

Drinking Water Quality Assessment in the Middle East Region (Israel, Palestine and Jordan), an Overview and Perspective

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Background

Among the many problems that plague the region, the western states of the Middle East, Israel, Palestine and Jordan suffer most from water scarcity. The three states depend on three major trans-boundary surface and groundwater reservoirs, which historically supplied 75% or more of water but nowadays are critically low because of over use, lack of rainfall and climate change which magnify the water stress in this arid region. Consequently, the shared water resources are under heavy natural and man-made pressures, in terms of quantity and quality, affecting every aspect of life from ecosystems and the environment, to food security and health.

Parts of the groundwater resources contain unhealthy levels of biological contaminants and nitrates and chlorides compounds, beyond the permissible limits, while many communities are exposed to water borne diseases because of lack of safe drinking water and basic sanitation. Also, inadequate treatment of point and nonpoint sources of pollution and trans-boundary movement of pollutants from one entity to another endanger the shared water bodies and pose a threat to the drinking water and the environment. Future population growth, urbanization and improved standard of living, together with the global warming are likely to result with more extreme stresses on watersheds coupled with intense precipitation events, altered river flows and changes in the growing season which will worsen the ongoing conflicts in the region in general and the Palestinian-Israeli conflict in particular.

Experts Working Group on the Assessment of Drinking Water Quality

The water crisis presents a clear opportunity and challenge for this troubled region, provided that the involved parties adopt a regional water strategy that will trigger the emergence of suitable forms of regional partnership able to address the acute crises of lack of water. The challenges and the potential for turning water into a pillar of regional cooperation were reviewed by an international group of 17 experts from Jordan, Palestine, Israel, Egypt, Kuwait and other U.S. and European members of IUPAC, the Chemistry and the Environment Division, CHEMRAWN and Malta Conferences Foundation (MCF).

The working group which was conceived in 2007 held the kick-off meeting during Malta IV Conference in Amman, Jordan, Nov. 2009, followed by several workshops and focus groups discussions. The findings were presented in Malta V Conference in Paris, Nov., 2011 and reviewed in MALTA VI conference, in November 10-15, 2013, in the Island of Malta. Scientists from 15 Middle East countries (Bahrain, Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Palestinian Authority, Qatar, Saudi Arabia, Syria, Turkey, and United Arab Emirates), Nobel Laureates, and other eminent scientists were present (Sarah Everts in *C&EN*, Vol. 91, Issue 46, Nov. 18, 2013, p. 7). Several consecutive workshops were held including Chemistry and Bio-Medicinal Chemistry; Analytical, Nanotechnology and Material Science; Energy, Air and Water Quality; Chemistry Safety and Security and Science Education at All Levels.

The Energy, Air, and Water Quality Workshop

The workshop which was organized by Chuck Kolb (U.S.), Yehuda Shevah (Israel), Tareq Abu Hamed (Israel), Alfred Abed Rabbo (Palestinian Authority) included the following sessions:

- *Session 1 – Solar Energy*
- *Session 2 – Water Resources and water Quality*
- *Session 3– Air & Environment*
- *Session 4 – Workshop Summary and Future Actions Report*

Water Resources and water Quality Workshop - Issues of Discussions and Recommendations

The shared water resources can supply on average no more than 150 m³ per year per capita, which is only 30% of the Scarcity Red Line of 500 m³ per capita/year. Even if one of the three states gets all the rights on the shared natural resources, it would not be sufficient in the long term. Under business as usual, the regional population is forecasted to reach 30 million, in 2040, an increase of 12 million from the present 18 million in 2010 and the overall water demand will increase from about 3 billion m³/year in 2010 to 6 billion m³/year. The increment of 100% between supply and demand will create significant pressure on economic and social development, as of the anticipated demand for water, only 40% could be met from natural resources, the rest could only derive from non-conventional sources, namely: water reuse (30%) and sea water desalination (30%). In total about 100 million m³ have to be produced annually for the next 30 years in order to satisfy the growing water demand.

For such a scenario to be realized, a concerted action plan is recommended as follows:

Regional Water Strategy and Cooperation

Genuine regional cooperation leading to the implementation of a cross border regional management is suggested for a sustainable use of the regional water and the development and the harnessing of new water resources. It is also essential to address the existing asymmetries in the shared water resources and the related health and environmental impact, irrespective of political and economic differences. Such regional collaboration may promote a joint action on the alleviation of the looming regional water crisis. Convinced of the added value of a regional water strategy and aware that a multilevel governance can achieve the goals that have been set, the three member states shall jointly make the necessary political effort to adopt a regional water strategy, promoted by stakeholders at national and regional levels and supported by international agencies having interest in the region. The key goal is to build bridges among the governments, which provide appropriate policies and regulations; the private sector that provides innovation and technology and the civil societies that provide inputs from user stakeholders, to the mutual benefit and peaceful coexistence among people in the three states.

