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MODULE SIX

WATER SUPPLY, SANITATION AND HEALTH WITHIN IWRM CONSIDERATION

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MODULE 6 **WATER SUPPLY, SANITATION AND HEALTH WITHIN THE IWRM FRAMEWORK**	
RATIONAL	Links between the development and management of water resources and human health are multiple and range from direct to highly complex. IWRM provides an optimal context to address the health issues related to water resources development in a holistic manner. The integration and multi-disciplinarity aspects of IWRM provides an adequate methodology for estimating and attributing the burden of specific diseases to water resources development in specific locations and in turn provide a powerful tool to design water management interventions for priority health issues. Health Impact Assessment is a key decision making tool in the planning of IWRM. Mitigating measures and health safeguards of a water management nature will form the basis for a sustainable public health approach that will prevent the transfer of "hidden costs" to the health sector and will allow the health services to adapt to new needs that will arise with the development of water resources. The economics of IWRM, health status and health services are intricately linked.
OBJECTIVES	1. Appreciate fully the links between water and human health, and need for research on water management interventions for health and discuss where IWRM fits. 2. Highlight the importance of including Health Impact Assessment (HIA) in integrated water resources management. 3. Introduce and illustrate the need for capacity building in HIA in integrated water resources management. 4. Discuss WHO's role in water supply, sanitation and health issues and introduce their major guidelines. 5. Discuss municipal water supply, pollution and water quality issues in ESCWA countries. 6. Introduce HIA principals through different exercises in the context of IWRM.
MAIN REFERENCES AND BACKGROUND MATERIAL	- Barnes R. and Scott-Samuel A. (2003) *Health Impact Assessment – Ten Minutes Guide*. Available at: http://ihia.org.uk/hiaguide.html *accessed* August 6, 2003 - ESCWA (2001) *Current Water Polices and Practices in Selected ESCWA Members Countries*, United Nations - WHO (2003) *Water and Sanitation*. Available at: http:// www.who.int/water sanitation health *accessed* August 6, 2003
SUGGESTED INTERNET LINKS	http://www.liv.ac.uk/PublicHealth/obs/OBS.HTM http://ihia.org.uk/hiaguide.html http://www.liv.ac.uk/PublicHealth/obs/OBS.HTM http:// www.who.int/water sanitation health www.who.int/entity/hia/about/en/HIA_sweden.pdf
DELIVERY OPTIONS	
DIRECTLY RELATED MODULES	7, 8, 9

SESSION TOPIC SYNTHESIS	
QUESTIONS FOR DISCUSSION	1. What role do NGOs and other members of civil society play in ensuring HIA principles are maintained? 2. What are the implications of lax environmental and health standards in water supply on well-being and productivity of low income groups? 3. How and why are women most affected by that? 4. How is it possible to measure these negative impacts and any improvements that may result from effective incorporation of environmental and health standards in water resources development plans? 5. What is the capacity needs to ensure effective incorporation of HIA in water resources development planning? 6. What can be done to enhance training in environmental management for health protection and ensure they acquire the necessary technical, institutional and organizational capacity to ensure that the environmental and health standards are observed? 7. What is the role of WHO in water supply, sanitation and health issues? 8. What is the situation in the ESCWA countries regarding the municipal water supply, pollution and water quality issues? 9. How can the principals of HIA be implemented in the context of IWRM?

Where IWRM Fits - The Health Impact Assessment

Integrated Water Resources Management facilitates the incorporation of cross-cutting issues such as health. In particular:

- It provides a context for an effective Health Impact Assessment (HIA) of different options for water resources development and of different management options once a water resources project becomes operational.
- It allows the introduction of water management practices and procedures that will support health safeguards or will mitigate potential risks of water-associated health problems.
- It promotes the application of water quality norms and standards within the natural boundaries of river basins, rather than administrative boundaries delineated by local government structures, which often are not congruent with those of river basins.
- Using Burden of Disease estimates expressed in Disability-Adjusted Life Years (DALYs), it permits the mainstreaming of health economics into the broad economic evaluation framework of IWRM.
- It is conducive to the analysis of water development and management policies and decision-making criteria, and the introduction of health issues into the policy frameworks of public sectors dealing with water resources management and water use.

To achieve the above development and implementation of heath and sanitation perspectives, new capacity building efforts are required. The promotion of HIA in water resources development not only needs an enabling policy environment, but also the capacity of all actors to understand the basic principles of water-health linkages and the skills needed to engage in intersectoral negotiation and decision-making.

