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The scourge of Malwa

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IT is well known in Punjab that the Malwa region shows a very high incidence of cancer, stunted growth and other neurological disorders. High level of uranium concentration has been found in the hair samples of children of Centre for Special Children, Faridkot by Dr Caren Smith, visiting toxicologist from South Africa. Blood samples were analysed in a German Lab. Besides uranium, lead, cadmium, strontium, barium were also found in the samples.

A study carried out by PGIMER Chandigarh doctors is not tenable because they compared the chemical quality of ground water in and around Talwandi Sabo (Bathinda) with that of Chamkaur Sahib, even though the two regions have different geology.

The absence of any systematic study carried out by Indian or foreign scientists has left sufficient room for wide and wild speculation on probable causes for this tragic phenomenon.

The high values of uranium have been attributed to Kota nuclear power plant; Khushab heavy water plant in Pakistan; and uranium-carrying winds from Afghanistan, without any scientific basis.

Though Malwa is a part of Punjab, geologically it is more akin to Haryana and Rajasthan.

There are no rocks exposed on the surface in the SW Punjab. However, the rocks of Aravalli-Delhi ridge and Malani granites and rhyolites are exposed at Tusham, district Bhiwani, just south of the region.

These rocks take a northwest turn from Tusham and become submerged under the Punjab Plains, only to get resurfaced at Kirana Hills, Pakistan. The gravity data have delineated 6 km wide and 240 km long pear shaped body under the Punjab plains covering the SW Punjab.

What is uranium

Uranium is a naturally occurring radioactive element which is present in trace in rocks, minerals plants and natural waters.

It occurs along with thorium and potassium in granitic rocks. It has the property to get dissolved in water in hexavalent form at a normal pH of 5 to 7). It gets precipitated in reducing environment in tetravalent form and form complexes such as hydroxides, phosphates, sulphate, carbonate etc.

Uranium compounds are soluble in water, very mobile and travel kilometres. When the bed rocks containing uranium and thorium and other elements are exposed to sun, rain, wind, they get weathered and break down to form soil.

Uranium gets dispersed in matrix, soil and finally gets re-deposited in areas/pockets where reducing conditions are present. Hence we get higher concentration of uranium in pockets.

The Tusham granites are high heat producing granites, that is, they are enriched in uranium, thorium and calcium. The uranium concentration in the granites is 8 to 11.5 parts per million (ppm) as compared to the normal value of 4.5 in granites in general. The average crustal value is 2.7 ppm.

The main source of uranium appears to be Tusham granites of Malani suite. There is a indiscriminate quarrying of granites being done at Khanak and adjoining areas of Tusham causing a lot of dust due to crushers.

Many young and old persons have been crippled due to contaminated water in Teja Rohila village of Fazilka. There is hardly any household in the village that does not have a severely affected person

Besides, there is a thick evaporites (salt) sequence with a total thickness of 130 m occurring at a depth of 305-350 m, below alluvium in Faridkot and Ferozepur districts. Evaporites also occur near Sirsa in Haryana. The evaporites have limestone, shale, gypsum, halite, sulphate etc. Limestone has 2.2 ppm and shale has 3.2 ppm of uranium.

Another natural source of uranium is the thick sediments under alluvium brought down by the Satluj and Beas rivers. In addition, the Satluj flows through Shivalik rocks which have dispersed uranium in them. Apart from these another source could be flyash coming out of the Bathinda thermal plant. Uranium gets concentrated after burning of coal. One kg of coal ash produced 2000 Bq of radioactivity whereas one kg of granite produced 1000 Bq of radioactivity in the environment.

A collaborative study undertaken by me and other scientists revealed that most water samples tested for uranium had higher concentration than the WHO-prescribed tolerable limit of 0.015mg/l, with some showing a value 20 times higher, that is 0.316 mg/l.

Interestingly, in spite of high concentration of uranium in water, the radon activity is within permissible limits (less than 400Bq/l) , because the gas escapes into the atmosphere.

Detailed study of chemical quality of groundwater in Jajjal, Malkana, Talwandi Sabo, Gyana and adjoining areas has shown that the groundwater in these areas contains more than the permissible limits of fluorine, sulphate, uranium, lead, chromium, and nickel, etc.

The high concentration of these elements can be attributed to the subsurface geology i.e. the presence of granitic rocks, evaporites sequence and limestone and dolomites. It may be mentioned that the chemical quality of ground water is influenced by the interaction of rainwater with bed rock, residency time of groundwater and the type of flow and the mineralogy of aquifers.

Permissible limit of sulphates in drinking water is 400 mg/l .However some of the samples we analysed , showed a value as high as 880 mg/l. It may be noted that excessive sulphate presence can cause diarrhea.

In small doses fluoride inhibits dental caries, while in higher doses it causes dental and skeletal fluorosis. Concentration levels of fluoride reported from groundwater in the study area vary from 0.30 to 3.82 mg/l. Here also, the upper value is way above the WHO limit of 1.5 mg/l

Lead is a poison and accumulates in the skeletal structure of human beings and animals. It has adverse effect on the central nervous system, kidney and may cause cancer and brain damage. While the prescribed maximum permissible limit for lead in drinking water is 0.05 mg/l, the six samples showed a range of values from nil to as high as 0.18 mg/l.

As is well known, there is indiscriminate use of agro-chemicals in the region as the area lies in the cotton belt of Punjab. The pesticides, phosphates and nitrogen fertilisers also contribute heavy metals such as lead, cadmium, mercury and arsenic to soil and water.

To sum up , the high concentration of hazardous elements in the region can be attributed to the reactions of groundwater with the rocks of buried Aravalli - Delhi ridge and uranium-rich granites of Tusham area along with the evaporites, including sulphur-rich limestone and dolomite which could contribute sulfate, carbonate and salinity to the groundwater.

It is unfortunate that we neither have authentic data on human misery nor a systematic scientific study of the causes thereof. There is urgent need for credible research carried out by an interdisciplinary team comprising geologists, medical doctors, nuclear scientists, biologists, anthropologists, agricultural scientists and others.

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