and to reach the *Millennium Development Goal* of halving the proportion of people without sustainable access to safe drinking water and sanitation by 2015, Decision-makers at all levels must be implicated and several measures, as guaranteeing the right to water, decentralizing the responsibility for water, developing know-how at the local level, increasing and improving financing and evaluating and monitoring water resources should be taken. Whatever the use of freshwater (agriculture, industry, domestic use), huge saving of water and improving of water management is possible.

Water is linked to the crises of climate change, energy and food supplies and prices, and troubled financial markets. Unless their links with water are addressed and water crises around the world are resolved, these other crises may intensify and local water crises may worsen, converging into a global water crisis and leading to political insecurity and conflict at various levels.

3. Role of the IAEA - Water Resources Programme

In order to Provide Member States with science-based information and technical skills to better understand and manage their water resources the IAEA established the Water Resources Programme.

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.

The Programme can be divided in several areas:

- **Sustainable Water Use and Services (Exchange of information, training and cooperation with** international organizations in isotope hydrology, Support to Member States for the management of national and transboundary groundwater resources)
- **Isotope Methods for the Improved Understanding of the Water Cycle** (Isotope Methods for the Assessment of Groundwater Sustainability, Development of isotope methodologies for water quality assessment and Management, Isotope Methods for the Study of Water and Carbon Cycle Dynamics in the Atmosphere and Biosphere)
- **Analytical Services for Isotope Hydrology** (Development of Member State capacity for isotope analysis of hydrological samples, Development of helium isotope applications for water resources management)

4. The IAEA and the Management of transboundary Aquifers

Management of national and transboundary aquifers is an increasingly important aspect of sustainable water resource management strategies in Member States and an important resource for helping to meet the Millennium Development Goals. Isotope techniques are critical for mapping renewable and non-renewable groundwater resources and for facilitating the management of transboundary aquifers, as well as for characterizing the interaction between national and transboundary rivers and aquifers. The Agency's work in facilitating the use of isotopes, and the role of isotopes in building a sound scientific understanding of aquifer hydrogeology are well known and have led to it being an important partner in the WB/GEF project to increase the awareness of groundwater in the policy and political debates in developing countries.

At the same time, there is a continued need to integrate isotopes into a broader set of member state capability for managing groundwater resources. This requires substantial assistance to Member States for the overall scientific and policy development approaches involving isotope data and methods. Potential impacts of climate change on water availability and use are another concern where isotopes, if used appropriately, can add significant value to strategies for mitigation and adaptation. Member States require assistance in increasing the awareness of the use of isotopes and in integrating their scientific capacity in isotope hydrology within their water sector. Projects with a wide scope, larger than a strict isotope hydrology focus, formulated and funding with external funding to supplement the Agency's and Member States' resources are an appropriate vehicle for assisting Member States' use and benefit from the advantages of isotope hydrology.

5. The Nubian Sandstone Aquifer

The Aquifer

The Nubian Sandstone Aquifer System (NSAS) is the world's largest fossil water aquifer system. It is located underground in the Eastern end of the Sahara Desert and spans the political boundaries of four countries in north-eastern Africa.

NSAS covers a land area spanning just over two million km2, including north-western Sudan, north-eastern Chad, south-eastern Libya, and most of Egypt. Containing an estimated 150,000 km3 of groundwater, the significance of the NSAS as a potential water resource for future development programs in these countries cannot be overstated.

Groundwater has been identified as the biggest future source of water to meet growing demands and development goals in each country. But it is not sure whether the NSAS can meet such demand because Over-abstraction has already started, at times leading to desertification. Other major human pressures include agricultural irrigation and climate change. Recently the Great Man-made River Project (GMMR) in

Libya began extracting substantial amounts of water from this aquifer, removing an estimated 2.37 km3 per year.

The Project

For many years, the IAEA has been working with NSAS countries through national and regional projects to try and understand the complexities of the aquifer. However, there remains a gap in understanding how the NSAS works.

Its long-term goal is to establish a rational and equitable management of the NSAS for sustainable socio-economic development and the protection of biodiversity and land resources.

