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## ArcGIS-Based Rural Drinking Water Quality Health Risk Assessment

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### ABSTRACT

Aiming at the unsafe of water quality which is the core problem in rural drinking water safety, the study collected 221 water samples of rural drinking water sources in Ya'an and detected the concentrations of the carcinogen and the non-carcinogen. Based on the analysis of water environment characteristics and the identification of water environment health risk source of Sichuan Ya'an City, which includes seven counties and a district and is the typical region of the western margin of Sichuan Basin, this study calculated and analyzed the carcinogenic risk (R) and non-carcinogenic risk (hazard index, HI) by applying the health risk model recommended by the US National Research Council of National Academy of Science. Then, taking advantage of the geo-statistic spatial analysis function of ArcGIS, this study analyzed the assessment result data (R and HI), selected the proper interpolation approach and deduced R and HI spatial distribution maps of the study area. R and HI of the single factor and integrate factors were evaluated and thus obtained the following conclusions: For one thing, the cancerous risk indexes of the vast majority of water sources (about 94%) is the level of 10<sup>-7</sup> and it belong to the safety extension. The main carcinogen in the water sources are As, Cr<sup>6+</sup> and Pb, their concentrations are in the ranges of 0.004-0.01, 0.005, 0.01mg/l respectively and such water source mainly distributed in Yucheng district and Mingshan county. For another, the non-cancerous hazard indexes of the vast majority of water sources (about 98%) is also less than the limit value 1 and will not harm the local residents. The health risk of non-carcinogen comes mainly from As and fluoride, their concentrations are in the ranges of 0.004-0.01 and 0.1-4.2mg/l respectively. The results of the integrate factors health risk assessment showed that the total cancerous risk were still at the level of 10<sup>-6</sup>, only 12 drinking water source investigation sites (5%) exceeded the drinking water management standard value of EPA (the limit value is 10<sup>-6</sup>); the total non-cancerous hazard indexes are still in the range of 10<sup>-2</sup>-10<sup>-1</sup>, and will not harm the local residents either, only 18 drinking water source investigation sites (8%) exceeded the drinking water management standard value of EPA (the limit value is 1). The densely populated areas such as Yucheng District, Tianquan County, Yingjing County and Shimian County are where the four contaminating materials, i.e., As, Cr<sup>6+</sup>, Pb and fluoride should be monitored with emphasis. Study results disclosed the health risk control indexes of source water quality of the studied area and thus provided the scientific basis for the water quality control of water sources. This study had worked efficiently in practice. Compared with the same kind of methods which had been found, the paper had the outstanding results for the health risk assessment of the rural drinking water safety.

### KEYWORDS

Water Sources, Water Environment, Water Quality, Health Risk Assessment, Arcgis, Geo-Statistical Analysis, Ya'an City

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