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WATER AND HEALTH: CURRENT ISSUES ON EUROPEAN LEVEL AND THE NEED FOR SUSTAINABLE WATER RESOURCES MANAGEMENT

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Profound pressure on water resources affects health, the economy and sustainable developement. Industrialization, intensification of agriculture and growing populations followed by increases in water demands accentuate the necessity for sufficient high-quality water resources. Conflicts between amount of use and availability, coupled with all the driving forces and pressures on the quality of water resources highlit the need for sustainable management of water resources.
Key words: water, health, sustainability, water resources management.

Voda i zdravlje: ključni aspekti na europskom nivou i potreba za održivim upravljanjem vodnim resursima. Intenzivan pritisak na vodne resurse utječe na zdravlje građana, ekonomiju i održivi razvoj. Industrijalizacija, sve intenzivnija poljoprivreda i rastući broj stanovnika koje prate sve veće potrebe za vodom naglašavaju potrebitost za dostatnim kapacitetima vode visoke kvalitete. Nesklad između dostupne količine vode i one količine koja se koristi, uz brojne pritiske koji utječu na kvalitetu vode ukazuju na naglašenu potrebu za održivim upravljanjem vodom.
Ključne riječi: voda, zdravlje, održivost, upravljanje vodnim resursima.

INTRODUCTION

Although many parts of Europe are currently well provided with fresh water, the water resources are unevenly distributed between and within countries, leading to shortages in many areas. Groundwater and surface water have a limited capacity for renwal, and pressures from agriculture, industry and domestic users affect the quantity of water resources.

Both water quality and availability must therefore be integrated in long-term planing and policy implications concerning water management. Although some aspects of water quality and supply have improved in some countries over the last decades, progress has been variable. Renewed emphasis is being placed on microbial quality and the acknowledgment of previously unrecognized and re-emerging microbial and other hazards. Inefficient use of water resulting from factor such: as network leakage, inappropriate agricultural irrigation, industrialization and population

distribution appear to be the most significant problems.

Many of technical solutions are as applicable today as they were a decade ago, but mayor changes affected many countries including the supply of water and sanitation service, land-use activities, pollution control and activities related to public health surveillance. Although high standards have been reached in some cuntries, outbreaks of waterborne diseases continue to occur across Europe.

WATER RESOURCES

The water resources of a country are determineg by a number of factors, including the amount of water received from precipitation, inflow and outflow in rivers and the amount lost by evaporation and transpiration - which is evaporation of water through plants. The potential for storage in aquifers and bodies of surface water is important in facilitating the exploitation of this resource by humans. These factors depend on geography, geology and climate. Freshwater resources are continuously replenished by the natural processes of the hydrological cycle. Approximately 65% of precipitation falling on land returns to the atmosphere trough evaporation and transpiration, while the remainder, or runoff, recarges aquifers, streams and lakes as it flows to the sea. Water resources vary considerably across the European Region and sustainable use of it can only be assured if the rate of use does not exceed the rate of renewal. Achieving the correct balance between use and renewal requires reliable quantitative assessment of the water resources and thorough understanding of the hydrological regime. Available resources must be managed carefully to ensure that abstraction to satisfy the various demands for water does not threaten the long-term availability of water. Sustainability should imply management to protect the quality of the water resources, which may include measures such as preventing contaminants from entering the water, and maintaining river flows so that any discharge are sufficiently diluted to prevent adverse effects on water quality and ecological status [1-3].

DRIVING FORCES AND PRESSURES ON WATER RESOURCES

Household

The water required for drinking and other domestic purposes is a significant proportion of the total water demand. Increased urbanization concentrates water demand and can lead to the over-exploitation of local water resources. One consequence of increased urbanization is a change in run-off patterns resulting from large areas being covered with an impermeable surface such as concrete, tarmac or roofs. Most rainfall in cities enters a storm-drain system and is discharged. Either directly or via a wastewater treatment plant, into surface waters. Thus, rainfall that in a rural area might have served to replenish groundwater supplies is, instead, directed to surface sources. However, urban water demand has chance to be stabilized as a result of the sustainable development followed by the use of appliances that are more water-efficient.

Domestic wastewater effluent is the most significant contributor of phosphorus to surface water, and detergent adds significantly to the phosphorus content of domestic sewage. Voluntary agreements have been successful in reducing the use of phosphate-based detergents in a number of European countries. Evidence also suggest that domestic sewage is a source of

endocrine-disrupting chemicals in the aquatic environment. Advanced methods of wastewater treatment are available and used in some countries in western and nordern Europe. In some of these countries, most sewage collected receives at least secondary treatment, although there are exceptions [4]. Some countries in southern Europe and in the eastern part of the European Region discharge significant proportions of collected sewage untreated. Where humans are potentially exposed to untreated wastewater the mayor acute health risks are associated with exposure to pathogens. Therefore treatment of wastewater is a highly effective method of safeguarding public health [5].

