

**NORTH CAROLINA DEPARTMENT
OF ENVIRONMENT AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL HEALTH
ON-SITE WATER PROTECTION SECTION**

**CONTROLLED DEMONSTRATION
WASTEWATER SYSTEM APPROVAL**

CONTROLLED DEMONSTRATION NO: CDWS 2009-06

ISSUED TO: Joe Walsh, President
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FOR: BioKube® Wastewater Advanced Pretreatment System

APPROVAL DATE: November 20, 2009

In accordance with General Statute 130A-343, 15A NCAC 18A .1969 and .1970, a proposal by Ashtecs for approval of the Biokube® wastewater advanced pretreatment system has been reviewed, and found to meet the standards of a Controlled Demonstration system when all of the following conditions are met:

A. GENERAL

1. Scope of this Controlled Demonstration Approval includes:
 - a. Use, design and construction requirements for the specified models of Biokube® wastewater advanced pretreatment systems to meet TS-I or TS-II effluent quality standards specified in Rule 15A NCAC 18A .1970.
 - b. Special operation, maintenance and monitoring of the Biokube® wastewater advanced pretreatment systems and associated subsurface systems to ensure the treatment performance standards shall be met at all times.
 - c. Proposal for evaluation of this Controlled Demonstration system.
2. Influent waste strength to the Biokube® wastewater advanced pretreatment system as permitted with this approval shall not exceed domestic septic tank quality effluent standards pursuant to Rule 15A NCAC 18A .1970(b).

3. This controlled demonstration is initially limited to 200 systems with design flows of up to 3,000 gallons per day. The intent of this Controlled Demonstration is to gain field experience sufficient to qualify this system for Innovative Approval, pursuant to Rule .1969(g).
4. Use of the Biokube® wastewater advanced pretreatment system that has a design flow exceeding 3,000 gallons per day may be permitted after approval by the Department on a case-by-case basis in accordance with the Large Systems Review/Approval Process (Rule 15A NCAC 18A .1938).
5. Use of the Biokube® wastewater advanced pretreatment system for facilities having a design flow less than 3,000 gpd and exceeding domestic septic tank quality effluent standards pursuant to Rule 15A NCAC 18A .1970(b) may be proposed by a Registered Professional Engineer to the Department for review and approval on a case-by-case basis, prior to permitting by the local health department. The system design must include the likely wastewater strength (BOD5, total BOD, TN, TSS) taking into account the expected organic loading (pounds of BOD) and hydraulic loading of the pretreatment system.

B. ADVANCED TREATMENT PERFORMANCE STANDARDS (TS-I and TS-II)

The Biokube® wastewater advanced pretreatment systems are designed, installed, operated and maintained to meet TS-I or TS-II effluent standards in accordance with Rule .1970. Refer to Rule .1970(a) Table VII - Effluent Quality Standards for Advanced Pretreatment Systems for treatment performance levels.

C. SITING CRITERIA

Sites may be used for the initial installation of a Controlled Demonstration system when they meet the requirements of this Section and the criteria for a conventional, modified, alternative, approved innovative or accepted wastewater system. The site shall have a repair area of sufficient size to install such a system and the Manufacturer agrees to provide another approved system if the Controlled Demonstration system fails to perform properly. Exceptions to the repair area requirement are as set forth in Rule .1969(f) (3) and (4).

Controlled Demonstration pretreatment systems may also be used as a repair to an existing malfunctioning system when there are no other approved or accepted repair options.

The Biokube® wastewater advanced pretreatment system and associated drainfield shall be sited and sized in accordance with Rule .1970 for TS-I or TS-II systems.

D. DESIGN CRITERIA

1. The Biokube® wastewater advanced pretreatment systems and the corresponding soil absorption systems shall be designed and sited in compliance with Rule .1970.
2. The Biokube® wastewater advanced pretreatment system utilizes two tanks, a pre-settlement tank and the Biokube® tank. The system and tank sizing is specified in Table 1 below.