Drinking water quality, sanitation and hygiene development

Contaminated drinking water contributes to water related disease in developing and developed countries worldwide. The levels and coverage of municipal water and sanitation services in some ESCWA countries are expected to improve in the coming decade. Meanwhile the picture is bleak. The deterioration of water quality has become a critical issue throughout the entire ESCWA region. The continuous degradation of water quality has persisted not only because of the rapid increase of population, urbanization and economic activity in all sectors, but also because of the poor maintenance and mismanagement of water resources. Since polluted water usually has little consumable use, water quality degradation itself has aggravated water scarcity in many parts of the region.

Water-related diseases

Water, sanitation and hygiene have important impacts on health. Water-related diseases include those due to micro-organisms and chemicals in water people drink; diseases like schistosomiasis which have part of their lifecycle in water; diseases like malaria with water-related vectors; drowning and some injuries; and others such as legionellosis carried by aerosols containing certain micro-organisms. Water also contributes to good health, for example through hygiene or access to safe drinking water

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International norms ("guidelines") on water, sanitation and hygiene

One of the core functions of WHO is to "propose... regulations and to make recommendations with respect to international health matters". In relation to water, sanitation and hygiene, this is achieved through development of normative "Guidelines". The following guidelines are available on the WHO website.

- Guidelines for Drinking-Water Quality
- Guidelines for the Safe Use of Wastewater
- Guidelines for the Safe Management of Health Care Wastes
- Guidelines for Safe Recreational Water Environments
    1. Volume 1: Coastal and freshwater
    2. Volume 2: Swimming pools and spas and similar recreational water environments

What is Health Impact Assessment?

HIA can be defined as the estimation of the effects of a specified action on the health of a defined population. Its purpose is:

- To assess the potential health impacts - positive and negative - of policies, programmes and water resources projects;
- To improve the quality of public policy decision making through recommendations to enhance predicted positive health impacts and minimize negative ones.

How to implement HIA within IWRM framework?

There is no one definitive methodology for HIA although several toolkits are currently being developed. A number of HIA guidelines, including notably the Merseyside Guidelines cited in Scott-Samuel et al (1998) provide perhaps the most widely used model and have proved to be practical and sufficiently flexible to be adapted to a range of circumstances. It is necessary to apply HIA to different options for water resources development and different management options to manage water resources as an integrated resource based on IWRM framework. The checklists and exercises of this module can help in the implementation of HIA within IWRM.

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MODULE 6
WATER SUPPLY, SANITATION AND HEALTH WITHIN THE IWRM FRAMEWORK

A. BACKGROUND

Drinking water supply and sanitation have been well enshrined in the WHO Constitution for over 50 years. In the last five years, however, the scope and focus of the WHO Water, Sanitation and Health Program have crystallized around expanded issues and within new boundaries, following a period of a less clearly defined outreach and rather nebulous goals. During the International Drinking Water Supply and Sanitation Decade (the 1980s) there was a firm focus on extending drinking water supply and sanitation coverage, with health as one of the implicit, underlying rationales. WHO has recently re-defined its role along the lines of the organizations comparative advantages, to include the following aspects:

- A focus on the water-health linkages in terms of the nature of this linkage, options for interventions and socio-economic dimensions
- A comprehensive concept of water and health issues, looking at all health aspects of water resources development and management, and of the various water uses, including drinking water supply and sanitation, irrigation and drainage, energy generation, waste water use and aquaculture
- A shift from the technical to the economic aspects of water supply and sanitation as key health interventions, in particular their cost-effectiveness compared to alternative interventions
- Establishment of greater coherence between the normative, operational, technical cooperation and capacity building functions of the Organization in the field of water and health

B. WHERE IWRM FITS - THE HEALTH IMPACT ASSESSMENT

Integrated Water Resources Management facilitates the incorporation of crosscutting issues such as health. In particular:

- It provides a context for an effective Health Impact Assessment (HIA) of different options for water resources development and of different management options once a water resources project becomes operational.
- It allows the introduction of water management practices and procedures that will support health safeguards or will mitigate potential risks of water-associated health problems.
- It promotes the application of water quality norms and standards within the natural boundaries of river basins, rather than administrative boundaries delineated by local government structures, which often are not congruent with those of river basins.
- Using Burden of Disease estimates expressed in Disability-Adjusted Life Years (DALYs), permits the mainstreaming of health economics into the broad economic evaluation framework of IWRM.
- It is conducive to the analysis of water development and management policies and decision-making criteria, and the introduction of health issues into the policy frameworks of public institutions dealing with water resources management and water use.

