

**OCCURRENCE AND DEPOSITION OF ATMOSPHERICALLY GENERATED PERCHLORATE IN  
ARID AND SEMI-ARID REGIONS OF NORTH AMERICA**

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**ABSTRACT:** Perchlorate ( $\text{ClO}_4^-$ ) occurrence in groundwater has previously been linked to industrial releases and the historic use of Chilean nitrate fertilizers. However, recently a number of occurrences have been identified for which there is no obvious anthropogenic source. The possibility that  $\text{ClO}_4^-$  contamination of surface and groundwater may have multiple origins (military, industrial, agricultural, or natural) complicates site characterization and efforts to assign responsibility for remediation. Other complications arise when assessing potential human exposure to  $\text{ClO}_4^-$ , especially if affected waters are used for drinking, livestock or irrigation of food crops. For example, human exposure to  $\text{ClO}_4^-$  has been documented in vegetation and in dairy milk. Until recently the well-documented Chilean deposits were believed to be the only occurrence of natural  $\text{ClO}_4^-$ . Recent studies that examined the  $\Delta 17\text{O}$  of Chilean  $\text{ClO}_4^-$ , nitrate and sulfate from these deposits indicate an atmospheric origin.  $\text{ClO}_4^-$  has been reported in atmospheric aerosols and precipitation in North America as well. Other reports of natural  $\text{ClO}_4^-$  occurrences in the US include a nitrate deposit in California and potash minerals and other evaporites from California and New Mexico, and more recently, a relatively large distribution of  $\text{ClO}_4^-$  in West Texas groundwater. Current work by this group indicates that a significant reservoir (up to 1kg/ha) of natural perchlorate is present in the unsaturated zone of semi-arid and arid areas of the Southwest in the United States and potentially the world. The perchlorate is most likely of atmospheric origin and concentrations in the subsurface are highly correlated to chloride concentrations which are known to have accumulated throughout the Holocene. This reservoir of perchlorate is sufficiently large to have a substantial impact on groundwater where irrigation from agriculture or urbanization is sufficient to flush accumulated salts. This relatively unexplored source may help to explain the growing reports of perchlorate in produce, milk, and other food items and should be considered when evaluating overall source contributions. This presentation will summarize the current understanding of natural perchlorate deposition and occurrence with particular emphasis on the potential for historical deposition to impact groundwater.

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