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Evaluating water resources quality and water pollution in Karabuk, Turkey

Meral Topcu Sulak[1] , Rahman Çalhan[1] and Süleyman Sulak[2 1]

[1]Karabuk University, Turkey

[2]Mevlana University, Turkey

Abstract

In this study, the quality of water resources especially used for drinking and daily life is evaluated. To make a convenient assessment, all of the villages were considered. It is very important to provide clear and healthy water to people to prevent disease and maintain health. In history, water resources were only considered by bacteriological analysis but with improving technology and industry, chemical and physical parameters have become very important. In this point of view, water samples were taken from specific points in villages of Karabuk. In our region, there is an important steel and iron industry, and also some poultry farms. Addition to this, there is not enough treatment plant in region, so water pollution is a very serious environmental problem. One of the purposes of this study is to compose an inventory about water quality in Karabuk. With this purpose all the villages were evaluated one by one both in bacteriological and physical parameters. According to results, some of the villages have not got an acceptable drinking water resource. This study aims also concerning the authorities about one the most important public health issue and a database for future studies.

Keywords: Drinking water quality, water management, health.

Introduction

Access to safe drinking water is a basic human right, a primary requirement for development and civilization and an essential element for ensuring public health and quality of life. According to WHO guidelines, access to a safe drinking water source represents the availability of at least 20 liters of water per person per day, up to 1 km radius of the user's home. Nowadays, 90% of the cancer sufferers are caused by chemical carcinogens (1) and 80% of the diseases are at tribute to the unsafe of drinking water in poverty-stricken areas. Nearly 25,000 people died of such water pollution problems everyday (2), and 1/3 of urban inhabitants in developing countries cannot get safe drinking water (3). In Black Sea Region, over 70% rivers and lakes are suffering pollution in various degrees. The threat of chemical or microbiological contamination to drinking water is well established, and would be an effective way of causing devastating public health consequences (4, 5). They may pose a special health risk for infants, young children, some of the elderly, and people with severely compromised immune systems. As it presently stands, the technology to detect these contaminants is lacking (6). More research needs to be done to figure out where the chemicals are coming from, what their effects are, and how they can be removed. Whether the threat is international or domestic, countries must begin to look at the security of their water systems and incorporate scenarios and remedial actions into their emergency response planning to reflect these new concerns. The pollutants in the water can be classified into contaminants of biological origin, physical origin and chemical origin according to their properties. The threat of drinking water quality safety comes mainly from chemical pollution. The chemical pollutants can be divided into carcinogenic pollutants and noncarcinogenic pollutants according to their different perniciousness to human. U. S. EPA (United States Environmental Protection Agency), IARC (The International Agency for Research on Cancer) and USDOE□U. S. Department of Energy□ provide a great many data about the perniciousness of chemical pollutants to human health. It is essential to carry out total health risk assessment in the safety management of drinking water quality. Through the health risk degree assessment of drinking water source, the comprehensive conclusion of water source quality which is represented by the risk degree of health hazard can be got directly. So, the primary and secondary of the pollutants in waters and priority setting of governance can be determined. Diseases are closely related to the following factors, such as climate, environment, water quality and management, education, air pollution, natural disease, society and so on. It is extremely essential for the understanding and further study of human health This investigation conducted a pilot study for the drinking water quality in Karabuk City, Turkey. Karabuk is an important industrial center in the Black Sea region. Karabuk is a town and the capital district of Karabuk Province in the Black Sea region of Turkey. Karabuk lies in a location near Filyos River formed by the merge of Araç and Soğanlı rivers. Its districts are Yenice, Eskipazar, Eflani, Ovacık and Safranbolu. Karabuk located about 200 kilometers north of Ankara, 115 km (71 mi) away from Zonguldak and 113 km (70 mi) away from Kastamonu. The district covers an area of 760 km2 and the town lies at an elevation of 354 m (1,161 ft). Safranbolu was a trading place and a center for growing saffron. Today saffron is still alive at the village of Davutobası which is 22 km east of Safranbolu and probably one of the best quality saffron in the world. Safranbolu was added to the list of UNESCO World Heritage sites in 1994 due to its well-preserved Ottoman era houses and architecture. The most important river of Karabuk is Filyos River which ends in Black Sea. Also this river is polluted day by day cause of industrial activities and urbanization. Water pollution is increasing because of discharging of wastewaters without any treatment. One of the major steel producers in Turkey, namely Kardemir (Karabük Iron and Steel Works), is located in Karabuk. There are also other steel producers and textile plants.

