

5, 1, 4 3.3 m I-049

# INQUIRY PROPOSAL

## Selenium Bioremediation Technology Research and Development Center

**Submitted by :**

Lawrence Berkeley National Laboratory  
Center for Environmental Biotechnology  
Bld 70A, 1 Cyclotron Road  
Berkeley, CA 94720

**in cooperation with**

Department of Water Resources  
San Joaquin District  
3374 East Shields Ave  
Fresno, CA 93726

University of California, Berkeley  
Department of Civil and Environmental Engineering  
Department of Molecular and Cell Biology  
Algae Research Laboratory  
Berkeley, CA 94720

San Luis and Delta Mendota Water Authority  
842 6th Street, Suite 7  
P.O. Box 2157  
Los Banos, CA 93635

Panoche Water District  
52027 West Althea Ave  
Firebaugh, CA 93622

July 27, 1997

## I. EXECUTIVE SUMMARY

(a) **Project Title** : Selenium Bioremediation Technology Research and Development Center

**Name of Applicants** :

Nigel Quinn, Lawrence Berkeley National Laboratory, (510) 486-7056, nwquinn@lbl.gov  
Jo Anne Kipps, Department of Water Resources, (209) 445-5289, jkipps@water.ca.gov

(b) **Project Description** :

An opportunity exists for the demonstration of innovative selenium load reduction technologies with the recent authorization of the interim Grasslands Bypass Project. Selenium treatment technologies were previously constrained to produce a 5 ppb selenium product water which led to excessive costs per acre foot of drainage water treated. The San Joaquin Valley Drainage Program (SJVDP) recognized that treatment costs in excess of \$100 /acre-ft were unlikely to be affordable to San Joaquin Valley farmers. The relaxation of this constraint and the new emphasis on selenium load reduction creates opportunities for the testing and demonstration of innovative flow-through selenium bioremediation technologies. The availability of the Los Banos Desalting Facility, closed since 1985, for the continued development of these technologies and the interest shown by the University of California in promoting and funding opportunities for applied graduate and undergraduate research, creates further opportunities for synergy and a long-term solution to selenium drainage problems in the San Joaquin Valley.

### **Grasslands Bypass Project**

The Grasslands Bypass Project (GBP) allows agricultural drainage from approximately 90,000 acres of farmland to be diverted from wetland channels within the Grassland Water District into the San Luis Drain. The former DWR Desalting Facility is located adjacent to the 28 mile section of the San Luis Drain used in the Grasslands Bypass Project between Checks 9 and 10.

### **DWR Desalting Facility**

The advantages of a common facility at which several prototype selenium removal technologies can be compared side by side include the economies sharing of common laboratory and plumbing facilities, site security and easy demonstration of the technologies.

The former DWR Desalting Facility is located on an 800 acre tract of land and contains 30 marshponds, two half acre solar ponds and associated pond facilities, a reverse osmosis unit, associated pre-treatment and post-treatment water holding tanks and two large buildings on a concrete pad (attachment 1). The Facility was in operation between 1980 and 1985 and was closed after the discovery of selenium toxicosis in Kesterson reservoir. The marshponds were used to remove turbidity from drainage water and to optimize the efficiency and cost effectiveness of salt removal using reverse osmosis. The marshponds are 300 feet long and 50 feet wide and unlined. The solar ponds are one half acre in area and approximately 15 feet deep. Two large buildings on the concrete pad in the front of the Facility contain the remnants of a workshop and laboratory. The concrete pad and the two main buildings are surrounded with a 6 foot high chain link fence. There are locked gates on the east, south and west sides of the enclosure.

An extensive groundwater monitoring well field exists at the site. During operation of the Facility DWR routinely collected data on groundwater elevations, groundwater chemistry and soil chemistry. Additional data were collected by DWR during 1995 and 1996 for site remediation purposes:

### **PROPOSED TREATMENT SYSTEMS (See attachment)**

1. Wetland Flow-Through System : (Horne, Leighton, Quinn - UCB/LBNL)
2. Algal-Bacterial Advanced Pond Treatment System : (Oswald, Green, Lundquist - UCB)
3. Subsurface Selenium Immobilization : (CH2M-Hill, LBNL)
4. Upflow Selenium Bioremediation Reactor : (Kipps - DWR)

**(c) Approach/Tasks/Schedule:**

The proposed treatment systems would be constructed in the first year of the project if all four received funding. Full proposals for treatment systems 2 and 4 have been submitted for implementation during the first cycle of Category III funding. Implementation costs would be reduced for these projects if combined at Los Banos owing to sharing of facilities.

**(d) Justification for the Project and Funding by CALFED**

Selenium and nitrate have been identified by the CALFED Water Quality Technical Group as water quality stressors of concern in the San Joaquin River and the Delta. The proposed facility would reduce selenium and nitrate loadings both the San Joaquin River and Bay-Delta.

**(e) Budget Costs : (3 year duration) : Total cost : \$ 3,330,000**

TASK NO.	Wetland Flow - Thru system	Algal-bacterial pond system	Subsurface immobilization	Upflow reactor
Labor + overheads	184,000	990,000	150,000	145,000
Materials / travel	161,000	350,000	105,000	94,000
Site Restoration	55,000	866,000	45,000	14,000
Laboratory	85,000	94,000	60,000	22,000
TOTAL	495,000	2,300,000	360,000	275,000

**(f) Applicant qualifications**

The team members for each project comprise individuals with more than a decade of experience working with selenium drainage issues in agriculture and in the oil industry.

Professor Alex Home , UCB : Expert in wetland ecology and wetland treatment systems.

Professor Terry Leighton, UCB : Expert in applied of selenium biotechnology to ag and oil industry

Dr Nigel Quinn, LBNL : 15 years of experience in selenium drainage research and monitoring.

Professor William Oswald, UCB : International expert in advanced pond treatment technologies.

Dr Bailey Green, UCB : Specialist in design and construction of algal treatment systems.

Dr Harry Ohlendorf, CH2M-Hill : Wildlife biologist and expert in selenium toxicology

Dr Sally Benson, LBNL : Expert in selenium hydrochemistry and remediation technologies.

Ms Jo Anne Kipps, DWR : Engineer with 20 years experience in selenium treatment technology.

Mr Dan Nelson, SLDWA : principal representative of federal ag contractors in Grasslands Basin.

Mr Dennis Falaschi, Panoche Water District : chief executive of largest water district in Basin.

**(g) Monitoring and Data Evaluation**

The monitoring and data gathering will be specifically tailored to the requirements of each treatment system. To facilitate mass balance analysis and to assist the DWR in their commitment to restore the site each of the reactor units will be lined to prevent selenium, boron and salt from

**(h) Local Support/Coordination with Other Programs**

The Bioremediation, Education, Science and Technology Program (BEST) at U.C. Berkeley is an innovative educational program designed to meet the growing national needs for environmental professionals and to increase the participation of traditionally under-represented groups. The BEST Research Program at U.C. Berkeley focuses on the development of microbial technologies for the environmental restoration of contaminated sites and remediation of contaminated waste-streams. The Los Banos Desalting Facility would provide an ideal learning environment for BEST interns interested in selenium treatment technology. The benefit to the Facility will be the leveraging of more than \$1,000,000 in research funds to support research and demonstration activities.

