

Development of Projects for the Prevention and Control of Groundwater Pollution in Rural China – A Brief Viewpoint

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Abstract

Groundwater pollution has become an issue of great concern in rural China. Consequently, a series of policies to control groundwater pollution and improve the groundwater quality have been implemented in China. However, these policies rarely provided suggestions on how to manage and protect groundwater in rural areas. In this paper, we illustrate many consequences of groundwater pollution in rural China, and suggest that environmental researchers need to work out a set of solutions for tackling the growing problem of groundwater pollution in rural China. Several viewpoints are suggested to be taken into consideration at least when formulating projects for the prevention and control of rural groundwater pollution in the future.

Keywords: Groundwater pollution; Groundwater management; Prevention

Introduction

Groundwater pollution is at the fore of public discourse in China. Some groundwater management policies for governing and protecting polluted groundwater, such as National Planning for Prevention and Control of Groundwater Pollution (2011–2020) [1] and Work Plan for Prevention and Control of Groundwater Pollution in North China Plain [2] have been implemented. However, these policies were primarily designed to tackle the pollution of groundwater in urban areas, and rarely provided suggestions on how to manage and protect groundwater in rural areas. Evidently, the groundwater pollution receives less attention in rural areas than in urban areas. Thus, the quality of groundwater in China has partially improved in some economically developed regions and large cities, whereas in less developed regions and rural areas, the condition has deteriorated and even become unmanageable [3,4]. In this paper, we briefly described the current status of groundwater pollution in rural China, and put forward some suggestions to effectively treat rural groundwater pollution.

Given that groundwater pollution in rural China has long been neglected, the safety of the rural residents' drinking water is at risk. As a result of the increasing investment in the implementation of projects to improve drinking water safety in rural China, the population suffering from unsafe drinking water has been reduced by over 220 million since 2004 [5]. However, though the quality of drinking water has improved for the greater number of the rural population, more than 196 million additional rural residents face health risks with their unsafe drinking water. This is partly due to the worsening condition of groundwater pollution [4,6,7]. Thus far, 298 million rural residents, which are almost half of the total rural population, do not have access

to safe drinking water [8]. Almost 70% of these residents are proved to be closely relevant to groundwater pollution. In rural China, more than 200 "cancer villages" and over 41.6 million rural residents suffering from endemic diseases [9], including arsenic poisoning, fluorine poisoning, Keshan disease, Kaschin-Beck disease, and goiter, have connected to the polluted drinking groundwater.

Moreover, close correlation has been found between rural groundwater pollution and urbanization in China [10–13]. Rural residents are the most direct victims of groundwater pollution because numerous villages still lack drinking water-processing facilities. Hence, in the case of groundwater pollution that threatens human health, rural residents are inclined to abandon farm work and relocate to urban areas as migrant workers. Henan, Hebei, Shandong, Anhui, Guangdong, Sichuan, and Heilongjiang provinces account for over 50% of the cancer villages, with over 70% of rural residents suffering from endemic diseases, as well as have the highest number of rural residents moving to urban areas as migrant workers [14]. Thus, groundwater pollution in rural China is not only an effect of urbanization, but also a factor responsible for accelerating the urbanization process [15]. Considering that China has the largest population in the world, we should be cautious about an exceedingly rapid urbanization process [16]. In this sense, environmental researchers should consider how to protect groundwater in rural areas to reduce the migration rate of farmers to cities.

In addition, groundwater is an important source of agricultural irrigation water for supporting the traditional staple food production in rural China, particularly in the north [17,18]. Unfortunately, more than half of the groundwater in irrigated areas has been seriously polluted and farmers continue to use the highly polluted groundwater for irrigation. Although the effect of polluted groundwater used for irrigation is less serious than that of polluted groundwater used as drinking water, groundwater pollution can still pose a risk to food

security and the consumers of the crops grown over time [19]. For example, rural residents in Heshan Village, Hunan Province feed on crops irrigated with polluted groundwater, which has an arsenic content that exceeds a hundred times the amount of water arsenic standard because of mining activities in the past 60 years. As a result, over half of the rural residents have suffered from arsenic poisoning, 157 of which have died.

Several suggestions may be taken into consideration to address the growing problem of groundwater pollution in rural China. Given the unique context of urban–rural dual economic structure, China will face an unprecedented challenge when formulating projects for the prevention and control of rural groundwater pollution in the future. Such projects must be different from those in urban areas, and will be more complex and difficult to implement. The executive department should focus on controlling pollution sources, enhancing the monitoring of issues related to rural groundwater environment, establishing a perfect risk management system and sound environment standard system for rural groundwater, strengthening technical support, and safeguarding sufficient funds to restore polluted rural groundwater. Thus, farmers, local executive department, enterprises, and scientists should cooperate to this end. First, measures should be proposed to subsidize farmers to improve the efficiency of fertilizer use and encourage them to adopt organic and ecological farming methods that are not dependent on heavy input of chemical fertilizer. Second, local executive department should serve as the principally responsible agents in implementing the projects for the prevention and control of rural groundwater pollution. Such projects should be funded by the local governments. In addition, the national executive department should increase interventions on local executive department to eliminate the power of local government–rural enterprise alliance. Third, several aspects of rural enterprises should be addressed, including the number and dispersion, substandard production technology, poor operation and management systems and routines, and their lack of environmental awareness. Finally, scientists have to guide the establishment of a surveillance network in rural China in order to fully understand the severity of groundwater pollution, and to establish a screening system for restoration technologies to determine the technologies that can support the restoration of polluted groundwater in rural China.

Conclusion

Overall, the groundwater pollution in rural areas is quite serious and has already threatened the health of local residents. Therefore, it is necessary to carry out pollution control and restoration projects to improve the quality of rural groundwater environment. We hope that our proposals can help to effectively control the pollution of rural groundwater in China.

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