

Silent Holocaust

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the arsenic poisoning of the Man and Environment from ground water in West Bengal and Bangladesh is the greatest environmental disaster in history. Here in Bengal the agricultural fields are poisoned, eco-systems spoilt due to annual withdrawal and spreading of thousands of tons of arsenic through the pumping of arsenic contaminated ground water. At present one person is dying from arsenic related cancer every 15 minutes in Bangladesh. International experts have hold out the gloomy prospect for the Bengalees, that in near future there will be an epidemic of cancer where everybody including the doctors will be helpless. Chronic arsenic toxicity causes bladder and lung cancers, skin cancer, prostate cancer, kidney and liver cancers, diabetes mellitus and high blood pressure. Evidences have also piled up showing increased abortions, stillbirths, defective chiidbirths. Nervous System anomalies leading to lowered IQ among children, which has been shown to be as high as 14%. Arsenic is an element, which is ubiquitous. It is present on this earth from its beginning and will remain here forever. It only changes forms; some are toxic, while most others innocuous.

The mechanisms of toxicity of As(III) and As(V) in human systems are different. As(V) uncouples oxidative phosphorylation and inhibits energy generation by stopping ATP synthesis. As(III) reacts with SH groups in some proteins and enzymes and cause disturbances in the functioning of the biological processes. As(III) is more toxic than As(V). But in living systems transformation of one form to the other is quite facile. Arsenic is a potent endocrine disruptor. It disrupts the biological activity of the steroidal glucocorticoid hormone and gives rise to various diseases.

In-Situ remediation of arsenic may enable us to do away with “pump and treat” option or Ex-Situ remediation, which are fraught with constant problems of toxic waste disposal and continuous maintenance problems and cost in buildings, instruments, chemicals etc. In-Situ or Subterranean remediation would involve only periodic modification underground of the geo-chemical conditions of arsenic mobilization by making the conditions less reducing or oxidizing and manipulating of the relevant microbial ecosystems. The aim is of prevention of the release of arsenic that so far remained confined in the aquifer adsorbed or co-precipitated on ferric, aluminum or manganese oxyhydroxide compounds or minerals.

When organic carbon mediated by some microorganisms reduce ferric to ferrous iron and/or As(V)- to AS(III) the adsorbed/precipitated, immobile arsenic(V) becomes mobile.

If this microbe mediated Reductive Co-dissolution can be prevented or reversed, then arsenic along with some other polutants including manganese will be left behind in the aquifer walls and potable wholesome water can be pumped out.

This can easily be done and are being done in some countries quite for many years by periodic injection of oxygenated water through the wells into the aquifer by water jet air pumps or simply using gravity from overhead tanks containing oxygenated water. The oxygen of air or from cylinders may be utilized. The aquifer is used as a natural biochemical reactor. The exact conditions of the process need be worked out by geochemists and hydro-geologists for the real conditions existing in the Bengal aquifers. Introduction of permanganate or hydrogen peroxide may be helpful. After several cycles, say 2-days' of injection of oxygenated water followed by 40 days' of withdrawal of arsenic free water, the water quality improves further. If there are many wells connected to a common reservoir, then it is possible to get uninterrupted supply of arsenic free water. That such arsenic remediation technologies are possible and worth trying can be seen from some success stories from Europe and America. Bangladesh is trying to develop and adopt such technology.

In the north of Germany at Paderborn, such plants are in operation since the 1990s. The pumping station Schuwacht of the drinking water company Hydron-ZH is a bank filtration unit with the pumping wells located at a distance of 70-100m farther river Rhine, near Gouda, the Netherlands. In 1998 and 1999, pumping from some filters was periodically interrupted to inject a volume of treated and aerated groundwater. Water was injected at 30 m³/h for 2 days and immediately afterwards pumping was resumed at 23 m³/h for 40 days.

In-situ oxidation of arsenic and iron in the aquifer has been tried in Bangladesh under the Arsenic Mitigation Pilot Project of the Dept. of Public Health Engineering (DPHE) and the Danish Agency for International Development (Danida). The aerated tubewell water is stored in feed water tanks and released back into the aquifers through the tubewell by opening a valve in a pipe connecting the water pump to the tubewell pipe under the pump head. The dissolved oxygen in water oxidizes arsenite to less mobile arsenate and the ferrous iron in the aquifer to ferric iron, resulting in a reduction of the arsenic content in tubewell water. Experimental results show that arsenic is reduced to about half. The method is eco-friendly, simple and inexpensive. But the method was not so far able to reduce arsenic content to an acceptable level where arsenic content in ground water is high. Chlorine and potassium permanganate have also been used in Bangladesh for oxidation of As (III) to As (V) in many treatments.

This writer has reports (without details) that such a scheme is in operation in Mexico. One can see in the Internet that some NGO of Barasat. has a project "Subterranean Arsenic Removal : Experiment to Delivery" in collaboration with Stuttgart University, Germany, for which a grant of \$ 200,000 has been received. All these are encouraging. But what the Marxist government is doing? Simply nothing.

Despite the existence of Subterranean Arsenic Removal options which are less expensive, pro-people and eco-friendly, why people are flooded with a variety of expensive domestic arsenic filters and installations of troublesome costly arsenic removal plants? Is it because perpetuating the arsenic menace will help receive more grants and garner profits by some groups? Aren't the wounds of a leper beggar is a valuable capital for begging and lingering fears/or help sales promotion among the public?

References

1. Banglaya Arsenic O Prakriti Pratikar by Manindra Narayan Majumdar, Bhasha Prakash (2000).
2. Welch A. H. and Stolienwerk KG : Arsenic in Groundwater : Kluwer Academic Publishers, (2003).
3. Rott U. and Friedle M. in Arsenic Exposure and Health Effects: (Ed.) Chappell WR, Abernathy Co. and Calderon R.L. : Elsevier (1999).