

Study of Radiological and Chemical Effects of Uranium in Ground Water of SW and NE Punjab, India

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Abstract : The Laser Fluorimetry Technique has been used for the microanalysis of uranium content in water samples collected from different sources like the hand pumps, tube wells in the drinking water samples of SW & NE Punjab, India. The geographic location of the study region in NE Punjab is between latitude 31.21°- 32.05° N and longitude 75.60°-76.14° E and for SW Punjab is between latitude 29.66°-30.48° N and longitude 74.69°-75.54° E. The purpose of this study was mainly to investigate the uranium concentration levels of ground water being used for drinking purposes and to determine its health effects, if any, to the local population of these regions. In the present study 131 samples of drinking water collected from different villages of SW and 95 samples from NE, Punjab state, India have been analyzed for chemical and radiological toxicity. In the present investigation, uranium content in water samples of SW Punjab ranges from 0.13 to 908 µg/L-1 with an average of 82.1 µg/L-1 whereas in samples collected from NE- Punjab, it ranges from 0 to 28.2 µg/L-1 with an average of 4.84 µg/L-1. Thus, revealing that in the SW- Punjab 54 % of drinking water samples have uranium concentration higher than international recommended limit of 30 µg/L-1 (WHO, 2011) while 35 % of samples exceeds the threshold of 60 µg/L-1 recommended by our national regulatory authority of Atomic Energy Regulatory Board (AERB), Department of Atomic Energy, India, 2004. On the other hand in the NE-Punjab region, none of the observed water sample has uranium content above the national/international recommendations. The observed radiological risk in terms of excess cancer risk ranges from 3.64x10⁻⁷ to 2.54x10⁻³ for SW-Punjab, whereas for NE region it ranges from 0 to 7.89x10⁻⁵. The chemical toxic effect in terms of Life-time average Daily Dose (LDD) and Hazard Quotient (HQ) have also been calculated. The LDD for SW-Punjab varies from 0.0098 to 68.46 with an average of 6.18 µg/ kg/day whereas for NE region it varies from 0 to 2.13 with average 0.365 µg/ kg/day, thus indicating presence of chemical toxicity in SW Punjab as 35% of the observed samples in the SW Punjab are above the recommendation limit of 4.53 µg/ kg/day given by AERB for 60 µg/L-1 of uranium. Maximum & Minimum values for hazard quotient for SW Punjab is 0.002 & 15.11 with average 1.36 which is considerably high as compared to safe limit i.e. 1. But for NE Punjab HQ varies from 0 to 0.47. The possible sources of high uranium observed in the SW- Punjab will also be discussed.

Keywords : uranium, groundwater, radiological and chemical toxicity, Punjab, India

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