C. CAPACITY BUILDING

To achieve the above development and implementation of heath and sanitation perspectives, new capacity building efforts are required. The promotion of IHA of water resources development not only needs an enabling policy environment, but also the capacity of all actors to understand the basic principles of water-health linkages and the skills needed to engage in intersectoral negotiation and decision-making. Hydraulic engineers and other water management specialists must understand the nature of water-health linkages to be able to consider options in IWRM that pose minimal health risks or even promote health. The capacity to monitor water and health indicators in a compatible and integrated way will provide the evidence base for joint, informed decision-making. And, finally, both health and IWRM professionals need to be made familiar

with each other's economic evaluation methods to ensure maximum efficiency in deploying health safeguards and seizing health opportunities in IWRM.

D. WHO ROLE IN WATER SUPPLY, SANITATION AND HEALTH

WHO works on aspects of water, sanitation and hygiene where the health burden is high, where interventions could make a major difference and where the present state of knowledge is poor (WHO, 2003).

D.1. Drinking water quality, sanitation and hygiene development

Contaminated drinking water contributes to disease in developing and developed countries worldwide. WHO prepared guidelines for drinking water quality, which are the international reference point for standard setting and drinking-water safety. The guidelines are supported by other publications explaining how they were derived and to assist in implementing safe water activities.

Around 1.1 billion people globally do not have access to improved water supply sources whereas 2.4 billion people do not have access to any type of improved sanitation facility. About 2 million people die every year due to diarrhoeal diseases; most of them are children less than 5 years of age. The most affected are the populations in developing countries, living in extreme conditions of poverty, normally peri-urban dwellers or rural inhabitants. Among the main problems which are responsible for this situation are: lack of priority given to the sector, lack of financial resources, lack of sustainability of water supply and sanitation services, poor hygiene behaviors, and inadequate sanitation in public places including hospitals, health centers and schools. Providing access to sufficient quantities of safe water, the provision of facilities for a sanitary disposal of excreta, and introducing sound hygiene behaviors are of capital importance to reduce the burden of disease caused by these risk factors.

D.2. Municipal water supply and water quality in ESCWA countries

The percentage of population with access to safe drinking water during 1990-2000 has generally improved in most ESCWA countries, but it varies from one country to another, as shown in Table 1 below. Most ESCWA countries have high level of population with access to water supply and sanitation, with GCC countries having best records. Nonetheless, the level of population serviced with connections to water is not always indicative of the quality or reliability of the service. This is particularly the case in lower income neighborhoods and informal settlements in major cities such as Beirut, Tripoli, Cairo, Amman and Sana'a, where water cut-offs are endemic to these areas, and has led many inhabitants to buy from private water vendors, often at higher rates than those charged by the utilities. Often municipalities undertake some upgrading and maintenance of the utilities within their own jurisdiction, however, as long as their role has not yet been well defined within a clear decentralization strategy, giving them more planning, fiscal and decision-making power, they will not be able to cope with growing citizens' demand for improvements in the service

In the case of Iraq, West Bank and Gaza Strip (WBGS), the situation has dramatically deteriorated to a crisis level over the past decade due to long years of sanctions and two major wars in Iraq and years of Israeli closure of bordures and control of water resources in WBGS. The hardship of Palestinians translates into excessive situation of water poverty. Unequal access to safe drinking water between settlers and Palestinians, with differences in per capita consumption of 139 m^3 per year of Palestinians in Gaza city as opposed to 1,143 m^3 for settlers, exacerbates the prevailing tension. While in Iraq water crisis after the war, has lead to outbreaks of epidemics such as typhoid and cholera related to the contamination of water supplies and disruption in the supply network. Water supply and sewage networks are further disrupted by cuts in electricity, which is crucial for pumping water, and treating wastewater. The challenge in these cases is mobilizing substantial resources from donors to cover large-scale capital investments for the rehabilitation and modernization of water supply and sanitation systems in the wider context of reconstruction strategies.

The major problem in providing adequate water supplies to the domestic sector is wastage, exacerbated by low water charges and extensive leakage in the distribution systems. Per capita water demand ranges from less than 50 liters per person in Yemen to 590 liters in Kuwait. Per capita consumption (liters per day) are in the brackets for each country: Bahrain (275), Egypt (206), Iraq (345), Jordan (140), Lebanon (219), Qatar (495), Saudi Arabia (440) and the Syrian Arab Republic (118). Leakage from the water distribution system ranges from 40 to 60 per cent, as reported for Egypt, Jordan, Qatar and Saudi Arabia. Leakage from the water distribution and sewage networks has contributed to a rise in the water table in major cities in Kuwait, Qatar and Saudi Arabia, creating major environmental problems.

