## CATEGORY III -Water quality

# Development of Biosensors for Real Time Analysis of Perchlorate in Water

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## Executive Summary:

Perchlorate ($ClO_4^-$) has been used industrially for decades, and improper disposal techniques have caused significant contamination of soils and groundwater in the U.S. Recent studies have revealed that low concentrations of $ClO_4^-$ in drinking water and vegetables irrigated with $ClO_4^-$ impacted irrigation water can adversely affect human health and wildlife. The increasing need to measure $ClO_4^-$ in water has prompted the development of analytical methods such as ion chromatography (IC), capillary electrophoresis (CE) and $ClO_4^-$ ion selective electrodes. These methods are time consuming, expensive, sometimes cumbersome, and subject to human error due to complex procedures and various interferences. Thus, there is an urgent need to develop a method that can accurately predict and determine low concentrations of perchlorate in the field. Biosensors, analytical devices that utilize biomolecules or intact cells in conjunction with a transducer such as an electrode or an optical device, are now attracting considerable attention as potential successors to a wide range of analytical techniques due to their unique properties of specificity. Development of $ClO_4^-$ and chlorite ($ClO_2^-$) biosensors for *in situ* applications will provide sensitive, accurate predictions of $ClO_4^-$ and $ClO_2^-$ in environmental samples in real time. The major goal of this proposed research involves the construction of biosensors to monitor $ClO_4^-$ in groundwater using $ClO_4^-$ reductase and $ClO_2^-$ dismutase from two representative $ClO_4^-$ reducing bacteria, *Dechloromonas agitata* and *Dechlorosoma* sp. perc1ace. The enzymes will be purified from the two organisms, characterized and used for biosensor construction. Further studies will concentrate on overproduction of the biosensor enzymes by employing recombinant DNA techniques. The project will provide a method for the determination of $ClO_4^-$, as well as $ClO_2^-$, a potential indicator of the biological process of $ClO_4^-$ reduction *in situ*. The proposed study is relevant to California needs in that $ClO_4^-$ is currently a contaminant of serious environmental concern. Moreover, the proposed study is novel to previous studies on $ClO_4^-$ and $ClO_2^-$ detection.