Table 1		
Design Flow (gallons per day)	Minimum Pre-Settlement Tank Size (gallons)	Minimum BioKube System Model
≤ 600	1500	Venus 600

3. All pre-settlement tanks shall be septic tanks approved by the Department and by Ashtecs, specifically for use with the Biokube® wastewater advanced pretreatment systems.
4. The Biokube® wastewater advanced pretreatment system consists of the following:
 - Pre-settlement tank
 - BioKube tank constructed of polypropylene with all interior and exterior walls at least 8 mm thick, bottom at least 10 mm thick and containing the following compartments and components
 - a. Flow equalization chamber with dosing pump (119 gallons)
 - b. 1st treatment chamber containing biofilter block-media and diffusers (256 gallons)
 - c. 1st clarification chamber with sludge return (60 gallons)
 - d. 2nd treatment chamber containing biofilter block-media and diffusers (138 gallons)
 - e. 2nd clarification chamber containing UV when required, sludge return and water recirculation and the outlet for the clean water by gravity or to pump tank. (31 gallons)
 - f. Electrical compartment to house system controller, air pumps and phosphorous control unit if applicable.
5. Multiple BioKube® units can be used for flows larger than 600 GPD but must be designed by a North Carolina Professional Engineer and approved by the Department.
6. A UV system already approved by the Department is required for TS-II installations.

7. The access lid of the BioKube® tank shall be secured with a stainless steel rod and locking device.
8. Site specific buoyancy calculations shall be completed by a North Carolina Professional Engineer if any part of the BioKube® advanced pretreatment system intersects the seasonal high water table. The calculations will be reviewed and approved by the Department on a case-by-case basis. A minimum of 5,400 lb of concrete is required when additional concrete ballast is needed.
9. Any tanks installed in paved areas must be traffic rated and must have been approved by the Department. As an alternative to a traffic rated tank, a North Carolina Professional Engineer may propose a site specific design for a traffic rated slab over a non-traffic rated tank. The proposal must be reviewed and approved by the Department.
10. Effluent dispersal from the Biokube® system can be by gravity, drip, or LPP systems.
11. Drip systems or LPP systems will have a separate pump tank following the BioKube system outlet. Timed dosing shall be provided to the disposal field.
12. Drip systems or LPP systems shall have control panels with pump cycle and run timer recording capability and shall meet the requirements of Rule .1952. When utilizing a drip system, a separate control panel must be used for the drip system unless the Department has approved a combination panel for the BioKube® and drip system.
13. The Biokube® wastewater advance pretreatment system is controlled by a programmable logic controller (PLC) located within the electrical compartment of the BioKube® system. The ORC must be able to access the controller when at the site. Changes to the software can be made by a laptop computer or from a mobile phone with Bluetooth capability. Ashtecs will work with the individual local health departments on a case-by-case basis to ensure that they have access to the controller, independently of the ORC.
14. Alarm events will be monitored using the web based NSF Onsite Monitoring Program telemetry system or Department approved equal. The 7-day and 30-day flow reading will be stored in the control panel on site. When the data upload option is available, in intervals of 30-days the panel will call the website and post data.
15. Influent samples shall be taken from within the inlet tee of the pre-settlement tank. Effluent samples shall be taken from a spigot or sampling port that is placed on the force main from the final dosing tank or from a free flowing sampling port after the outlet on gravity systems.
16. Biokube® wastewater advanced pretreatment systems shall be designed by an Ashtecs certified designer or by a North Carolina Professional Engineer. All systems over 600 gallons per day must be designed by a North Carolina Professional Engineer.

E. INSTALLATION AND TESTING PROCEDURES

1. Prior to the beginning of any required site improvements or system installation, a preconstruction conference shall be required to be attended by the system designer, Ashtecs certified installer, and local health department (LHD).
2. The Biokube® wastewater advanced pretreatment system shall be located in compliance with the horizontal setback requirements of Rule .1950(a) and Rule .1970 and shall be located to prevent surface/subsurface water inflow/infiltration. The top of the BioKube tank shall be a minimum of 12” from ground level. The drainfield horizontal setback requirements are in accordance with Rule .1970 for TS-I or TS-II systems.
3. The BioKube® Venus shall be installed so that either the top of the unit or the electrical control system is located outside the system and above the 100-year flood level or otherwise protected against a 100-year flood.
4. All Biokube® wastewater advanced pretreatment systems shall be installed according to directions provided by Ashtecs in the “BioKube Installation and Operation & Maintenance Manual” and instructions found on Ashtecs drawings and specifications for each system. Additionally, all Biokube® wastewater advanced pretreatment systems and components used shall be installed in accordance with all applicable regulations and manufacturer instructions.
5. All individuals/companies installing Biokube® wastewater advanced pretreatment system shall be in possession of all necessary permits and licenses before attempting any portion of an installation. The individual/company must be a level IV installer and Biokube® certified/authorized.
6. The Biokube® wastewater advanced pretreatment system and all connections shall be water tested prior to backfilling.
7. The water testing for the tanks shall be demonstrated by a 24-hour leakage test conducted at the installation site. A water level change of 1/2 inch or more, within a 24” riser, over 24 hours, or visual observation of leakage shall be cause for failure of the watertightness test. Initial water level shall be to 2” above the riser/adaptor seam in the pre-settlement tank and any dosing tank and to the operating level of the BioKube Venus tank.
8. An Ashtecs certified system operator shall startup and commission the Biokube® wastewater advanced pretreatment system for each installation and shall provide an installation and start approval letter to the LHD prior to issuance of the operation permit, certifying that the system start-up and installation is in accordance with all Ashtecs requirements.