Integrated Water Resources Management (IWRM) and Decision Support Systems (DSS)

Based on technical and economic realities and not on water rights and administrative division, access to a sufficient, safe, and regular supply of drinking water for the whole population from fresh and artificially produced sources, isolated from other regional issues, shall be secured, based on IWRM and DSS tools. IWRM and DSS which consider upstream and downstream interactions provide a viable solution for the development and delivery of the substantial quantity of water, needed over the next 30 years. Combining engineering, social, environment and economic components, IWRM provides a sustainable solution for exploitation and use of water by all sectors of the economy, including irrigation. Considering the dominance of agriculture in the regional economy and the multiple functions it performs for food production, social and environmental benefits, the water needs of agriculture have to be met, although, water productivity in irrigation systems has to greatly improved incorporating recycled water and eventually adjust to more costly water - desalinated water supply.

IWRM recognizes the right of individuals, civil societies and the local authorities and other interested parties to participate at the different levels in decision-making processes and the involvement of the

private sector in development and implementation. It also, respect the rightful allocation of waters, considering agreed quantities and quality and safe exploitation of the shared water resources, using consistent and uniform techniques of measurement. Based on MIS and reliable data base, IWRM accommodates a monitoring system able to monitor progress, recording and reporting data, including health, environmental and social impacts, sources of pollutants and trans-boundary movement of pollutants and atmospheric deposition.

Initiate and Promote the Development of New Water Resources and Conservation

Innovative and advanced technologies shall be adopted as related to conservation, desalination, water reuse, restoration of depleted and degraded resource and aquatic ecosystems, strategic groundwater storage, rainwater harvesting and cloud seeding. Installation of wastewater treatment and reuse systems and brackish and sea water desalination plants shall be accelerated, taking advantage of the unprecedented technical and economic advances that have already occurred and the accumulated and proven experience within the region and beyond. The associated and the emerging environmental impacts of large-scale seawater desalination installations and use of recycled waters have to be fully elucidated.

Regional Water Research and Development (R&D) and Experts Support

To set up a regional R&D program for scientific and technological based development of water resources and to encourage scientific cooperation and partnership, at a national, regional and international level. The close regional cooperation that was established shall form a base for further regional collaborations, providing a framework for dissemination of information and research supported by the international scientific community. Consultative forums shall be established to review alternative engineering solutions, as well as facilitating cross-border mobility for professionals, tackling the problems and specific needs of each sub- basin, based on a participatory approach and detached from other regional disputes and conflicts.

Dissemination

The findings in a form of a consensus Declaration is being endorsed for dissemination to the state governments, regional agencies, communities and to other relevant local and international agencies and organizations. The complete document on the regional water quality assessment project may be found in a publication: Shevah Y. (2013) Adaptation to Water Scarcity and Regional Cooperation in the Middle East. In: Ahuja S. (ed.) Comprehensive Water Quality and Purification, vol. 1, pp. 40-70. USA: Elsevier. Additional information may be obtained from Dr. Yehuda Shevah <ysheva@gmail.com> and www.iupac.org/web/ins/2008-003-3-600

Concluding Remarks

It is a simple fact that the Middle Eastern countries are experiencing a severe water scarcity in which available water resources cannot match the existing and the rising demands, while depleting resources and anthropogenic pollution renders parts of the resources unusable for human consumption. The water crisis that has significantly provoked conflicts among the three states presents a clear opportunity and challenge to solve the problem provided that the parties adopt a regional water strategy that will trigger the emergence of a regional partnership that addresses the acute crises of adequate, safe and reliable drinking water supply for all, building a bridge over trans-boundary waters with an added benefit to coexistence and peace in the region. The study proved that despite the destabilized political and economic climate in the Middle East, it is possible for scientists from opposing sides to meet in an attempt to bridge the deep distrust and intolerance.

Finally, the study covered **the "what" is needed to be done regarding** trans-boundary management of water resources, considered long-term development trends and proposed the mechanisms that can be used to increase effective regional cooperation on trans-boundary water resources. **It remains to expand the work on "how" it can be done.** Successful strategies that will emerge would pave the way for intense

cooperation on water technology and other related issues such as climate change, food and energy, setting an example for other nations of the Middle East and elsewhere facing growing water scarcity.

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Photos



Groundwater basins and groundwater flow under the study area.



Island of Malta



Attendees in Session



Attendees at a reception at the U.S. Ambassador's residence in Malta. Sarah Everts/C&EN



Participants at the Malta IV Conference in Amman, Jordan, 14–19 November 2009.