

**QUARTERLY PROGRESS REPORT**  
**September 1, 1999 – December 31, 1999**  
**DEP Contract No. BIO99-01: Bioreactor Landfill Project**

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**ACCOMPLISHMENTS**

**Work Accomplished During the Quarter**

A response to the first Request for Additional Information (RAI #1) was submitted to DEP on September 27, 1999.

New River Regional Landfill installed piping for the Bioreactor Site on October 5, 1999.

The leach field was installed on October 12, 1999.

Drs. Reinhart and Townsend gave a presentation on the Florida Bioreactor Landfill Demonstration Project to the DEP Solid Waste Program meeting on October 29 in Daytona Beach.

A research team meeting was held on November 11, 1999 at the DEP Northeast District Office in Jacksonville. The purpose of the meeting was to discuss the second RAI (request for additional information) on the landfill construction and operations permit application.

A response to RAI #2 was submitted to DEP on November 18, 1999.

Project manager applications were submitted to the Center by the December 15, 1999 deadline.

A response to RAI #2.5 was submitted to DEP on December 23, 1999.

The research team is currently monitoring the pressure transducers, investigating the instrumentation package design and testing, and exploring alternative in situ moisture measurement devices.

A system has been designed that will allow the bioreactor to be operated aerobically or anaerobically. Instrumentation placed on the landfill liner surface in May has provided data which has been presented in periodic reports as well as at the Center's Advisory Board meetings on September 3 and December 10, 1999.

The researchers continue to provide input to the bioreactor design team and have updated the Operations Plan. They are currently planning an alternative in situ moisture measurement device experiment.

The researchers are investigating the Volusia County Landfill as potential second bioreactor site. Volusia County recently adopted a unique process for shredding the waste at the landfill face as the waste is received. Landfill operators estimate an increase in compacted density of approximately 50%.

The research team has developed a bid package.

### **Deliverable Status Report**

**Objective 1:** *Design and operate the bioreactor using innovative techniques and concepts.*

#### **Deliverables for Objective 1**

1. Statement of successful placement and operation of instrumentation and equipment.

Pressure transducers to measure head of leachate on the liner were successfully installed in the leachate collection system on cell 2.

2. Presentation of data from instrumentation in periodic reports.

Data collected from the cell 2 pressure transducers have been presented in previous presentations to the Center advisory board and progress reports from the UCF investigators.

3. Establish Bioreactor Web Site.

A bioreactor project web site has been established at [www.bioreactor.org](http://www.bioreactor.org).

*Additional Comment:* The bioreactor landfill has been designed using innovative techniques and concepts. The design includes both aerobic and anaerobic treatment zones and cap system to collect gases emanating from the landfill. Instrumentation beyond that mentioned above has also been designed to monitor and control the system.

**Objective 2:** *Design and operate the bioreactor in a manner to control and measure the major inputs and outputs.*

#### **Deliverables for Objective 2**

1. Description of inputs and outputs in periodic reports.

Measurement of inputs and outputs will begin once the bioreactor construction has been completed and operation begins. The bioreactor has been designed to collect information on the inputs and outputs using state-of-the-art techniques and concepts.

2. Presentation of data in periodic reports.

Data regarding the measured inputs and outputs will be presented as part of the normal reporting process once bioreactor operation begins. Data are currently being collected on leachate quality.

**Objective 3:** *Evaluate the use of aerobic bioreactor landfill technology and compare the aerobic approach to the use of anaerobic bioreactor technology.*

#### **Deliverables for Objective 3**

1. Presentation of data in periodic reports.

The bioreactor has been designed to evaluate the use of aerobic technology for achieving rapid landfill stabilization. The bioreactor has also been designed to collect data needed to make this evaluation. Information relating to the design of the landfill is found in the permit application to DEP. Preliminary issues regarding the use of aerobic technology are also available.

**Objective 4:** *Instrument the landfill bioreactor to permit in-situ monitoring of bioreactor activity and to measure previously unmeasured information (e.g. leachate head on the liner).*

#### **Deliverables for Objective 4**

1. Statement of successful placement and operation of instrumentation and equipment.

Pressure transducers to measure head of leachate on the liner were successfully installed in the leachate collection system on cell 2.

2. Presentation of data in periodic reports.

Data collected from the cell 2 pressure transducers have been presented in previous presentations to the Center advisory board and progress reports from the UCF investigators.

