

STUDY ON GROUNDWATER RESOURCES AND DRINKING WATER SAFETY OF XIANGCHENG COUNTY, HENAN PROVINCE, CHINA

Lili Liu¹, Changqian Zhu², Di Shi³, Wenxiu Sun⁴

^{1,4} School of Civil Engineering and Architecture, Southwest Petroleum University, Chengdu 610500, China

² School of Petroleum Engineering, China University of Petroleum(Beijing), Beijing 102249, China

³ School of Water Conservancy and Environment, Zhengzhou University, Zhengzhou 450001, China

Abstract:

Through literature research, questionnaire survey, the method of combining of xiangcheng groundwater resource distribution and the investigation of rural drinking water safety, and by the methods of probability and statistics for the data collection, investigation and data analysis, summed up the county of groundwater resources and the basic situation of the safety of drinking water, underground project form the survey data of detailed and reliable, and can provide effective reference for decision-making for the relevant government departments, for the county water resources utilization, protection and planning management is of great significance.

Keywords: Water Resource, Drinking Water Safety, Resources Investigation, Rural Environmental Protection

INTRODUCTION

Unsafe drinking water in rural areas, mainly drinking fluoridated water containing arsenic water and high salinity water pollution and high water, people a long time to drink this water, no assurance of health, chronic disease incidence rate is high, resulting in people a year treatment costs, labor ability difference, seriously restricted the local economic development and people's living standards improve. To solve the problem of rural drinking water safety has become the requirements of the times. With the gradual advance of the new rural construction, rural drinking water safety issues more and more attention by the party and state leaders. In July 2014, I and the other 3 students together, to carry out groundwater pollution and drinking water safety survey in Xiangcheng County, Henan province.

1. WATER RESOURCES IN XIANGCHENG COUNTY

Xiangcheng County, Xuchang City, Henan Province is located in the hinterland of the Central Plains, East relies on is the head of the Funiu Mountains, West meets the Huanghuai Plain in the eastern margin, geographical coordinates: longitude 113 degrees 22', 113 degrees 45', 33 degrees north latitude 42' - 34 degrees 02', an area of 920 square kilometers. County in the southwest undulating mountainous area, to stable hill is the highest, the sea dials 462.7 meters; northern hilly areas, sea dials 90-128; Middle East Plain, the sea dial 80-90 m; eastern lowland, altitude 64 meters. The terrain was from west to East, from northwest to

Southeast Wang Luo Xiang Fang Cun Jiang Zhuang Xiang Hebei Cun five, grade 1:1600.

Xiangcheng County is in the Huaihe River Basin, the territory of river size 16, throughout the county 16 township (town), northwest, flows southeast, 299.5 km total length, including North Ruhe River, Ying River, horse of the Yellow River, Zi River, new fan River, Yang River, slandering River, Liu Yejiang, Nirvana River from south to north, the Mara River, Majia River, Liuhe, Zhanhe, mud river, and culture of river. The southern sand Ru River system, east of Ying river. North Ruhe River, Ying River two major rivers, from the west, northwest entry, through 11 townships (town), 69.9 km total length, undertake overseas in 12 counties by the running water; tributaries of the territory has 14 seasonal river drainage, northwest, Southeast, South and southwest northeast direction and distribution in the county 16 townships (towns).

Xiangcheng county is rich in surface water, but uneven distribution, the amount is not available. The surface flow is the same as the natural precipitation, and the rainy season intensity is large and concentrated. The hills and plains area of artesian flow through the perennial for a total of 142000000 cubic meters, 3590000 cubic meters of reservoir can only control. Produced by the flow, more with the river discharge. The average annual rate of 1100000000 cubic meters. In the north of the largest river flow, up to 947000000 cubic meters. Baiguishan Reservoir Water Nan'an perennial (northruhe) 2260 cubic meters, 43000 acres of the design.

The main source of underground water of the county's irrigation water, due to the natural precipitation distribution in time and space, topography, soil lithology, buried depth of different conditions, the formation of the obvious difference of different shallow Shuifu District: depth 30 m, rich water from 0.1 to 2 tons / M hills weak watery zones accounted for 25% of the county area; buried depth of 5 meters, rich water 10-30 tons / metres of Zhongyuan secondary water rich area accounted for 48.4% of the area of the county; the transition between the two zone depth 5 - 10 meters, rich water for 5 - 10 tons / metres of Zhongyuan secondary water rich area accounted for 26.6% of the area of the county.

2 DISTRIBUTIONS OF DRINKING WATER

SAFETY ISSUES

In recent years, with the development of industrial and agricultural economy and the improvement of people's living standards, industrial wastewater, domestic sewage and other industrial water use is not up to standard discharge, resulting in the pollution of some water, some areas are affected by closed and semi closed terrain, underground runoff is not smooth, shaped into rural drinking water fluoride, arsenic, salt over the problem. 2009, Xiangcheng County Water Conservancy Bureau, Health Bureau of the county's 16 towns of drinking water safety survey showed that the rural drinking water unsafe number of 186000 people, of which: the population of 19000 people, over 38000 people, 12000 people suffering from salt water, water quality and serious pollution, 27000 people, 155000 people. These drinking water unsafe situation, to the farmers production, life has brought a safety hazard.

