

## 2003 CASI Project Concept

A project concept submitted to the OC-ALC TTA for funding consideration in CASI Program.

### Pilot Testing of Hollow Fiber Bioreactor Technology

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### 1.0 Background

OC-ALC provides depot level maintenance to Air Force weapons system. This includes chemical cleaning, chemical paint stripping and electroplating operations. Wastewater generated from maintenance activities is treated in the industrial wastewater treatment facility. Aircraft chemical depainting operations at OC-ALC involve the use of solvents primarily composed of methylene chloride, benzyl alcohol, and phenol. Currently, there is no process dedicated to the treatment of these volatile organic compounds. Proposed EPA regulations and process improvement initiatives to reduce energy costs, improve plant efficiency, and produce a high quality effluent have prompted studies of alternative treatment methods for the treatment of organics from chemical depainting operations.

### 2.0 Problem Statement

The objective of this study is to evaluate two technologies and determine the method most effective in treating the organic waste stream generated from OC-ALC chemical depaint operations.

### 3.0 Anticipated Methodology/Tasks

The first technology utilizes activated biomass adhered to hollow fiber membranes to consume the organics in a plug-flow bioreactor. This biotic process has the potential to reduce VOCs by 80-85% without significant loss to the surrounding atmosphere. A pilot-scale bioreactor will be constructed in the pilot-scale testing facility at the industrial wastewater treatment plant [IWTP]. The bioreactor will be acclimated to the organic waste stream and monitored for methylene chloride, toluene, phenol, TCE and PCE concentrations using a hand-held PID-GC analyzer. The pilot-scale reactor is an extension of the bench-scale studies completed in the Summer 2001 CASI project. However, that project concentrated on the destruction of a citrus-based degreaser / cleaner [PENAIR HD-1] and not specifically VOCs. The second technology utilizes sparged air to volatilize the organic compounds for subsequent release into the surrounding environment. This abiotic process [equalization basins] is currently poorly designed at the IWTP and produces a low VOC reductions potential. This process will also be evaluated in the pilot-scale IWTP facility, with some minor modifications. The primary process change would be to convert the existing parallel flow scheme to a plug flow [allowing for a higher hydraulic residence time], and thus potentially higher VOC reduction.

### 4.0 Anticipated Schedule

For the 2003 CASI program, the following schedules/periods of performance are allowed (you may wish to include this list and check all of the periods of performance that you would accept, i.e.):

- Execution and Completion of Project between June 1 and August 31, 2003.
- Execution and Completion of Project between June 1 and May 31, 2004
- Executed as a single project, or

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- Executed in two or more phases with an intermediate set of deliverables and successful completion of the intermediate deliverables required before funding successive phase(s).  
NOTE: CASI research phases will normally have completion dates that correspond to the academic researcher's semester schedule, i.e., August 15 or December 31.
- Execution and Completion of Project between August 15, 2003 and May 31, 2004
  - Executed as a single project, or
  - Executed in two or more phases with an intermediate set of deliverables and successful completion of the intermediate deliverables required before funding successive phase(s).  
NOTE: CASI research phases will normally have completion dates that correspond to the academic researcher's semester schedule, i.e., August 15 or December 31.
- Execution as the first phase of a multi-year project. NOTE: Due to funding mechanisms, only the effort between June 1, 2003 and May 31, 2004 can be funded by the 2003 CASI program. The project must produce a set of intermediate deliverables at the end of the 2003 funding cycle and funding of successive phases/years is contingent upon funding availability, project priority, and performance.

### 5.0 Anticipated Deliverables

The deliverables are to investigate and recommend the method most effective in treating the organic waste stream generated from OC-ALC chemical depaint operations. A Final Report shall be submitted which includes the results as well as a description of any work associated with the project. A cost benefit analysis will be required and a final briefing will be held at the end of the project period. In addition, brief monthly status updates shall be submitted to the project manager for the purpose of project tracking.

### 6.0 Anticipated Benefits

The proposed US Environmental Protection Agency metal products and machinery rule will drastically decrease the amount of metals and organics in effluent discharged. Although the current ITWP has sufficient processes to treat the metal waste, there is no existing unit operation dedicated to reduce the VOC content. The research herein will investigate two plausible approaches for the reduction in VOC. The investigation shall include an on-site assessment of two treatment options using the existing pilot-scale IWTP facility to determine the reduction efficacy of VOC. The study shall use the results from these pilot-scale studies to develop a process methodology. The alternatives will be compared and evaluated for both technical and economic feasibility.