Additional Comment: The bioreactor has been designed to include in-situ instrumentation for measuring landfill temperature and moisture content. These devices will be installed during bioreactor construction and data collection will begin immediately after.

**Objective 5:** *Monitor the bioreactor in a manner that measures the impact of bioreactor activities and allows for control of the waste treatment process (e.g. leachate and gas composition and generation, waste characteristics, settlement).*

#### **Deliverables for Objective 5**

1. Models for use in generating protocols for controlling the waste treatment process.

The landfill has been designed to collect the data necessary to model the waste treatment process. Work on such models will begin after the start of operation of the bioreactor and upon collection of data.

2. Protocols for controlling the waste treatment process

The landfill has been designed to collect the data necessary to generate protocols for controlling the waste treatment process. Such models will be developed upon collection of data.

3. Methodology for quantifying settlement.

The measurement of settlement of the bioreactor will begin as soon as final waste placement in the bioreactor is complete. Surface elevations will be measured using an Ashtec GPS surveying system purchased as part of the bioreactor project. The settlement data will be completed with data collected to measure the degree of waste settlement, gas emissions, and leachate quality.

**4. Presentation of data in periodic reports.**

Data regarding the degree and progress of biological treatment and landfill stabilization will be presented in periodic reports. Initial leachate data (baseline for the bioreactor) are available. The laboratory methodology for characterization of leachate, landfill gas, and solid waste has been developed. The methodologies to be used are presented in the bioreactor DEP quality assurance project plan. This plan was developed specifically to address quality control and quality assurance issues associated with collection of data from the bioreactor project.

**Objective 6:** *Collect data through instrumentation, field monitoring, and laboratory analysis that will enable the project team to assess the success of the project, the feasibility of this technology for other sites, and to enable the future design and operation of landfill bioreactors in Florida.*

**Deliverables for Objective 6**

**1. Presentation of data in periodic reports.**

The bioreactor has been designed to evaluate the use of bioreactor technology (both aerobic and anaerobic). The data collected will be used to assess the success of the various technologies evaluated. The results of such assessments will be presented in periodic reports and other publications.

**Objective 7:** *Develop standardized design and operation procedures for this technology.*

**Deliverables for Objective 7**

**1. Models for use in generating protocols for standard operating procedures.**

The landfill has been designed to collect information necessary to develop models of this type. Development of such models will begin after bioreactor operation has commenced.

**2. Standard Operating Procedures**

The landfill has been designed to collect information necessary to develop standard operating procedures. Development of standard operating procedures will begin after bioreactor operation has commenced.

**3. Models for use in simulating physical, chemical, and biological processes occurring in landfill bioreactor.**

The landfill has been designed to collect information necessary to develop models of this type. Development of such models will begin after bioreactor operation has commenced.

**4. Presentation of data in periodic reports.**

Data from the efforts referred to in deliverables 1, 2, and 3 of objective 7 will be presented in periodic reports after bioreactor operation has commenced.

**Objective 8:** *Further define and quantify the true costs and benefits of landfill bioreactors.*

**Deliverables for Objective 8**

**1. Methodology for preparation of cost/benefit analysis**

The methods for preparation of the cost/benefit analysis will be developed during the first year of bioreactor operation.

**2. Periodic cost/benefit projection reports throughout project**

Periodic cost/benefit reports will be presented after the bioreactor has commenced operation and the methodology for preparing such analysis has been developed.

**3. Project's Final Report to include a Cost/Benefit Chapter describing potential impact of bioreactor landfill on post-closure care costs and financial responsibility regulations.**

The project's final report will include a detailed cost analysis of bioreactor landfill technology based on information gathered during the project.

**Objective 9:** *Provide a resource and training ground for students in the State University System, landfill operators, and engineers in Florida.*

**Deliverables for Objective 9**

**1. Schedule and description of training opportunities**

A schedule and description of training opportunities will be developed following the commencement of bioreactor operations.

**2. Report on the attendance and results of training opportunities**

Attendance and results of training opportunities will be reported.

**3. Plan for extending training after the project.**

A plan for extending training after the project will be developed.

*Additional comment:* The bioreactor landfill project has already provided training, research, and education opportunities to a number of students from the University of Florida and the University of Central Florida. Efforts will be made to involve students from other

Universities as the project commences. Information on the proposed design and operation of the bioreactor has been presented to various state, national, and international audiences at a number of meetings.