Over the past 10 years, the quality of drinking water and the extent of sanitation services have improved in all of the ESCWA member countries except Iraq, Lebanon and Yemen. Progress has been made in meeting targets for most urban areas; however, rural communities in the ESCWA region are still inadequately serviced in terms of easy access to safe drinking water and sanitation facilities. Sanctions against Iraq have had a serious adverse effect on water supply and sanitation facilities. The same problems were faced as a result of the past conflict in Yemen. The availability of safe drinking water and sanitation is a major problem in the Gaza Strip. Complicating the situation is the expected increase in the urban population, which will exert even greater pressure on water supply and sanitation facilities.

TABLE 1. PERCENTAGE OF URBANIZATION AND ACCESS TO SAFE DRINKING WATER AND SANITATION IN THE ESCWA REGION

Country	**Percentage of urban population**				**Access to services, 1995 (percentage of population)**			
					Safe drinking water		**Sanitation services**	
	1990	**1995**	**2010**	**2025**	**Urban**	**Rural**	**Urban**	**Rural**
Bahrain	87.6	93.5	94.4	95.5				
Egypt	43.6	43	44	51.4	99	96	100	96
Iraq	69.6	67.5	67.7	72.1	96	48	93	31
Jordan	72.2	79.3	80.1	83.3	100	84	100	98
Kuwait	94.9	96.4	96.7	97.3				
Lebanon	84.2	91.2	92.1	93.5	100	100	100	87
Oman	64	68.3	70	75.2	41	30	98	61
Palestine	62.1	78.6	80.8	85	97	86	100	100
Qatar	89.8	93.7	94.5	95.7				
Saudi Arabia	78.2	88.5	90	92.1	100	64	100	100
Syrian Arab Republic	48.9	53.3	55.4	63.2	94	64	98	81
United Arab Emirates	80.2	88.9	90.5	92.8				
Yemen	22.8	26.3	28.5	37.7	85-74[d]-55[e]	64-68 [d] -30 [e]	87-89[d] –45[e]	31-21[d] -10 [e]

Source: Compiled from ESCWA 2003

A persistent and detrimental over-withdrawal of groundwater has been occurring for many years in several ESCWA member countries. The deterioration of water quality has become a critical issue throughout the entire ESCWA region. The continuous degradation of water quality has persisted not only because of the rapid increase of population, urbanization and economic activity in all sectors, but also because of the poor maintenance and mismanagement of water resources. Since polluted water usually has little consumable use, water quality degradation itself has aggravated water scarcity in many parts of the region.

The principal sources of surface and groundwater pollution are:

(a) Leakage and leaching of untreated municipal waste-water;
(b) Untreated industrial effluents discharged into municipal sewer systems or directly into water bodies;
(c) Seepage and run-off of agrochemicals, such as fertilizers and pesticides;
(d) Seepage from unsanitary landfills;
(e) Sea water intrusion into coastal aquifers;
(f) Water-logging in some irrigated areas.

Among the negative externalities of declining water quality that many of the ESCWA member countries have witnessed are (ESCWA 2001):

(a) Increased health hazards and the incidence of epidemic diseases. The problem of cross-connection between water and sewer pipes has been cited as causing the outbreak of cholera, hepatitis and other waterborne diseases in some cities of the region;
(b) The negative effects on the productivity of human resources and the quality of life due to environmental degradation;
(c) Declined agricultural output and productivity, due to poor drainage and faulty irrigation practices;
(d) Increased treatment costs to downstream users and the preclusion of reuse for particular purposes.

D.3. Water-related disease

Water, sanitation and hygiene have important impacts on health. Water-related diseases include those due to micro-organisms and chemicals in water people drink; diseases like schistosomiasis which have part of their lifecycle in water; diseases like malaria with water-related vectors; drowning and some injuries; and others such as legionellosis carried by aerosols containing certain micro-organisms. The World Health Organization (2003) has estimated that water related diseases are in the order of 250 million cases annually with 5 to 10 million deaths. Water also contributes to good health, for example through hygiene.

Water-related diseases are a major concern in most of the developing world. While the water-health linkage is clear, it remains difficult to quantify precisely the incidence, stages of development and circumstances exacerbating water borne diseases due to major limiting factors such as unavailability of proper diagnosis, proper disease reporting and comprehensive epidemiological investigations.

