The Electrochemical Society
INTERFACE

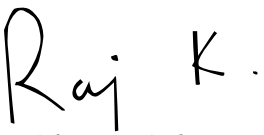
"Rocket Fuel" in Drinking Water and Milk?

Perchlorate has been in the media headlines in recent months, having been increasingly detected in soil, groundwater, irrigation run-off, and drinking water. Disturbingly, traces of this chemical have been found in dairy milk and even in the breast milk of nursing mothers. The quotation and question marks in the header above underline the fact that some of these media headlines are not entirely correct in a strictly chemical (and factual) sense and enjoy journalistic license. Specifically, perchlorate (mostly as the ammonium salt) is used as an *oxidizer* (rather than as a *fuel*) in missile and rocket propellant formulations and in flares, pyrotechnics, ordnance, explosives, and the like. Interestingly, no maximum contaminant level (MCL) currently exists for perchlorate, although the U.S. Environmental Protection Agency had initially asked for a MCL of 1 part per billion in drinking water. In the wake of a National Academy panel recommendation of a safe dose, this level may now be adjusted upward. Perchlorate competitively inhibits iodide uptake by the thyroid gland, resulting in the decreased production of thyroid hormones (TH). Early TH deficiency results in difficulty with processing visual-spatial information, poor sensorimotor coordination and memory/attention deficits. Perchlorate has been implicated with adverse effects in fetal and neonatal development.

Current concerns with perchlorate contamination began with its detection in Lake Mead, Nevada followed by a spate of similar findings in Arizona, California, Utah, Texas, and Massachusetts. My good friend and chemistry colleague, Sandy Dasgupta and his colleagues at the Institute of Environmental and Human Health at Texas Tech University (Lubbock) find from a very recent study, that while perchlorate levels in breast milk are high, iodide levels in breast milk are about one-third what they were 30 years ago. This finding underlines the problem with perchlorate in inhibiting iodide uptake/transport and suggests an effective countermeasure by increasing the recommended daily allowance of iodine for lactating and nursing women. Much activity and research on perchlorate remediation are presently underway, although it will likely be years before concentrations actually decrease in the environment.

Two metals in the environment, namely beryllium and cadmium, have also raised health concerns. Beryllium is used in an increasing number of products from cell phones and computers to cars and golf clubs. Ounce for ounce, this metal (as airborne dust) is claimed to be more harmful than plutonium, causing fatal damage to lungs and other organs. Cadmium uptake occurs through air, water, and food from contaminated crops. One crop that specifically accumulates cadmium is tobacco, making smokers very susceptible to bio-accumulation of this metal, specifically in dopamine-rich brain regions such as striatum. Regulatory and health agencies clearly have steep challenges ahead in setting proper exposure limits and standards for these metals, and more importantly, in assessing the outcomes of chronic exposure.

While technology is racing ahead, nature is also sending us cautionary periodic reminders for the need to balance economic and technological advancement needs with quality of life concerns. We owe it to future generations to pay heed to these "warning signals" and it is heartening to see that ECS is sponsoring more and more symposia on environment-related topics. Stay tuned.



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