



May 15, 1997

Richard Gimello
Assistant Commissioner, NJDEP
CN028, 6th Floor
401 East State Street
Trenton, New Jersey 08625
(Transmittal Via Fax # 609-777-1914)

RE: Cost proposal For Iron Powder Treatability of Sediment and Dredge Materials

Dear Mr. Gimello:

As a follow-up to our correspondence dated April 17 which consisted of technical information regarding our zero valence iron powder treatment technology, Accutech is pleased to provide this cost proposal for treatability and benchscale tests to evaluate the feasibility of treating Passaic River sediments using zero valence iron powder.

The scope of this proposal is as follows:

Project Tasks

The project entails the laboratory investigation of the effectiveness of the proposed iron powder technology in treating target contaminants in a sediment matrix. These may include PCB's, chlorinated pesticides and herbicides, chlorinated semi-volatiles, dioxins, Furans and metal salts. The zero valence iron has successfully been used to remediate chlorinated volatile organic compounds and lindane, its use in treating the above halogenated organics has not been investigated.

PHASE I Laboratory Investigation

Task I-1. Site selection and Sample Collection: This task entails the selection of a location in the Passaic river from which sediment samples will be collected and where a future in-situ demonstration may be conducted. The sampling location will be made on the basis of certain criteria which include the following:

Previous knowledge of contamination history of site and levels of target contaminants

How representative is the location with respect to the levels of contamination and the priority for remediation.

Samples will be collected from the selected site and will be characterized in the laboratory. Characterization parameters will include, naturally occurring organic matter (NOM), grain size, PCBs, dioxins, and heavy metals concentrations. The leachability of the pollutants will be evaluated using the toxicity characteristic leaching procedure (TCLP).

Task I-2 Direct Contact Treatment of Sediment: This task entails the execution of shaker flask scale treatability studies to determine the effectiveness of the E-200 iron powder in treating the various toxic contaminants present in the sediment under well mixed conditions. In these experiments, the organic pollutants and heavy metals in the sediment samples will be treated by mixing the Fe powder with sediment samples under batch conditions in closed reactors employing shaker tables. Different dosages of Fe powder will be added in the sediment samples. The effectiveness of different percentages of Fe powder on the concentration reduction of the various contaminants will be measured. A control sample without the addition of Fe powder will be prepared and tested alone with the treated samples. All experiments will be performed in duplicate. The Fe and contaminants in the sediment samples will be mixed for different time periods. Two batch samples will be analyzed at 2, 5, 10, and 20 days of reaction times. The total contents of the organic pollutants, such as PCBs, dioxins, and other halogenated organic compounds in the samples will be determined with solvent extraction procedures according to EPA standard methods. The leachability of the heavy metals in the samples will be evaluated using TCLP test. The experimental results obtained will be used to determine the optimal Fe dosage required for the treatment of the contaminated sediments. The data obtained will also be used to design the insitu sediment treatment process that will reduce the chlorinated organics and metal salt to targeted levels in the sediment.

Task I-3 Laboratory Column Tests: An in-situ Fe treatment may be developed by placing a layer of Fe powder on the surface of the sediment. The iron powder can potentially migrate downward into the sediment bed due to its high specific gravity of 7.8 and mixing of the sediment with the iron powder due to the turbulence induced by river flow. Also, the reactive hydrogen produced from the reduction of water by the iron powder can diffuse into the sediment and reduce the chlorinated organic compounds in contact with the catalyst that exist in the sediments naturally occurring organic matter.

In order to simulate this treatment scenario, column tests will be conducted. A series of columns will be filled with the sediment sample. Then, Fe powder will be placed on top of the sediment in the columns. Control columns without Fe powder will also be

prepared. Various advection and diffusion transport mechanisms will be simulated. After several weeks of reaction, sediment samples will be collected at different depths. The samples will be analyzed for total PCB, dioxin, and PAH contents and TCLP leachability. The water column will also be analyzed for the content of target contaminants. All experiments will be conducted with water collected from the field site.

At the completion of this testing, we expect to have all the necessary parameters to design and execute a pilot scale demonstration project of the technology.

Phase II In-Situ Delivery Method

Task II-1 Selection of Iron Powder Delivery Method: In order for in-situ application of this technology to become possible, a suitable delivery mechanism of the iron powder to the contaminated sediment must be investigated. We intend to investigate several methods of achieving the delivery. The important issues associated with the iron powder delivery are:

- Minimum loss of the powder to areas outside the target sediment
- Ability to deliver powder to targeted locations
- Minimum re-suspension of contaminated sediment during placement operations

These issues will form the basis upon which various delivery techniques will be evaluated. A two phase program is proposed. In the first phase various delivery techniques will be evaluated in the laboratory. These techniques include:

- a) Direct application of iron powder to the surface of the sediment
- b) Surface application in a slurry form
- c) Shallow injection of iron powder/sediment slurry

Experiments will be conducted in a laboratory experimental tank to assess the effectiveness of each technique in delivering the iron powder. Parameters that will be used to evaluate the suitability of each method include:

- Uniformity of iron powder distribution
- Stability of powder in the sediment surface under varying water column current conditions (varying bottom shear stresses)
- Re-suspension of sediment during delivery

Equipment adaptability and cost issues

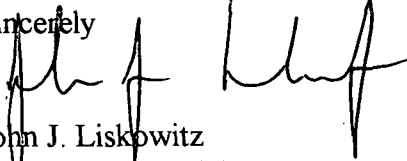
The results of this study will be used to design a delivery system suitable for field scale operations.

Task II-2 Final Report: Upon completion of all the project tasks, the feasibility of the application of the technology will be demonstrated. This will include in addition to the technical issues, cost and technology market potential as well as a final plan for commercialization. A final report will be prepared to document the project results and identify the critical steps needed to implement the commercialization plan.

An attached cost breakdown to show the allocation of the funding is attached to this correspondence.

Please contact us at 908-739-6444 with any questions you may have regarding our technology.

Sincerely



John J. Liskowitz
Accutech Remedial Systems