2.1 Origin and Distribution of High Fluorine

Under normal condition of the fluorine is colorless, thick layer is light yellow, with highly toxic and strong stimulation, in the air is easy to turn into hydrogen fluoride. Fluorine is a very strong oxidizing agent, which can be directly related to a lot of chemical elements to produce a simple compound, complex and complex ion.

Because of the above characteristics, the chemical and geographic migration of fluorine is very strong. Therefore, it is widely found in rocks, soil, water, air and animals and plants in the body most easily obtained. Rock ore is a huge source of fluorine, which is the material basis for the formation of endemic fluorosis of drinking water. The arid climate determines the distribution of the disease. A village of wangluozhen, population of 1290 people, as in endemic fluorosis area. The villagers mostly macular teeth, adult teeth, multi wear out were broken, some premature tooth loss; some villagers suffering from fluorosis, lumbocrural pain, limbs not agile, hunched over and labor capacity weakened. According to the results of the laboratory wangluozhen epidemic prevention station, the fluoride content in the drinking water in the village up to 5.6mg/l. Village prevalence number 780 people, the prevalence rate of 60%, including 542 dental fluorosis, accounting for 42% of the total number of the village, fluorine disease seriously affects people's health, weakened the labor of their ability to

get rich. At present, the village has been hit by a deep well, closed the upper water, the use of deep underground water way to use the safe water.

2.2 The Cause and Distribution of High Arsenic

Arsenic is widely distributed in the nature of non metallic elements, arsenic in the environment is often in the form of compounds, the most common is arsenic trioxide, soluble in water, highly toxic. People with drinking water, air or food for a long time, people with excessive arsenic and lead to chronic endemic arsenic poisoning, the county's main types of arsenic poisoning for drinking water. Ying Qiao Zhen village is a current population of 2147 people, due to excessive arsenic in drinking water caused 148 people in the village are different degree appeared skin lesions, palmoplantar hyperkeratosis, action inconvenience, visceral disease, lower limb ulcer arsenic poisoning symptoms. According to statistics, Xiangcheng County, the county has a population of over 38000 people.

2.3 Cause and Distribution of High Salt

High salinity is mainly for brackish water and chemical types as chloride or sulphate chloride type, due to the specific hydrogeological conditions caused by two, because the water contains a lot of chloride, sulfate, magnesium, calcium and iodine substances and bitter astringent. Salt content of water, drinking tea and other things can not be swallowed. People are more skin dry, hair early white, memory loss, high blood pressure, heart disease and other symptoms of high salt. According to statistics, Xiangcheng County salt over the number of 155000 people.

2.4 Cause And Distribution Of High Pollution

When the water of harmful substances over the self purification capacity of water, pollution will occur. The sources of water pollution are mainly the industrial wastewater, domestic wastewater and some industrial waste water. Water pollution according to different pollution of the different chemical pollution, physical and biological pollution. These forms of pollution in Xiangcheng county have varying degrees of existence. Ziyun TA Zhen Wang Zhuang Cun, Zhang Zhuang village, chemical plant emissions of sewage pollution, 30 m deep wells pumped water smells smelly, after drinking villagers prevalence increased significantly. According to the survey, more than 800 people in the village, women with breast disease in patients with unilateral breast resection of more than 20 people, 2 people, a bilateral resection, but also multiple gastrointestinal diseases. Number of Xiangcheng County high pollution has 2.7 million people, mainly distributed in economic development faster county urban and rural integration, Ziyun Town, Zhan Bei Xiang.

2.5 Cause And Distribution Of Local Water

Shortage

One is the thin mountain ridge of land, arable land, people living in scattered, 35 households formed a natural village, these places low-income farmers who is poor and backward area, plus mountain steep slopes, easily to cause soil erosion, some old water sources dried up, water shortage is very serious; the second is low in the past to build water engineering standards, coupled with aging year by year, benefit is getting lower difficulties arise draft; third, with the development of society, people on water quantity and quality requirements are also rising, and to improve their living conditions, occupies the site of the relocation, is also facing to improve drinking water quality and open up new sources of task. According to statistics, Xiangcheng County, the local population has 14000 people.

3 STUDY ON THE COUNTERMEASURES OF SOLVING THE PROBLEM OF RURAL DRINKING WATER SAFETY

Xiangcheng County is located in the North-South climatic transition zone, annual rainfall 674mm, belonging to semi humid and semi-arid climate, the frequent occurrence of drought, main reason is: in spatial and temporal distribution of rainfall caused by uneven most of the rainfall concentrated in the flood season rainstorm floods, drought and waterlogging caused staggered. Therefore, through the strengthening of soil keep working, increasing vegetation cover, vigorously improve slope land, the construction of retaining engineering, reduce soil erosion, increase rainwater infiltration rate, the underground water level has been restored and maintained a long-term balance is basis to ensure the effective utilization of water resources.