Project partners include UNDP/GEF, IAEA, UNESCO and the four NSAS countries.

IAEA

The International Atomic Energy Agency serves as 'Executing Agency' for the project. This entails responsibility for overall project management including the recruitment of a project manager, assuring that the project delivers the expected results and working directly with the four countries. It will also lead the technical components of the project given its expertise in the groundwater sector and utilization of cutting-edge isotope techniques.

The IAEA has already been involved in numerous technical assistance projects for the NSAS countries, both at the national and regional levels, as well as in groundwater and water management projects in other parts of the world. It is therefore ideally placed to take on the management of this project and to ensure that the efforts of all of the partners are targeted, synergized and optimized.

UNESCO

As a 'Cooperating Organization', UNESCO will guide the implementation of the legal component of the project. UNESCO is an UN organization with extensive experience with international basin agreements and in codifying international groundwater law. Via the 'International Shared Aquifer Resource Management' (ISARM) initiative, UNESCO is currently providing technical and legal advice to the UN International Legal Commission (ILC) responsible for the formulation of a Convention on International Groundwater.

Countries

The four NSAS countries are the main beneficiaries of the Nubian Project. They are responsible for implementing activities at the national level and agreed to actively contribute to the project and provide institutional and financial support. In many respects, the Nubian Project is a test case as to what extent the four NSAS countries can further their cooperation and joint activities.

Each country will identify their National Focal Institutions and National Project Coordinators, establish and coordinate national inter-ministerial committees and coordinate the necessary national expert teams.

6. A Future Project for the IAEA

The NSAS is not the only region in the world where groundwater and aquifer dynamics remain a mystery. There are many more aquifers, within and beyond Africa, where more exploration and understanding are needed. Globally, the fields of groundwater science, management and law are still in their infancy, far less developed than their big brothers in the water world including river basins and the earth's seas.

That's a rather scary prospect given that some aquifer reserves in arid areas such as the NSAS are basically non-renewable with limited life times. The water is being used up without really knowing what's happening. This also means that plans need to be developed for that time in the future when the water finally does run dry.

We will be simulating a **Meeting of the Board of Governors debating on the issue of managing transboundary aquifers, especially focusing on the possibility of establishing a new project in North Africa.**

Mandatory Readings

http://www-naweb.iaea.org/napc/ih/IHS_programme3_wr.html
http://www-naweb.iaea.org/napc/ih/Nubian/IHS_nubian.html
http://www.unwater.org/downloads/05_Institutional_Capacity_Development_in_Transboundary_Water_Management.pdf
http://www.unwater.org/downloads/chp4_en.pdf
http://www.unwater.org/downloads/UNW_TRANSBOUNDARY.pdf
http://www.unwater.org/downloads/wwdr2_ch_11.pdf

Useful Links

IAEA Water Resources Programme
http://www-naweb.iaea.org/napc/ih/index.html
http://www.iaea.org/NewsCenter/Multimedia/Videos/Isotopehydrology/index.html
UN-Water
http://www.unwater.org/flashindex.html
World Water Council & World Water Forum
http://www.worldwatercouncil.org/
http://www.worldwaterforum5.org/
Groundwater in International law – Groundwater agreements:
http://www.fao.org/docrep/008/y5739e/y5739e05.htm
International Hydrological Programme (IHP)
http://typo38.unesco.org/index.php?id=240
http://www.unesco.org/water/ihp/description/index.shtml
International Association of Hydrogeologists
http://www.iah.org/
United Nations Development Programme
http://www.undp.org/water/index.html
International Waters Learning Exchange and Resource Network
http://iullemeden.iwlearn.org/
The World Bank - Water
http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTWAT/0,,menuPK:4602384~pagePK:149018~piPK:149093~theSitePK:4602123,00.html
ISARM - Internationally Shared Aquifer Resources Management
http://www.isarm.net/
http://www.isarm.net/dynamics/modules/SFIL0100/view.php?fil_Id=228
Economic Community Of West African States (ECOWAS)
http://www.ecowas.int/
The Great Man Made River
http://www.gmmra.org/en/