Methods

Overview of the Study Area

Karabuk, was a district of Zonguldak till late 1995 hence it's one of the newest cities of Turkey in North Anatolia. One of the first steel factories of Republic of Turkey was established in this area in 1939, and had improved itself on a high speed based industrially. After 1995 city economy grew significantly and in 2007 University of Karabuk was established. Because of increased population and industrialization, pollution became one of the biggest problems of Karabuk.

Drinking Water Project started in 2007 and after the Project, today 32.37 hm^3/year water is supplied to Karabuk from four main points: the Eskipazar, Eflani and centre of the Karabuk. On the other hand, there is not enough study for identifying the quality of water resources in the area. In this study, water samples were taken from Araç, Soğanlı and Filyos Rivers to identify water quality. Additionally drinking water samples were taken from 4 main districts of Karabuk. These samples were analysed by an accredited laboratory. Results of analyses were evaluated according to national regulations and EPA standards. This study is important for defining the water pollution problem of city.

Results

Drinking water quality

Drinking water samples were taken from 4 main districts of Karabuk. These samples were analysed by an accredited laboratory. Results of analyses are given in Table 1 and Figure 2. According to results of analysis, Antimony, Selenium and Copper values are above the limits in national regulations and EPA standards as can be seen in Figure 3. Antimony occurs naturally in the environment. But it also enters the environment through several applications by humans such as industrial activities. Antimony can be found in soils, waters and air in very small amounts. Antimony will mainly pollute soils. Through groundwater it can travel great distances towards other locations and surface waters. Laboratory tests with rats, rabbits and guinea pigs have shown that relatively high levels of antimony may kill small animals. Whether antimony can cause cancer has not been fully specified yet. Because copper is released both naturally and through human activity it is very widespread in the environment. Copper is often found near mines, industrial settings, landfills and waste disposals. Usually water-soluble copper compounds occur in the environment after release through application in agriculture. When copper ends up in soil it strongly attaches to organic matter and minerals. As a result it does not travel very far after release and it hardly ever enters groundwater. In surface water copper can travel great distances, either suspended on sludge particles or as free ions. Copper does not break down in the environment and because of that it can accumulate in plants and animals when it is found in soils. On copper-rich soils only a limited number of plants has a chance of survival. That is why there is not much plant diversity near copper-disposing factories. Due to the effects upon plants copper is a serious threat to the productions of farmlands. Copper can seriously influence the proceedings of certain farmlands, depending upon the acidity of the soil and the presence of organic matter. Despite of this, copper-containing manures are still applied Copper can interrupt the activity in soils, as it negatively influences the activity of microorganisms and earthworms. The decomposition of organic matter may seriously slow down because of this. Chronic copper poisoning results in Wilson's Disease, characterized by a hepatic cirrhosis, brain damage, demyelization, renal disease, and copper deposition in the cornea. When selenium uptake is too high health effects will be likely to come about. The seriousness of these effects depends upon the concentrations of selenium. The health effects of various forms of selenium can vary from brittle hair and deformed nails, to rashes, heat, swelling of the skin and severe pains. Selenium poisoning may become so severe in some cases that it can even cause death. The results indicate that quality parameters such as as colour, pH, turbidity, Nitrate were within acceptable limits. Heavy metals such as Pb, Cd, Cr, Fe and Mn were also under control. However, desirable value of Mg is about 50 mg/L, in Karabuk, this value was up to two times higher than this. Excessive value of Mg cause eyes irritation and also diarrhea. The most important source of Mg is soil. Araç and Filyos River under risk because of untreated wastewaters sourced from both municipal and industrial.

Surface water quality

To indicate water quality according to civilization and industrialization in Karabük, water samples has been taken from Araç River from specific points. According to the analysis, it can be seen that after large industrial plants and points where population is high, values are increases

Discussion

In this study, samples are taken from water bodies around Karabuk and these samples are analyzed in an accredited laboratory. Results show that Mg, Antimony, Copper and Selenium concentrations are in high levels and does not comply with national and international standards. There are lots of water bodies in the western Black Sea region. Population is high in river valleys and coast. As a result of high population, coastal zones and water systems are polluted by untreated wastewaters. This study aimed to indicate pollution level in waters. As a result of analyzes, surface water quality in Karabuk is not suitable, it is appropriate for only irrigation according to national standards. Drinking waters are generally safe for drinking with exception Antimony, Copper and Selenium parameters in some regions. More researches are necessary to identify source of these parameters