

GROUNDWATER POLLUTION

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ABSTRACT: Groundwater constitutes a major natural resource for drinking water supply. The serious deterioration of groundwater quality observed in all industrialized and densely populated countries can be considered as an unspectacular, but ubiquitous "man-caused environmental disaster". Groundwater management has to match the increasing demands of drinking water supply (and other uses) with the constraints of the natural groundwater system with respect to both quantity and quality. In this paper, groundwater pollution problems are described and strategic considerations with respect to groundwater protection and subsurface remediation are illustrated. It is shown that the way towards adequate engineering solutions for sustainable development of groundwater resources still poses many challenges to hydraulic research.

KEYWORDS: Groundwater, Pollution, Drinking water.

INTRODUCTION: Groundwater pollution (also called groundwater contamination) occurs when pollutants are released to the ground and make their way down into groundwater. This type of water pollution can also occur naturally due to the presence of a minor and unwanted constituent, contaminant or impurity in the groundwater, in which case it is more likely referred to as contamination rather than pollution. Groundwater a major source for drinking water supply. Groundwater is the water contained beneath the surface in rocks and soil, and is the water that accumulates underground in aquifers. Groundwater constitutes 97 per cent of global freshwater and is an important source of drinking-water in many regions of the world. In many parts of the world groundwater sources are the single most important supply for the production of drinking-water, particularly in areas with limited or polluted surface water sources. For many communities it may be the only economically viable option. This is in part because groundwater is typically of more stable quality and better microbial quality than surface waters. Groundwaters often require little or no treatment to be suitable for drinking whereas surface waters generally need to be treated, often extensively. There are many examples of groundwater being distributed without Groundwater and public health 5 treatment. It is vital therefore that the quality of groundwater is protected if public health is not to be compromised.

In many parts of the world, groundwater constitutes a major natural resource for drinking water supply. Because of its purity and pleasant taste, natural groundwater is considered to be the best water for human consumption. Groundwater systems are naturally well protected against contamination, partly due to the filtration effect of the covering layers, and partly to the purification potential of the aquifer strata. In Germany, about 72% of public water supply stems from groundwater. The overall demand of 4 to 5 billion m³ per year amounts to only about 2% of the hydrological cycle and hence poses no quantitative problems due to the favorable hydrological conditions. However, during the last two decades a continuing degradation of groundwater quality due to anthropogenic causes has been observed and has brought to our attention that groundwater resources, like surface waters, need protection and remediation efforts in order to maintain their quality. The detection of large scale groundwater contaminations by chlorides, chlorinated hydrocarbons and nitrates showed the new dimension of the problems, which have to be dealt with at regional rather than only local scale. A contamination potential for groundwater results from nearly any activity of our 109 industrial societies. Pollutant sources may be roughly classified as: infiltration from surface waters (rivers, lakes, reservoirs), diffuse area sources (rainfall-infiltration, deposition, agricultural sources of nitrates and pesticides, leaking sewage canals), local sources of industrial contaminants (industrial sites, deposits, spills and accidents). It is only recently that numerous headlines in the media have sharpened public awareness of the problems affecting groundwater. Industrial sites and disused waste dumps have caused pollution of the groundwater to an extent which still remains to be determined. In Germany, about 135,000 suspect areas are registered as potential hazards to groundwater, many of which are in need of remediation. In addition, annually 1, 500 to 1, 800 accidents during storage and handling of substances hazardous to water are recorded. The subsequent contamination of the subsoil adds up to hundreds and thousands of m³ • Considering the concentration levels found in the polluted soil and comparing it to drinking water standards, dilution factors of 106 to 1010 are not unusual. This makes evident why local pollution can result in degradation of the groundwater over large areas and times. When assessing groundwater pollution, the time factor is of vital importance. Due to the very low rate at which groundwater moves, its reaction to contamination is very slow, and many years or decades can pass from the time at which pollution occurs to its "discovery" in the raw water reaching a water supply well. Therefore, degradation of groundwater is a long term problem which can only be rectified at great expense and over correspondingly long time periods. Hence, groundwater protection is posing significant new tasks for the water industry. These embrace preventive measures for avoiding pollution as well as techniques for the observation and assessment of groundwater quality, methods for predicting the future transport and fate of pollutants as well as designing and optimizing remediation schemes for polluted aquifers. These tasks are linked to an ever growing demand for quantitative predictions of the transport and spreading of contaminants in aquifer systems. The public health and socioeconomic context of groundwater protection The use of groundwater as a source of drinking-water is often preferred because of its generally good microbial quality in its natural state. Nevertheless, it is readily contaminated and outbreaks of disease from contaminated groundwater sources are reported from countries at all levels of economic development. Some groundwaters naturally contain constituents of health concern: fluoride and arsenic in particular. However, understanding the impact of groundwater on public health is often difficult and the interpretation of health data complex. This is made more difficult as many water supplies that use groundwater are small and outbreaks or background levels of disease are unlikely to be detected,

especially in countries with limited health surveillance. Furthermore, in outbreaks of infectious disease, it is often not possible to identify the cause of the outbreak and many risk factors are typically involved.

Causes of groundwater pollution

- Naturally-occurring (geogenic)
- On-site sanitation systems
- Sewage and sewage sludge
- Fertilizers and pesticides
- Commercial and industrial leaks
- Hydraulic fracturing
- Landfill leachate

WAYS TO PROTECT AND CONSERVE GROUNDWATER

1. Go Native

Use native plants in your landscape. They look great, and don't need much water or fertilizer. Also choose grass varieties for your lawn that are adapted for your region's climate, reducing the need for extensive watering or chemical applications.

2. Reduce Chemical Use

Use fewer chemicals around your home and yard, and make sure to dispose of them properly - don't dump them on the ground.

3. Manage Waste

Properly dispose of potentially toxic substances like unused chemicals, pharmaceuticals, paint, motor oil, and other substances. Many communities hold household hazardous waste collections or sites - contact your local health department to find one near you.

4. Don't Let It Run

Shut off the water when you brush your teeth or shaving, and don't let it run while waiting for it to get cold. Keep a pitcher of cold water in the fridge instead.

5. Fix the Drip

Check all the faucets, fixtures, toilets, and taps in your home for leaks and fix them right away, or install water conserving models.

6. Wash Smarter

Limit yourself to just a five minute shower, and challenge your family members to do the same! Also, make sure to only run full loads in the dish and clothes washer.

7. Water Wisely

Water the lawn and plants during the coolest parts of the day and only when they truly need it. Make sure you, your family, and your neighbors obey any watering restrictions during dry periods.

8. Reduce, Reuse, and Recycle

Reduce the amount of "stuff" you use and reuse what you can. Recycle paper, plastic, cardboard, glass, aluminum and other materials.

9. Natural Alternative

Use all natural/nontoxic household cleaners whenever possible. Materials such as lemon juice, baking soda, and vinegar make great cleaning products, are inexpensive, and environmentally-friendly.

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