Background:
Although the distribution of perchlorate in the environment is not well documented, it is beginning to appear that perchlorate is more widespread than initially anticipated, albeit at relatively low concentrations and with sources that are not linked to known anthropogenic sources. Naturally occurring perchlorate has environmental, agricultural, and economic implications. The Department of Defense (DoD) is under increased scrutiny as a contributor of perchlorate in the environment, adding to the necessity to distinguish between anthropogenic and natural sources of perchlorate.

Objective:
This project seeks to identify and confirm natural mechanisms of perchlorate production, characterize hydrologic and geochemical processes for the selective geographic concentration of perchlorate, and supply field evidence of the atmospheric and geochemical processes involved in the formation of natural perchlorate in near-surface, geologically young environments.

Process/Technology Description:
Using a mix of new and established tools, researchers will investigate the occurrence, mechanisms of formation, and isotopic characteristics of natural perchlorate. Key elements of this project include (1) investigation of the role of chemical reaction mechanisms such as lightning discharges and energetic ultraviolet/ozone inputs with chloride-bearing water in the formation of perchlorate; (2) determination of accumulation mechanisms; (3) development of technologies to separate and purify minute amounts of perchlorate from complex matrices; (4) accurate chlorine and oxygen isotopic analyses of these micromolar-sized perchlorate samples; (5) collection, analysis, and characterization of natural perchlorate samples; (6) determination of the geologic, hydrologic, and climatic conditions under which natural perchlorate may be expected to form and be preserved in the environment; and (7) proof-of-concept tests. Collectively, this research should make it possible to distinguish natural from anthropogenic perchlorate and predict the occurrence and distribution of natural perchlorate.

Expected Benefits:
This project will provide DoD and the scientific community with the boundary conditions of natural perchlorate production, accumulation, and occurrence. In addition, it will lead to the capability to differentiate natural from anthropogenic sources of perchlorate as well as to predict where natural perchlorate will most likely be found under various geological and climatic conditions, greatly aiding forensic investigations of perchlorate in the environment. (Anticipated Project Completion - 2009)

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