From the analysis of the hydrogeological structure, there are good conditions for the formation of the Xiangcheng county. In the earth rock mountain area, there are some uneven bedrock fissure water, mainly as follows: carbonate rocks, clastic rocks and metamorphic rocks of the 3 water bearing rocks. The county territory topsoil loose slope of gentle, good infiltration storage conditions, easy enrichment and the formation of groundwater, North Ruhe engineering on groundwater supplement. In this area provide the water to ensure that water quantity of single well up to 30-45t/h. Xiangcheng County North Wang Lo, Fen Chen area hillock is mainly diluvial loam with stiff stone, development, lots of local stiff stone Zhongrong hole and single well out of water 20-40t/h. The main hydrogeological structure provides a water source guarantee for solving the problem of rural drinking water safety.

Rural drinking water safety project is a great cause of the relationship between the rural population to prevent diseases, protect health, welfare, promote rural economic development and benefit future generations. Therefore, we must protect, manage, use good water supply engineering facilities. Water source is the source of water supply project, is the top priority of the water supply project, to double

protection, to ensure the sustainable use of water resources. Protection of water source engineering: to take well to strengthen management, build system of water supply station, benefited from the village to the water source protection nano pacts to, water conservation engineering is not destroyed equipment and not stolen, the establishment of the pump and pipeline maintenance, repair and overhaul of the system, the water supply project in good running condition.

Protection of water sources: for the surface water source, according to the relevant provisions of the state to protect the water intake of domestic water, limit the production and operation activities within a certain range of the water intake port. The local government should prohibit the construction of paper, leather, livestock and poultry farms or other high polluting industries or projects in the upper reaches of the upper reaches. To dry underground water supply area, the local government departments to coordinate the work of environmental protection. In the vicinity of the water supply works not to play the same depth or depth of the well, to ensure that the water supply conditions are not damaged or deteriorated, the normal use of water supply functions.

4 CONCLUSION

The groundwater resource in Xiangcheng County is not rich, and cannot meet the needs of the industrial and agricultural production and life. Most rural drinking water is from groundwater, which has the characteristics of high fluoride, high arsenic and high salt. The poor quality water induces the residents fluorine tooth, hypertension and other cardiovascular disease. Therefore, the local government should pay more attention to water resources protection, as soon as possible to help rural residents access to clean water, in order to ensure the health of the people.

ACKNOWLEDGMENTS

This paper is financially supported by Natural Science Foundation of China (Grant No.51174170) and China National Sci-Tech Support Plan Grant No. 2012BAC26B05

REFERENCES

- [1]. Pei GH, Yu F, Liu JJ. Feasibility Study of Individual Treatments of Desizing Wastewater. *Journal of Residuals Science & Technology*, 2015, 12(S1):85-91
- [2]. Huang L, Tang TW, Yang TT, Fang DL. The mixture theory for unsaturated bentonite. *Materials Research Innovations*, 2015, 19(S1):469-476
- [3]. Pei GH, Wang CY, Liu LL. Experimental Study on the Cause of Inorganic Scale Formation in the Water Injection Pipeline of Tarim Oilfield. *Journal of Chemistry*, 2015, AR 619834, DOI 10.1155/2014/619834
- [4]. Liu JJ, Song R, Cui MM. Numerical Simulation on Hydromechanical Coupling in Porous Media Adopting Three-Dimensional Pore-Scale Model. *Scientific World Journal*, 2014, AR 140206, DOI 10.1155/2014/140206

- [5]. Ji YJ, Zhang LZ, Yue JN. Solution of AntiSeepage for Mengxi River Based on Numerical Simulation of Unsaturated Seepage. *Scientific World Journal*, 2014, AR 270939, DOI 10.1155/2014/270939
- [6]. Le Yu, Jianjun Liu. Stability of interbed for salt cavern gas storage in solution mining considering cusp displacement catastrophe theory. *Petroleum*, 2015, 1(1):82-90
- [7]. Shuyong Hu, Yongkai Li, Ziwei Wang, Guoqiang Hu. A new approach of proration-injection allocation for water-flooding mature oilfields. *Petroleum*, 2015, 1(1):27-30
- [8]. Liu Baojun, Liao Shengping. The Present Situation, Utilization and Protection of Water Resource. *Journal of Southwest Petroleum University*, 2007, 29(6):1-11
- [9]. He Sha, Deng Gan. Ecological Compensation Mechanism Abroad and Its Illumination to China. *Journal of Southwest Petroleum University (Social Sciences Edition)*, 2010, 3(4):66-69
- [10]. Liu Jian-jun, Song Rui, Cui Meng-meng. Improvement of predictions of petrophysical transport behavior using three-dimensional finite volume element model with micro-CT images. *Journal of Hydrodynamics*, 2015, 27(2):234-241
- [11]. He Xiangli, Ye Mao, Jiang Yutong. Prediction of Groundwater in Minqin Oasis Based on 3D Numerical Model Including Unconfined Aquifer and Confined Aquifer. *Journal of Southwest Petroleum University (Social Sciences Edition)*, 2015, 37(3):168-173