The predominating water related disease entities associated with morbidity and mortality are the following; diarrhea diseases, intestinal helminthes, Schistomiasis, Dracunculiasis, Trachoma, Malaria, Dengue Fever, Poliomyletis, Trypanosomiasis, Bancroftian Filariasis and Onchocerciasis. Poliomyletis is still a noted disease entity, given the intensive efforts, worldwide, in planning and implementing immunization campaigns. Water related diseases are normally classified into four types of categories:

- Water-borne diseases; relate to water as the agent of disease transmission, mainly pathogens from excreta to water to humans. This entity includes most enteric and diarrheal diseases caused by bacteria, parasites and viruses.
- Water -washed diseases, relate to inadequate sanitation or contact with contaminated water, mainly via personal hygiene activities.
- Water-based diseases, relate to hosts that either live in water or reside in water as part of their life cycles. Such disease entities are passed to humans mainly through ingestion and skin contact.
- Water – related insect vector relate to disease entities that spread by insects that breed or feed on contaminated water.

D.4. Misconceptions in the management of water –related diseases.

1. Types of environmental interventions

In the 1960`s and 1970`s, most water supply projects focused on improvements of water quality. However, with time and reported success associated with purely technical measures to improve water quality, it became more evident that management of water related diseases are associated with a variety of water and water-related interventions. With the beginning of the International Drinking Supply and Sanitation Decade (IDSSD), water related and sanitation activities started gaining inertia. Environmental intervention should relate to:

- Water quantity and quality
- Excreta and wastewater disposal
- Personal and Domestic Hygiene

Integrated cost-effective management of environmental management interventions is a critical factor in promoting the health profile reducing the prevalence of water-related diseases. Recently, experiences from implementing environmental health projects and cumulative results from the increasing number of health impact studies, have led to a type of consensus among professionals in the water-environment sector: (UNICEF 1999):

- Isolated water supply interventions are not adequate for water-relayed disease prevention
- Sanitation services, as a sole intervention, is more effective than water services, alone
- Promoting hygiene and hygiene education, coupled with sanitation is highly effective in decreasing diarrhea incidences
- Improvement in water supply (quality and quantity), in combination with improved provision of sanitation services and personal hygiene awareness and practices, is critical in the promotion of public heath.

2. Diagnosis of water related diseases

A wide variety of water related diseases such as gastrointestinal and diarrhea diseases are mainly self-limiting. As such, a variety of variables may hinder diagnosis of such disease. These are:

- Personal perception of disease
- Accessibility to health services
- Expenses

D.5. Wastewater use

As freshwater becomes increasingly scarce the use of wastewater in agriculture, aquaculture, and groundwater recharge and in other areas will increase. In some cases, wastewater is the only water resource available to poor, subsistence-level farming communities. Although there are benefits to using wastewater in agriculture - including health benefits such as better nutrition and food security for many households - uncontrolled use of wastewater frequently is associated with significant negative human health impacts. These health impacts can be minimized when good management practices are implemented.

Guidelines for the safe use of wastewater in agriculture need to find the right balance between maximizing public health benefits and still allowing for the beneficial use of scarce resources. Guidelines need to be adaptable to the local social, economic and environmental conditions and should address issues of hygiene promotion, provision of adequate drinking water and sanitation, and other primary health-care measures.

WHO published Guidelines for the Safe Use of Wastewater and Excreta in Agriculture and Aquaculture in 1989. These guidelines have had a major impact on the rational reuse of wastewater and excreta in countries

worldwide. The WHO guidelines for the safe use of wastewater and excreta in agriculture and aquaculture are currently under revision with expected publication in 2004 (WHO, 2003).

D.6. International norms ("guidelines") on water, sanitation and hygiene

One of the core functions of WHO is to "propose... regulations and to make recommendations with respect to international health matters". In relation to water, sanitation and hygiene, this is achieved through development of normative "Guidelines". The following guidelines are available on the WHO website.

- Guidelines for Drinking-Water Quality
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- Guidelines for Safe Recreational Water Environments
    1. Volume 1: Coastal and freshwater
    2. Volume 2: Swimming pools and spas and similar recreational water environments
- Guide to hygiene and sanitation in aviation

E. HEALTH IMPACT ASSESSMENT (HIA)

HIA is necessary to apply to different options for water resources development and different management options to manage water resources as an integrated resource based on IWRM framework. The checklists and exercises in this module can help in the implementation of HIA within IWRM. There are many materials and references available on HIA. There will be no attempt here to discuss every aspect of HIA. The following will be a summary and a guide for HIA; these include notably: International Health Impact Assessment Co. 2003; Barnes and Scott-Samuel 2003; Welsh Assembly 2003; Department of Public Health 2003.

HIA can be defined as the estimation of the effects of a specified action on the health of a defined population. Its purpose is: (1) to assess the potential health impacts - positive and negative - of policies, programmes and projects; and (2) to improve the quality of public policy decision making through recommendations to enhance predicted positive health impacts and minimize negative ones.