Industry

Urbanization often accompanies increased industrialization and economic activity. The resulting rise in the standard of living is generally associated with increased water demand, for example from the use of water-consuming appliances. Industrial demand and effects on water quality can directly affect the water supplies of a large number of people where industry coexist with highly populated urban areas. Some industries, especially traditional heavy industries, require large amounts of water for cleaning or cooling and therefore compete for water resources. The amount of water abstracted for cooling usually far exceeds that used during industrial processes, but this is often regarded as a non-consumptive use, as the water is returned to its source virtually unchanged except for an increase in temperature and, in some instances, the presence of a biocide. The amount of water required also depends on the type of process used. According to the principles of sustainability it is expected that modern industrial plants incorporate as much as possible water-saving measures. Industrial processes produce contaminated wastewater hat is released into fresh or marine surface either directly or following treatment.

The range of chemical contamination that may be released is large, but special attention should be paid to substances that may accumulate in sediment or bioaccumulate and enter the food chain, such as certain heavy metals and organic substances. In addition to controlled or intentional discharge, contamination can also occur as a result of spillage, poor handling, improper disposal methods and accidents.

Acute pollution of source water can also occur following road accidents involving chemical tankers or a fire. Many states recognize that industrial pollution is poorly controlled and it is supposed that industrial discharge will, in general, change as the dominant industries change and improve practice and disposal techniques [6].

Agriculture

The development and intensification of agriculture in recent decades has implications for both the quantity and quality of water sources. Agricultural demand for water in Europe is dominated by its use for irrigation. Concerns about impact of agriculture on the quality of water resources are often related to the leaching and run-off of agricultural chemicals applied to crops and soil. Some agricultural contaminations can originate from point sources, but most stems from diffuse sources. The use of agricultural chemicals depends on the type of agriculture practiced within a country and the market price of the crops grown. The economic conditions of the country and the agricultural subsides available to farmers also strongly influence the extent of use. Contamination of water by nutrients and microbial pathogens from farm waste and animal slurry are also concerns. Common inorganic fertilizer formulations contain

nitrogen, phosphorus and potassium in varying proportions. The use of pesticides in agriculture has become commonplace over the last half century. Herbicides are used in the greatest quantities, and this type of pesticide has been detected most frequently in European groundwater. Groundwater is usually regarded as being most vulnerable to pollution by pesticides, because of the long residence time and minimal biodegradation. However, pollution by pesticides can also affect surface water and can have toxic effects on aquatic life. Pesticides have been implicated in various disorders and diseases, including cancer, adverse reproductive disorder, impaired immune function and allergic reactions, especially of the skin [5,6].

Tourism

Tourism is an important source of income in certain areas popular for tourism. The seasonal influx of large numbers of people can significantly affect exploitation of available water resources and greatly increase the volume of wastewater requiring treatment and disposal. Domestic water use by tourists is often twice that of residents, and large volumes of water are also required for recreational facilities such as swimming pools, water parks and golf courses. Touristic areas are often warm areas, thus concentrating the demand in an area where water resources may already be limited, especially in Mediterranean, and demand often peaks during periods when the renewal of water resources are low.

Localized shortages of water may therefore be common in areas used for tourism. Supplying sufficient water at the time of peak demand, often at the driest time of year, may require the construction of additional reservoirs.

A large seasonal influx of tourists can, beside challenges in the design and operation of water supply systems, produce challenges in wastewater collection and treatment. Sewerage and treatment for fluctuating amounts of sewage present specific technical difficulties. A large variation in the quantity of wastewater to be treated makes designing and operating efficient sewage systems and wastewater treatment plants difficult. In temperate regions, the tourism season may coincide with the cyanobacterial growth season [7].

Climate change, droughts and floods

Although regional differences are relatively high, most of Europe experienced increases in temperature of about 0.8°C on average in the twentieth century and climate models predict global mean surface temperatures could rise by about 1-3°C until the year 2100. Predictions of climate change are subject of huge uncertainty. Even where the likely global trend appears to be clear, the response in individual regions may vary substantially from it. Global average precipitation is predicted to rise, but this increase is also likely to be regional. It is predicted that winter and spring precipitation will increase in Europe and summer precipitation will decrease, although the Mediterranean region and central and eastern Europe are expected to experience reduced precipitation. The incidence of drought and heavy precipitation events is also therefore predicted to increase, which suggests implications not only for increased contamination resulting from run-off but also decreased groundwater recharge and an increased incidence of flooding. Complex interactions in time and space between precipitation, evaporation and discharge, storage in reservoirs, groundwater and soil make it difficult to model and analyse exactly the influence of climate change on the hydrological cycle. One of the basic mechanisms is that higher temperatures lead

