Application Form
2006-07 TWRI Mills Scholarship Program

1. Name of Student and TAMU Student ID Number.

   SUCHETA PARKHI

2. Name and Contact Information for Faculty Advisor or Committee Chair.

   Dr. TIMOTHY KRAMER

   Office: **WERC 205-K, TAMU**
   Phone number: **(979) 845-9709**
   E-mail address**: tkramer@civil.tamu.edu**

3. Description of the student's proposed research, emphasizing how it will address a water resources-related concern (one page or less).

The objective of my research is to investigate an innovative treatment method for the destruction of oxy-anions like perchlorate in drinking water using electrochemically induced pitting corrosion of zero-valent Iron.

For decades, the Department of Defense (DoD) has tested and fired munitions on millions of acres or operational ranges to conduct research, development, evaluation of munitions and weapon systems, and training of personnel [(1)]. In these areas, a high density of unexploded ordinance (UXO), discarded military munitions or munitions constituents have been found and pose an imminent and substantial threat to public health risk [(2)].

Perchlorate salts, especially ammonium and potassium perchlorate, are powerful oxidizing agents that have been widely used in the military as major components in solid rockets and missile propellants, and also present in varying amounts in explosives. However in the aqueous phase, perchlorate salts are dissociated and perchlorate ion looses its strength as an oxidizing agent. From a thermodynamic standpoint, perchlorate should easily oxidize water and be reduced to chloride ion. However, the high activation energy barrier protects the perchlorate from the attack of common reductants and lends great stability to the ion [(3, 4)]. Additionally, the low charge density of perchlorate makes it highly soluble and mobile in aqueous environments [(3)]. Due to its stability and mobility, the perchlorate has often been detected in remote groundwater and drinking water from the perchlorate sites.

My research includes developing a simple method using zero-valent iron (Fe^0) to effectively reduce perchlorate to innocuous chloride. It has been known that iron metal is always protected by a thick natural oxide film that spontaneously forms on the surface of the metal in air and aqueous solutions. The oxide film, which is chemically inert in air and most aqueous solutions, serves to separate the thermodynamically highly reactive underlying Fe^0 from most natural environments. Thus, no chemical reaction is developed between perchlorate and Fe^0 in the presence of the surface oxide film. The research includes electrochemically inducing pitting corrosion that can remove the surface oxide film and develop rapid destruction of perchlorate on the exposed bare Fe^0.

The experimental setup is simple and includes Fe^0 sheets placed in the reactor as an anode and a cathode and connected to a DC power supply to develop pitting corrosion. A Potentiostat is used to measure the pitting potential.

The general goals of this project are to improve perchlorate elimination by the Fe^0 process to a cost effective system and evaluate the influence of any field conditions and design factors which significantly affect the applicability or long-term performance of the Fe^0 process for perchlorate reduction. The research will provide answers regarding 1) a detailed understanding of the mechanism of perchlorate and co-contaminants (TCE and Nitrate) elimination by the Fe^0 process, 2) an improvement of the Fe^0 system to a cost effective process 3) an assessment of the Fe^0 process for full-scale demonstrations.

Successful completion of the overall studies will lead to development of an innovative treatment technology that can completely destroy toxic contaminants including perchlorate, TCE and nitrate, and significantly reduce remediation costs for perchlorate contaminated Department of Defense (DoD) sites, and contribute to the protection of public health from perchlorate contamination.

4. Proposed use of funds resulting from this Scholarship (for example, to pay tuition, conduct research, etc.). One to two paragraphs or less.

The funds availed from this scholarship will be used for multiple reasons. The foremost use of this scholarship will be to pay my tuition at Texas A&M University. Some of it will also be used to buy lab supplies and equipments as needed. It can also aid me in participating in water-resources related programs. I can also buy material required for my research as well as my further course-work.

5. Intended career path the student anticipates pursuing. (One to two paragraphs or less).

I have enjoyed an interdisciplinary approach in my environmental studies major so far and become aware of the environmental needs and concerns. Furthermore, my research in the related field is helping me gain knowledge and develop a good base for my future endeavors. My research has also facilitated me develop responsibility, efficiency and commitment towards my work. I would like to continue exploring and developing techniques that would deal with water-related problems. Eventually, I would like to contribute my proficiency to the industry and in the educational field, and persist in working towards building an environment free from toxins.