HIA is a broad concept that may be interpreted in different ways by a range of different users. For the majority of users, there are common elements that can be agreed to provide a framework for common action. A number of specific usages exist, all of which imply an interest in the safeguarding and enhancement of human health and a concern that human activities and decisions, in the form of water development projects, plans, programmes and policies can affect human health in both positive and negative ways.

There is no clear delineation between environmental assessment and social impact assessment. There is no clear definition about where health concerns end and where environmental or social concerns begin. The different users of these terminologies may choose to set the boundaries based on different frames of references.

HIA's strength lies in providing a tool, which enables informed water policy decisions to be made based on a valid assessment of their potential health impacts, at the same time adding health awareness to policy making at every level. In the longer term it has the potential to improve public health standards and contribute positively to public policy development.

The Key principles of HIA are (1) A social model of health and well-being, (2) An explicit focus on equity and social justice, (3) A multidisciplinary, participatory approach, (4) The use of qualitative as well as quantitative evidence and explicit values and openness to public scrutiny.

HIA is also underpinned by an explicit value system focusing on equity and social justice. In this context, equity has a moral and ethical dimension resulting from avoidable and unjust differentials in health status:

Equity is concerned with creating equal opportunities for health and with bringing health differentials down to the lowest possible level.

HIA is not the preserve of any one disciplinary group. Instead, it draws on the experience and expertise of a wide range of stakeholders which include water professionals, decision makers, relevant voluntary organizations and most importantly representatives of the communities whose lives will be affected by the policy.

E.1. How can HIA be applied?

Ideally, HIA should be applied at the concept stage (before policy, programme or project implementation) to ensure that steps are taken, at the planning stage, to maximize positive health impacts and to minimize the negative effects. In practice it is not always possible to do this so HIA may also be carried out concurrently (during the implementation stage) or retrospectively (after it has finished) in order to ensure that ongoing developments are compliant with the requirements and standards set through HIA.

E.2. How to implement HIA within IWRM framework?

There is no one definitive methodology for HIA although several toolkits are currently being developed. The Merseyside Guidelines cited in Scott-Samuel et al (1998) in line with a number of existing guidelines provide perhaps the most widely used model and has proved to be practical and sufficiently flexible to be adapted to a range of circumstances.

Descriptions of health impact assessment have identified a number of steps, which can be grouped into the following five major steps: (Welsh Assembly 2003):

1. Screening consists of a preliminary assessment to see if the water project is likely to pose any significant health questions and is therefore worth subjecting to health impact assessment. Where a policy is clearly beneficial to health it may well be decided that no further health impact assessment is needed though it may be considered worth undertaking one in order to quantify the benefits.

2. Scoping is the process of broadly outlining the possible hazards and benefits and identifying the questions that must be addressed in the assessment process. This is referred to as setting the terms of reference.

3. Risk assessment involves characterizing the nature and magnitude of the harmful and beneficial factors, how many and who are the people who will be affected by the risk factors and how they will be affected. A risk management plan flows from the risk assessment with suggestions on how the effect of harmful factors can be negated or minimized and how the effect of beneficial factors can be maximized.

4. Decision making involves considering the report of the risk assessment and the risk management plan and making a choice of options (including the no action option). Once the main option has been determined, there will be sub-options, possible modifications and ways of mitigating possible disadvantages to consider.

5. Implementation and monitoring involve action to implement the decision(s) and to observe the consequences. Monitoring is particularly important where adverse consequences are predicted but where their nature, size and timing are uncertain. Early detection of adverse consequences may allow their effect to be minimized by modification of the way in which the decision is implemented or at least mitigated with appropriate measures.

In practice, the process is not necessarily sequential but iterative i.e. some steps may need to be repeated. For example, preliminary risk assessment may identify further issues requiring a revision of the terms of reference agreed in the scoping process. Decision making after the first risk assessment may identify further questions, which in turn require further assessment. Modification of the initial proposals may generate a need

for further assessment. Developments during implementation and monitoring may lead to decisions being revisited with the need for further assessment and so on.

It can be seen that health impact assessment and decision-making are not distinct activities but all part of the same process. However, different people may undertake the two. It is clear that those who undertake the assessment and those who take the decisions need to work together very closely and need to understand each other's perspectives and goals. Health impact assessment is not a method by which decisions are based on complex calculations. Health impact assessment can improve decision-making by making explicit the underlying assumptions and reducing the risk that a development will bring about unforeseen and unwanted consequences. In this respect, it is very similar to cost benefit analysis.