to higher potential evaporation and decreased discharge, which is also a function of precipitation, storage and topography. Predictions about hydrology are difficult in Europe because of anthropogenic factors, such as changes in land-use patterns and the drainage conditions of rivers and an increasing proportion of impermeable areas, strongly influence the European hydrological cycle [8]. Cooper et al. found that the effect of various climate change scenarios on aquifer recharge depended on the aquifer type, and that a scenario incorporating high evaporation produced the greatest change in hydrological regime [9]. The central emission scenario of the Intergovernmental Panel on Climate Change predicts a rise in sea level of 0.5 m by the year 2100. However, the predicted rise will not be uniform around the world [10].

ACCES TO SAFE WATER AND HEALTH EFFECTS

A reliable and adequate source of clean drinking-water is considered to be a basic human right and is one of the highest priorities of any country. The way in which people obtain their water depends on the natural and financial resources of a country and historical influences on a local level. The population density and pattern of habitation also influence the extent to which consumers are supplied by piped networks or rely on local sources for drinking-water. Access to a sufficient supply of safe water is essential in maintaining public health. Poor hygiene caused by the lack of drinking-water results in the increased transmission of infectious diseases [11].

Where the sources of portable water are of poor quality, or the financing, staffing and other infrastructure to maintain the distribution system are lacking, mortality rates attributable to infectious diseases, to the availability of sanitation services and to general hygiene may increase. Inadequate water supplies increase the likelihood of person-to-person disease transmission and can compromise the effectiveness and efficiency of water-based sewage collection and treatment processes, posing an additional risk of disease. In recent years the privatization of water supplies in some countries has resulted in an increase in the number of households disconnected from water supplies. Water has become an increasingly expensive commodity and evidence indicates that, where water meters have been introduced, those with lower incomes use less water. A few studies have examined the social and health effects of water disconnection or of excessively low water use to save money [12]. One study showed a significant correlation between the number of disconnected households and the incidence of hepatitis A and shigellosis in some areas of the United Kingdom. This study also implicated involuntary reduction in water use because of economic deprivation as the cause of the increase in disease [13]. The provision of a microbial safe drinking-water supply is the most important step that can be taken to improve the health of a community, by preventing the spread of waterborne diseases. Poor sewerage systems and the discharge of untreated sewage are likely to affect source water quality.

Some microorganisms are more resistant to treatment than others and can after treatment be discharged into surface waters in sewage effluent [14]. Public supplies may be also at risk if financial constraints result in discontinuous or insufficient disinfection. Technical faults and faulty connections may result in wastewater infiltrating into the supply network, potentially contaminating the drinking-water. In countries with less protected water sources, less sophisticated

water treatment facilities and less well maintained water distribution systems, the proportion of water-related diseases is higher, but it is also important to know and emphasize that water-related diseases break out even in countries with sophisticated water treatment facilities [15].

Beside microbial problems which are the most unpredictable and found most frequently, very serious threats for safe water quality represent also: waterborne chemicals, nitrate and nitrite, radioactivity, pesticides, disinfection by-products, solvents, and aesthetic aspects - which depend on the local geology, causing „dirty water" problems. Water-related diseases not only cause preventable illness and death but may also have substantial economic effects on the affected people and their families and society as a whole, including expenses for health care and loss of productivity.

CONCLUSION

Shortage of clean drinking-water may be the most urgent health problem currently facin some European countries, exacerbated by geography, geology and hydrology. Climate change is predicted to influence water availability, especially in coastal areas. The extent of provision of piped drinking water supplies to household varies across Europe between urban and rural populations.

The utilization of water for irrigation and for industry exerts pressure on water resources. Change in population distribution and density are key factors influencing the quality of water resources. Outbreaks of waterborne diseases continue to occur across Europe, and minor supply problems are encountered in all countries. Inadequate sewage systems are a significant threat to public health.

Numerous chemicals are found throughout the aquatic environment. Eutrophication is a major threat to European surface waters. Considerable evidence has accured linking the quality of bathing water with minor illnesses.

Additional efforts are required to sustain the European water resources and to provide safe water for its inhabitants, both for drinking and for other purposes. These include measures to control demand and to prevent, control and reduce contamination by improving water and sanitation management at the international, national and local levels. Partnership and cooperation are needed betweeen the environmental and health sectors at all levels of government to disseminate technology, to improve management and to provide financial and institutional support to ensure access to safe water and sanitation for all.

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