9. Specified site preparation steps and construction specifications for the ground absorption system shall be strictly adhered to, including specified depth of trenches in relation to site limiting conditions, cover material specifications (if needed), trench installation method, etc.
10. Prior to Operation Permit issuance, the final Health Department construction inspection shall include at least the following checks:
 - a. Observation of the water tightness testing.
 - b. Testing the controls and alarm settings.
 - c. Recording all pump model numbers and time clock settings.
 - d. Checking to ensure vents are installed and functional.
 - e. Confirming that the riser hatches have tamperproof bolts and/or riser lock ring.
11. Each BioKube® control panel or alarm shall have a label as shown in Attachment A.

F. OPERATION, MAINTENANCE AND TESTING

1. Biokube® wastewater advanced pretreatment systems shall be classified at a minimum as a Type Vc system according to Table V(a) of Rule. 1961(b). Management and inspection shall be in accordance with Rules .1961 and .1970.
2. All Biokube® wastewater advanced pretreatment systems require an operation and maintenance agreement between the system owner and Ashtecs or its authorized representative, as per Rule .1970. The system shall be inspected by a certified Subsurface Operator. The Certified Operator shall be either an employee of Ashtecs or authorized in writing by Ashtecs to operate and maintain the system. The operator must have proper equipment and training to access and program the system controller on site.
3. All Biokube® wastewater advanced pretreatment systems shall be operated and maintained according to the latest version of the Ashtecs BioKube® O&M manual.
4. The operator report shall be submitted to the health department within 30 days of the date of the system inspection and shall include all the information specified in F.5 at a minimum.
5. At each Biokube® wastewater advanced pretreatment systems inspection the Operator in Responsible Charge (ORC) shall, at a minimum, observe, monitor, and record:
 - a. wastewater level in the tanks,
 - b. sludge and scum levels in the pre-settlement tank and aeration chambers,
 - c. the effluent filter screen in the pre-settlement tank for clogging,
 - d. the functioning of the controller, aeration system blowers, diffusers ,
 - e. that the bioblock media is evenly aerated and that air bubbles surface evenly,
 - f. level and spread of biofilm on the media,
 - g. the dissolved oxygen content in the clarification chambers and pump compartment

