

Perchlorate as an emerging contaminant – health implications, environmental forensics, and novel remediation techniques

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Perchlorate (ClO_4^-), the dissociated anion of perchlorate salts such as potassium perchlorate and ammonium perchlorate, is primarily used in the manufacture of solid propellants for rockets and missiles; it is also used in fireworks, road flares, blasting agents, automobile air bags, and lubricating oils. As a result of past production, storage and disposal practices, perchlorate has been identified in drinking water supplies throughout the world. Recent studies in the United States have shown ubiquitous human exposure through the detection of perchlorate in urine which has instigated its investigation as a possible food contaminant by the United States Food and Drug Administration (US FDA).

Perchlorate, as an anion, is different from most other water pollutants dealt with in the industry. As a salt, it can rapidly spread throughout groundwater plumes, resisting degradation and contaminating entire aquifers and municipal water supplies. Sourcing perchlorate can be difficult as natural sources of perchlorate exist mostly derived from Chilean nitrate fertilizers from the Atacama desert in Northern Chile. It has recently been shown that using environmental forensics techniques such as stable isotope analysis for oxygen and chlorine it is possible to distinguish between natural and anthropogenic perchlorate sources.

Perchlorate also has potential health implications due to its persistence and its ability to reduce iodine transport into the thyroid gland impacting the body's ability to produce and control thyroid hormone production. The United States Environmental Protection Agency (US EPA) and several state jurisdictions have instituted or are investigating perchlorate to determine appropriate drinking water standards. Because these agencies often use different reference doses (RfD), relative source contributions (RSC), and/or receptors when deriving drinking water standards, cleanup criteria or allowable limits for perchlorate in groundwater vary from one state to another.

Due to increasing focus on perchlorate research in the United States, many remediation technologies have been developed to remove perchlorate from drinking water supplies. These primarily involve using ion exchange through a number of engineered designs.

This presentation will cover the monitoring, detection (including isotopic fingerprinting), health implications and remediation of this emerging contaminant.

Dr. Court Sandau, Ph.D., P.Chem, is the co-founder of Trium Environmental Solutions Inc. and the director of Trium World Experts. Dr. Sandau's technical expertise includes analytical and environmental forensic chemistry, toxicology and risk assessment. Dr. Sandau is world renowned for his research on the metabolism of persistent organic pollutants and their human and ecological health impacts, especially impacts on the endocrine system.

Dr. Gwen O'Sullivan, Ph.D. Dr. O'Sullivan's technical expertise includes environmental chemistry and forensics in contaminated land and groundwater. Dr. O'Sullivan specializes in the application of natural attenuation as a risk based groundwater remediation strategy and the development of novel techniques for tracing the fate and behavior of organic compounds in the environment.

Dr. Erik Martin, Ph.D. Dr. Martin's technical expertise includes environmental and mechanistic toxicology, and human health and ecological risk assessment. Dr. Martin applies his toxicological expertise to evaluating potential human and ecological health impacts associated with contaminated sites and media.