Health impact assessment must not be allowed to delay unduly decision making or it will become another hurdle to be overcome rather than support the decision making process. Therefore it will be necessary to strike the right balance between speeding up the assessment in order to take appropriate action and giving due time to complete, process and analyze the data on which the assessment is based.

Various ways of organizing health impact assessment within the framework of the five stages have been recommended. A selection of checklists from the Forbundet and Kommunforbundet (1998) cited in Welsh Assembly (2003) are presented thereafter. They illustrate how checklists can be used as screening tools or as starting point for scoping and can help in the application of IWRM principals. Box 1 shows an example of a very simple checklist. This gives very little guidance to its users on what aspects of the proposal they should be checking and so is probably best suited to those who have a considerable understanding of health impacts. Pastides and Corvalan (1998) cited in Welsh Assembly (2003*)* recommended a 10 steps model the different stages for implementation HIA. This is shown in Table 1. Steps 1-7 describe the sequence for making the risk assessment based on measurement and information from technical literature. Qualitative assessment is given little prominence in this model and further research is needed in this respect to strengthen this viability of this tool in capturing all the dimensions involved in policy statements such as " the well-being of society".

BOX 1. HEALTH IMPACT ASSESSMENT CHECKLIST

Health Impact Assessment is guided by a number of key questions. They may for example, be appropriate to rise prior to analyses of the strategic options for water resources development.

General questions

1. What does the local Public Health Guidelines show regarding the health conditions of different groups within the municipality/country?
2. Are there defined health policy targets?

Questions which may be linked to the matter at hand

1. Are there particular health risks, which can be expected to decrease or increase as a result of the to different options for water resources development? Will impacts become apparent in the short term (within 5 years) or in the long term?
2. For an assessment of morbidity conditions for a given population, it is important to determine which groups are subjected to decreased/increased health risks, and whether any decision will affect these groups' capacity to deal with potential difficulties or alternatively increase their vulnerability to health risks.
3. In what way is the social environment at local and national levels affected by the options for water resources development?

Is there a risk that the options for water resources development may have a range of direct and indirect impacts on certain groups i.e. that both their health risks increase and their social environment deteriorates? Are there alternative policies, which might result in better health for exposed groups and the population as a whole?

Source: WHO

TABLE 2. A 10 STEP RISK ASSESSMENT MODEL

0. Scoping	▪ Defining the scope of relevant topic
1. Project analysis	▪ Coverage of construction phase, normal operation, accidental releases and decommissioning phase ▪ Expected emissions, odors, noise vibration ▪ Hazard characterization/ classification (toxicity etc.)
2. Regional analysis	▪ Physio-geography, meteorology, natural features ▪ Anthropogenic changes, land use (housing, gardens, schools, nurseries, hospitals, agriculture, industry) ▪ Definition of area of interest for further investigation
3. Population analysis	▪ Population size, distribution by age, sex etc. ▪ Health status, based on health reports, disease registries ▪ Behavioral patterns, activities, food, hobbies
4. Background situation	▪ Environmental monitoring e.g. air, groundwater, soil, food ▪ Analysis of existing pollution concerning chemicals, odors, noise, vibrations, radiation ▪ Identification of additional data needs (parameters, places, environmental media)
5. Prognosis of additional pollution	▪ Based on data from similar plants/facilities which are already in existence (same technology different location) ▪ Coverage of air, water (surface, ground) soil, flora, fauna ▪ Modeling of dispersion from (non-) point sources, transfer between environmental media, terrestrial, limnic food chain
6. Prognosis of health impact	*6.1 Qualitative assessment* ▪ Changes concerning neighborhood features, quality of life ▪ Citizen concerns (incl. Non-government organizations, local newspapers) *6.2 Comparison with media-specific limit values* ▪ Comparison of predicted emissions and ambient concentrations of chemical in air, water, soil, food with limit values ▪ Comparison of predicted intensity of noise, vibrations, odors, radiation with limit values ▪ Total burden rather than single agents. *6.3 Quantitative risk assessment* ▪ For non-threshold effects especially carcinogenecity: Quantitative risk assessment including all relevant pathways and carcinogens leading to probability statement on additional cancer risk and on population cancer burden ▪ For threshold effects: Estimation of hazard quotient/hazard index summarizing over chemicals, which affect the same target organ system.
7. Summarizing assessment of impacts	▪ Summary and assessment of predicted impacts ▪ For threshold agents the assessment is implied in the comparison of predicted and threshold limit values ▪ For non-threshold agents there needs to be agreement about “acceptable risk”.
8. Recommendation	• Recommendations on planning alternatives • Recommendations on additional steps e.g. emission control monitoring, public information, post-project analysis
9. Communication	▪ Communication of results to all parties involved including planners, decision makers, public at large ▪ Risk comparison, visualization of results. Communication ▪ Communication of results to all parties involved including planners decision makers, public at large ▪ Risk comparison, visualization of results
10. Evaluation	▪ If project is put into practice comparison of predicted impact to actual situation: systematic evaluation of prognosis providing basis for improvement of subsequent tests, methods and/or procedures ▪ Evaluation of communication and decision making