- h. watertightness of tanks, risers and pipe connections at tanks,
 - i. operation of pumps, floats, valves, electrical controls, NSF telemetry and alarms,
 - j. the condition of tubing from blowers to the diffusers and sludge air lifts,
 - k. the condition of the outlet filter screen in the 2nd clarification chamber,
 - l. pumping frequency from the controller,
 - m. drainfield pump delivery rate (drawdown test),
 - n. drainfield dosing volume and measured or calculated average pump run times,
 - o. the condition of the tanks and landscaping around the system,
 - p. any structural damage, accessibility, adequate ventilation, excess odors, ponding of effluent, insect infestations, vegetative growth over the drainfield, the drainfield area for surfacing of effluent, and a sample of Biokube® wastewater advanced pretreatment system effluent collected from the sampling point to check for effluent clarity and odor, and
 - q. the pump cycle and run time meters and any water meter readings.
6. The ORC shall also conduct other additional observations, measurements, monitoring, and maintenance activities as specified in the Operation Permit and as recommended by the manufacturer and as approved for the site specific disposal system.
7. Sampling and Testing
 - a. All sampling shall be done in accordance with Rule .1970(n).
 - b. All systems shall be tested for effluent CBOD₅, TSS, NH₄-N, and fecal coliforms. TS-II system effluent shall be additionally tested for TN. Influent shall be tested for BOD₅ and TKN.
 - c. Influent samples shall be taken from the inlet sanitary tee of the pre-settlement tank.
 - d. Effluent samples for drip disposal systems or other pressurized dispersal systems shall be collected from a tap on the drainfield forcemain (prior to spin filters for drip systems). The preferred location of the tap is in the pump tank discharge assembly. The sample shall not commence until at least 30 seconds of continuous discharge through the sample tap has been completed. Effluent samples from gravity systems shall be from a free flowing sampling port after the outlet.
8. Notification and Performance of Maintenance and Repairs
 - a. The ORC shall alert Ashtecs, the local health department, and the system owner within 48 hours of needed maintenance or repair activities including, but not limited to, landscaping, tank sealing, tank pumping, filter blockage, outlet blockage, pipe or control system repairs, and adjustments to any other system component.
 - b. The pre-settlement tank will be pumped when the ORC or local health department determine it is needed and in accordance with the Biokube® wastewater advanced pretreatment systems Operation & Maintenance Manual. At a minimum, the pre-settlement tank will be pumped whenever the solids level exceeds 25% of the tank's total liquid working capacity or the scum layer is more than 4 inches thick.
 - c. The tank(s) shall be pumped by a properly permitted septage management firm, and the septage handled in accordance with 15A NCAC 13B .0800.

- d. The ORC shall notify the system owner, Ashtecs, and the local health department whenever the pump delivery rate efficiency or average pump run time are not within 25% of initial measurements conducted prior to system startup.
- e. System troubleshooting and needed maintenance shall be provided to maintain the pump delivery rate and average pump run time within 25% of initial measurements conducted during system startup.

9. Reporting

- a. The ORC shall provide a completed written report to Ashtecs, the system owner, and the local health department within 30 days after each required visit. At a minimum this report shall specify:
 - (1) the date and time of inspection,
 - (2) system operating conditions observed according to F.5, above,
 - (3) system operating conditions measured according to F.6 and F.7 above,
 - (4) results from any laboratory analysis of any influent and effluent samples,
 - (5) maintenance activities performed since the last inspection report,
 - (6) an assessment of overall system performance,
 - (7) a list of any improvements or maintenance needed,
 - (8) a determination of whether the system is malfunctioning, and the specific nature of the malfunction, and
 - (9) a summary report of data retrieved from the BioKube controller indicating actual flow and operating conditions.
- b. Proposal for Evaluation and Reporting
 - (1) The manufacturer shall maintain a contract for evaluation of the performance of the controlled demonstration wastewater system with Don Alexander.
 - (2) The third party shall review the site-specific sampling and flow-monitoring protocol, collect and analyze the ORC inspection reports, sampling and monitoring data, and prepare Semi-Annual Reports summarizing all data for all the sites. These reports are due by January 31 and July 31 of each year, and shall include all data gathered through December 31 and June 30 of the previous six-month period, respectively. These reports shall provide information to the Department based upon the monitoring data and observations made from the Controlled Demonstration systems installed pursuant to this Approval. This should include an assessment of system performance in relation to the established treatment performance standards; an assessment of physical and chemical properties of the materials used to construct the system, in terms of strength, durability, and chemical resistance to loads and conditions experienced; recommended areas of applicability for the system; and any conditions and limitations related to the use of the system.
 - (3) Upon completion of the research and testing protocol, and prior to completing any application by Ashtecs, to the Department for reclassification of the Biokube® wastewater advanced pretreatment system as an Innovative System, and within a maximum of five years of the effective date of the first Controlled Demonstration

System Operation Permit (CDSOP) issued pursuant to this approval, the approved third party shall prepare a Final Report to the Department that includes the results from all of the systems installed during the Controlled Demonstration, including sampling results, flow-monitoring information, ORC reports, etc., and provide recommendations on future use of the system. The Final Report shall be in electronic format and may be published on the On-Site Water Protection Section's website without confidentiality. The contents of the interim and final reports shall not be altered from the original document without approval from Ashtecs.

