HEALTH IMPLICATIONS OF ORGANICS IN GROUNDWATER: SOME MANAGEMENT PERSPECTIVES

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Summary

Organic solvents comprise a large group of compounds, with a variety of chemical structures. Their common characteristic, related to their widespread use in many industrial processes, is the ability to dissolve and readily disperse fats, oils, waxes, paints, pigments, varnishes, rubber and many other materials. "Lilis (1990), states that little is known about the natural history and prognostic significance of chronic solvent effects; at least part of the explanation is to be found in the subjective nature of most of the systems and the paucity of studies using objective methods for the assessment of neurological status." This paper examines the above issue in terms of its management by healthcare authorities and the implications of organics in groundwater. It also attempts to expose the health worker to the dynamics and dangers of organics in groundwater.

Introduction

The finding of the highly toxic organic pesticides, in groundwater and other organic chemicals is serious, and often find their way into drinking water supplies. What is the significance, and what programmes should be undertaken by those charged with protecting public water supplies? Essentially this is the theme of the paper, for purposes of dealing with this vexing issue, and its importance cannot be underestimated by those that work in the health sector and particularly in the public health sector.

Discussion

Not since the late 1880's when William T. Sedgwick noted the flood of new bacteriologic knowledge coming out of European research laboratories and applied it to the control of waterborne disease through the purification of water, have we been faced with as many unknown about the quality of drinking water. According to Metzler (1982: 1323) these mysteries of groundwater contamination are related to the nature of organics in groundwater, and their seemingly sudden appearance, their source, and their possible negative health effects." The potential of modern organic chemistry to benefit society is admittedly enormous. On the other hand, the rapid growth in the manufacture and use of synthetic organic chemicals, the seepage of waste dumps, the discovery of illegal underground disposal sites, and spills of toxic substances have focused the attention of healthcare and public health professionals on the chemical quality of drinking water. Worldwide interest in the reuse of water for potable purposes has also heightened the significance of its chemical content.

Analytical chemistry, with more sensitive techniques and new methods for finding organics, has revealed compounds not previously found in drinking water. "Sedgwick's was the age of microbiology. We are still concerned with microbial contaminants, but we have entered a new age of microchemistry and micro - chemical contaminants. Groundwater, which supplies 80 percent of the systems and 50 percent of the population in the United States, has been generally regarded as safe from contamination and as requiring minimum treatment before use. This assumption is now in question" (Council for Environmental Quality, 2011).

"Many organic compounds have been found in groundwater of nearly every state in the United States and in populated and sparsely populated areas of the world. Their concentrations are much higher than have been found in surface water supplies obtained from the Ohio and Mississippi Rivers and in many other rivers across the world" (Safe Drinking Water Committee, (1982). Several chlorinated hydrocarbon solvents which do not occur naturally have been found most frequently. Governments therefore, in many instances have to close down wells and test borehole water that is used for consumption. There is a real possibility, and this has occurred throughout the world, were leaking fuel tanks, gas storage cylinders / jugs in salt formations, and pipelines have contaminated drinking water. Investigation covering more than almost a century have, produced a wealth of information which is regularly examined by the Safe Drinking Water Committee, National Academy of Sciences in the US. Most countries conduct this type of examinations, for obvious reasons and this is regulated by governments for public health reasons and for purposes of promoting the healthcare of communities.

The causes of infectious disease outbreaks are much better understood than the possible chronic effects of chemicals. Chronic toxicity from lead or cadmium can occur over a period of years. Sodium is associated with age – related diseases of the circulatory system, while other trace elements in water may have a beneficial effect, that is, calcium and magnesium hardness seems to offer some protection against heart attack. Fluoride can be beneficial or harmful, depending upon its concentration. The same may be true of selenium and other chemical elements" (Last, 1982). Still quiet unknown are the possible chronic effects of long term exposure to trace levels of organic compounds in drinking water, new laboratory instrumentation permits such compounds to be detected at the part per billion or even part per trillion.. "The acute effects of more intensive exposure to many organics are known from industrial exposures, but most synthetic organics in drinking water are found at very low concentrations and may be ingested over many years. Little is known about their long term effects. The knowledge of long term exposures at low levels has not kept pace with the ability to manufacture new compounds or to detect them; indeed, it cannot be expected to do so by virtue of the time element itself "(Anderson et al, 1982).

Solutions have been sought through attempts to determine mutagenicity by screening with bacterial mutants, by extrapolation of high doze animal studies, and by epidemiologic studies with matched population groups. Each approach has important limitations. Assumptions must be made which leave the test results open to question; some of the difficulties are detailed in data previously cited. The establishment of maximum contaminant levels for trihalomethanes is an example of the difficulty of health risk assessment. Their presence, caused by the chlorination of organic materials in the raw water, has caused great controversy, and has also

called attention to the other processes in water purification which may be capable of promoting the synthesis of mutagens and carcinogens" (Zaki, 1982). "Of the 33 organic contaminants found most frequently in groundwater, in the US, 14 were selected by the National Cancer Institute for animal carcinogenicity experiments. Eleven of the 14 were carcinogenic in at least one species of animal; while this method provides only a crude measure of the human risks; the findings justify a conservative approach when confronted with organic contaminants. Detection of the nature and extent of groundwater contamination is often difficult and expensive. Invariably, monitoring wells are needed. Where should they be located? How deep? How sampled? Investigation of hazardous waste sites is by no means a simple undertaking. Specialized knowledge is also needed. The advice of engineers, geologists, geophysicists and others experienced in groundwater studies must be sought.

While research laboratories are finding new ways to measure the long – term effects of these synthetic organic chemicals in water supplies, public health officials must face the every day practical problems from the leaks in tanks and pipelines which store or transport fuels and chemicals. These facilities are 'born to leak' and owners seldom know the extent unless the losses are very high. Whereas canaries were once used to measure toxic gases in mines, and fish can be an indicator of pollutants in streams, we have no such alert mechanism for contamination of groundwater. Prevention is the only answer.

Healthcare management officials, utilizing management principles, techniques, strategies, and consolidating planning mechanisms must see to it that, proper controls are put into place, in order to prevent pollution and contamination of groundwater. In this regard municipalities must also play a leadership role. Health officials need to take a more aggressive stance in learning where and why synthetic organic chemicals occur in groundwater. The long term health effects of exposure to these compounds need to be determined. "The most important task and part of the management of the public sector health system is that, at present is the requirement of reevaluation of the actionable levels of the frequently encountered contaminants, should be emphasized" (Zaki et al, 1982). These actions are needed in an atmosphere of scientific objectivity, free of the hysteria which has accompanied some of the well publicized contamination incidents throughout the globe in respect of our medical history.

Conclusion

The central, government of South Africa and the nine provincial governments, together with the local authorities, the management of hospitals, and all health institutions within the Republic, have the responsibility to support the research and studies needed to establish minimum contaminant levels within the ambit of health protocols. The provinces must be better equipped to monitor their groundwater and to act promptly when safe levels are exceeded. While some provinces have had a groundwater protection strategy for a long time, these strategies were not designed to meet the threat from organic chemicals. Each provincial government must have an upgraded programme for the protection of fresh groundwater against contamination. The call for new programmes and additional expenditures in the face of diminishing financial resources to support them forces us not only to look critically at

present programmes, but also to become involved in decisions about how and where all government funds are allocated.

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