F. EXERCISES

1. The participants can discuss the case studies in Boxes 2 & 3 and analyze similar cases from their countries to propose solutions within IWRM framework through HIA.

2. The participants could be divided into two groups to conduct Health Impact Assessment for the following two projects. They can make assumptions about any necessary data (but should define what these assumptions are) and should use the above checklists.
   - Groundwater recharge project using reclaimed wastewater.
   - Reuse of wastewater in agriculture.

Box 2: HEALTH IMPACT OF RAW SEWAGE DISPOSAL AND THE USE OF SCAVENGER WELL TO CONTROL GROUNDWATER POLLUTION IN GAZA, PALESTINE

Although groundwater is the only reliable source of water for Gaza, there is a constant increase of groundwater pollution by direct dumping of untreated wastewater and over-pumping of the aquifers. Low coverage of sewerage systems, lack of effective control of storm water runoff, absence of sound provision for ultimate disposal of solid waste and over-pumping the shallow aquifer of Gaza constitute the main problems facing planners in the groundwater and environmental sectors in Gaza. Over-pumping results in groundwater salinization, which substantially reduces the availability of good quality water for potable use and irrigation.

In 1997, Gaza Strip faced an outbreak of viral meningitis. The reason was mainly due to bathing in polluted seawaters as a result of mixing with untreated sewage, which is being discharged to the sea. In 1994, a breakout of Cholera occurred in Gaza City. One death case was reported. The reason was related to communicating with water contaminated with sewage. The aim of this case study is twofold. First, to demonstrate that disposing raw sewage on ground surface in Gaza has caused severe health risks. Second to illustrate that scavenger wells can be used to control groundwater salinization problems in the polluted coastal aquifer of Gaza. It is shown in this case study that 60% of the reported diseases are water-borne and the prevalence of intestinal infestations among the Gaza refugee population is very high over the last years due to the poor environmental conditions.

The study demonstrates that scavenger wells are useful means to control groundwater saliniziation problems. It is shown in this case study that groundwater pollution by salinization can be greatly reduced if the screen of the freshwater well is located in the upper part of the aquifer. The study also shows that saline upcoming continues as a result of operating the freshwater pump alone and the only way to stop that upcoming is to operate the saline water pump. The Palestinians may develop these resources in the future, however this is a function of the final status of the negotiations process. Utilization of groundwater resources would provide Palestinians with a high degree of independence in the control of their water resources.

Box 3: GUIDELINES FOR GROUNDWATER PROTECTION AND POLLUTION CONTROL IN THE GCC COUNTRIES

In addition to their over-exploitation and quality deterioration, groundwater resources in the GCC are being threatened and polluted by numerous point and non-point sources of pollution generated from various anthropogenic sources (agricultural, industrial, and domestic activities). Currently, groundwater management efforts in the GCC countries are concentrated on supply augmentation and, to a lesser extent, on demand management and conservation, which are directed mainly towards alleviating the stress on groundwater resources and to mitigate their quality deterioration, and in some cases to rehabilitate their water levels and quality. On the other hand, protection of groundwater resources from anthropogenic activities and external pollution sources has not been given much attention so far in most of the GCC countries.

In fact, surface sources of pollution to groundwater such as nitrate, bacteria and pesticide residues, have more adverse affects on human health than lowered water tables and salinization of aquifers. While salinization or lowering the water table of an aquifer impacts development of the various economic sectors, anthropogenic pollution impacts both economic development and the well being of humans, and therefore, it is imperative that groundwater supplies are protected from these sources of contamination. Furthermore, it is much more cost-effective to prevent the contamination of a groundwater resource as opposed to trying to clean it up. To adequately protect groundwater, health impact assessment of over-exploitation and pollution of ground water should be conducted within the IWRM framework. Moreover, vulnerable areas must be mapped and policies must be drafted, implemented and enforced at the country and the municipal levels. It is suggested that groundwater protection, vulnerability assessment and wellhead protection areas be implemented to restrict harmful land use practices or subsurface activities.

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