- (4) The research and testing protocol that is proposed and agreed is as follows:
- (a) All systems will be sampled quarterly.
 - (b) A minimum of 15 sites must be sampled.
 - (c) A minimum of 50 data points is required, with at least two data sets per site collected over a 12-month period.
 - (d) For coastal resort communities, the two samples shall take place between June 1 and September 8 of each year. The samples must be taken at least six weeks apart. Other seasonal homes shall be sampled during the times of greatest use.
 - (e) A copy of the sample results will be provided to the On-Site Water Protection Section directly from the laboratory after the analyses are completed.
 - (f) The Department and Ashtecs agree that any systems that are out of compliance due to owner intervention, i.e. excessive flows, chemical disposal, or high strength waste, etc., shall not be considered in the Controlled Demonstration approval and any test results from those systems shall not be held against Ashtecs or the Biokube® wastewater advanced pretreatment systems.

11. Effluent Quality, System and Site Compliance. Compliance of each site and the system shall be in accordance with requirements set forth in Rule .1970. Consideration shall be given for the system to be reclassified as an approved Innovative system when the requirements of Rule .1969(g)(2) for "Fast Track" approval and system compliance requirements of Rule .1970(o)(2) have been met.

G. RESPONSIBILITIES AND PERMITTING PROCEDURES

1. Prior to the installation of a Biokube® wastewater advanced pretreatment system at a site, the owner or owner's agent shall notify the local health department of their proposed use of such a system. The local health department shall issue an Improvement Permit and an Authorization to Construct or amend a previously issued Authorization to Construct allowing for the use a Biokube® wastewater advanced pretreatment system. Up to 200 Biokube® wastewater advanced pretreatment system can be installed statewide upon a finding that all the provisions of this Approval and all other applicable rules are met
2. The Improvement Permit and Authorization to Construct shall contain all conditions the site approval is based upon, including the proposed use of the Controlled Demonstration System. The operation permit will include all conditions as specified in the Improvement

Permit and Authorization to Construct. Notification of the issuance of all Operation Permits by the local health department, pursuant to this Controlled Demonstration, Approval shall be submitted to the On-Site Water Protection Section.

3. When a special site evaluation is required pursuant to Rule .1970(p)(1), an evaluation and written, sealed report from a Licensed Soil Scientist regarding the site shall be provided to the local health department. The report shall contain the information specified in Rule .1970(p)(2) and “Requirements for Submittals of Soil Reports and Pretreatment and/or Dispersal System Designs”. The local health department may request the assistance of their Regional Soil Scientist in evaluating this report prior to Improvement Permit issuance.
4. The Biokube® wastewater advanced pretreatment system shall be designed by one of the following: an Ashtecs certified designer or North Carolina Professional Engineer.
5. Prior to the issuance of an Authorization to Construct for a Biokube® wastewater advanced pretreatment system, a design submittal prepared by an authorized designer or North Carolina Professional Engineer shall be submitted for review and approval by the local health department. The design submittal shall include the information specified in “Requirements for Submittals of Soil Reports and Pretreatment and/or Dispersal System Designs”.
6. It is recommended that local authorized environmental health practitioners attend a design training session offered by the manufacturer prior to permitting the system. Also, at the request of the local health department, a Regional Engineer will review the design.
7. The Ashtecs authorized installer and authorized designed must certify in writing that the system was installed in accordance with the approved design prior to Operation Permit issuance.
8. A professional engineer shall certify in writing that a system required to be designed by an engineer was installed in accordance with the approved plans and specifications prior to Operation Permit issuance.
9. For sites required to be evaluated by a Licensed Soil Scientist or Professional Geologist (see Section G.4, above), the health department may specify as a condition on the Improvement Permit and Authorization to Construct that a Licensed Soil Scientist or Professional Geologist oversee critical phases of the site improvements and drainfield installation and certify in writing that the installation was in accordance with their specified site/installation requirements prior to the Operation Permit issuance.
10. The operator shall be present during initial system commissioning. The ORC shall be certified both as a NC Subsurface Operator and an authorized Ashtecs Biokube® system Operator.

H. REPAIR OF SYSTEMS

The provisions of 15A NCAC 18A .1961 (c) shall govern the use of the Biokube® wastewater advanced pretreatment systems for repairs to existing malfunctioning wastewater systems.

Approved By: _____ Date: _____

Attachment A

Label is 4.75" long by 1.5" tall.

**NON-TYPICAL SEPTIC SYSTEM
BIOKUBE® WASTEWATER
RECYCLING SYSTEM
CONTROLLED DEMONSTRATION
SUBSURFACE WW OPERATOR NAME
AND CONTACT INFORMATION**