GWINNETT COUNTY
DEPARTMENT OF FINANCIAL SERVICES
PURCHASING DIVISION

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July 25, 2025

ADDENDUM #3
BL083-25
Purchase and Installation Support of Odor Control System for Influent Distribution Box at F. Wayne Hill Water Resources Center

****BID SUBMITTAL DEADLINE HAS BEEN POSTPONED UNTIL FRIDAY, AUGUST 01, 2025, NO LATER THAN 2:50PM****

The following addition/changes modify the Bid No. BL083-25 "Purchase and Installation Support of Odor Control System for Influent Distribution Box at F. Wayne Hill Water Resources Center " Contract Documents, dated June 2025, as first advertised on June 18, 2025.

I. Revisions:

R1. In the Invitation of Bid, under the paragraph "Bid submittal date and location", CHANGE the date shown from "~~July 28, 2025~~" to "August 01, 2025" no later than 2:50 P.M. This date change should also be changed throughout the bidding documents.

R2. Please use the attached (A1) REVISED bid schedule (Pages R2 through R5).

II. Questions:

Q1. Is there anyway that the General Arrangement drawings can be released for this bid? The drawings that were included in the addendum are the Process & Instrumentation layout and these didn't provide any information on the actual physical layout of odor control unit or the ducting that is required to be included.

A1. Drawings are not available at this time. Final layout will be coordinated with Engineer during shop drawing reviews. Specification 44 31 31 has been updated and attached (A2) to clarify what ductwork and transition pieces are included in the Vendor scope of work.

III. Attachment:

A1. Revised Bid Schedule Pages R2-R5
A2. Updated Specification 44 31 31

Acknowledge receipt of this addendum on the bid form page (2) of the Invitation to Bid.

Thank you,
Brittany Bryant, CPPB
Purchasing Associate III

FAILURE TO RETURN THIS PAGE AS PART OF YOUR BID DOCUMENT MAY RESULT IN REJECTION OF BID.

BID FORM

(This Bid Form is part of the Bid Documents)

BID NUMBER: BL083-25 **BID DATE: AUGUST 01, 2025**

SUBMITTAL DATE: _____

BY: _____
(Bidder)

PROJECT DESCRIPTION: **Purchase and Installation Support of Odor Control System for Influent Distribution Box at F. Wayne Hill Water Resources Center, M-1191-51**

THIS BID IS SUBMITTED TO: Gwinnett County, Georgia (hereinafter called Owner) acting through its Board of County Commissioners

1. Undersigned Bidder offers and agrees to enter into Agreement with Owner, in accordance with the instructions, requirements and forms included in Bid Document Package (including the NOTICE OF BIDs, and Instructions to Bidders Package), and to complete all Work for the Bid Price and within required calendar days, all in accordance with the Bid Document Package.

2. Bidder accepts terms and conditions contained in Bid Document Package including without limitation those dealing with Owner's time for accepting Bid and disposition of Bid Security.

3. In submitting this Bid, Bidder makes representations required by Instructions to Bidders and further warrants and represents:

   a. Bidder has examined Bid Document Package, including NOTICE OF BID and Instructions to Bidders, and following addenda:

No.	_____	Dated	_____	No.	_____	Dated	_____
No.	_____	Dated	_____	No.	_____	Dated	_____
No.	_____	Dated	_____	No.	_____	Dated	_____
No.	_____	Dated	_____	No.	_____	Dated	_____

   b. Bidder has examined site and locality where the Work is to be performed and legal requirements (federal, state, and local laws, ordinances, rules, and regulations) and conditions affecting Work cost, difficulty, progress, or performance and has made independent investigations as Bidder deems necessary.

   c. Bidder has correlated results from observations, examinations, investigations, explorations, tests, reports, and studies with terms and conditions contained in Bid Document Package.

   g. Bidder has given Owner written notice concerning conflicts, errors, or discrepancies discovered in Bid Document Package and written resolution by Owner is acceptable to Bidder.

   h. This Bid is genuine and not made in interest of or for any undisclosed person, firm, or corporation and is not submitted in conformity with any agreement or rules produced by any group, association, organization, or corporation; Bidder has not directly or indirectly induced or solicited any other

Bidder to submit false or sham Bid; Bidder has not solicited or induced any person, firm, or corporation to refrain from bidding; and Bidder has not sought by collusion to obtain for itself any advantage over any other Bidder or over Owner.

i. Bidder will submit a projected Monthly Cash Flow projection with the bid. The monthly projections will add up to the Bid Amount on the Bid Form.

4. Bidder submits the following lump sum and alternate bid items for **Purchase and Installation Support of Odor Control System for Influent Distribution Box, M-1191-51** project identified in Bid Schedule as part of this Bid. Work included within each Bid Item is described in **Technical Specifications**. Bidder understands that if a Contract is to be awarded, it will be awarded to the lowest responsible, responsive Bidder for the Total Bid (Part 1).

BID SCHEDULE

Bid Item No.	Description	MANUF. & NO.	DELIVERY A.R.O	Lump Sum
1.1	Furnish and ship all equipment and appurtenances for an odor control system as specified in **Section 44 31 31** and all referenced Technical Specifications of the Contract Documents.			$
1.2	Provide technical services to ensure equipment has been installed by others according to manufacturer's recommendation. Provide Manufacturer's Certificate of Proper Installation. Provide technical services to test and start up the odor control system.			$
			TOTAL	**$**

Notes:
1. The lump sum **MUST** include ALL charges, including but not limited to delivery, test-run, and start-up assistance to the installation contractor.
2. If submitting an approved equivalent, please submit product cut sheets or information documents.
3. Reminder to include the Manufacturer/Product Number and the Delivery A.R.O (time to receive the product after receiving the purchase order).

COMPANY NAME _____

Major Equipment Schedule

All major equipment items listed on the bid form shall be bid according to the following:

The Bidder must include in the lump sum Bid Item 1.1, one of the named manufacturers/suppliers in this listing of major equipment items. The Bidder must circle one the named manufacturer/supplier, indicating which manufacturer/supplier the Contractor's Bid is based on. If an acceptable deduct is provided for substitute equipment and the equipment is accepted by the Owner, the amount of deduct shall be accounted for by a change order after award of the contract by the Owner.

Should a Bidder fail to indicate which manufacturer/supplier the Base Bid is based on, or circles more than one listed manufacturer/supplier per specification section, the Bidder shall provide the first listed ("A") manufacturer/supplier at no increase in the Contract amount.

The Bidder may indicate substitute in addition to the circled Base Bid manufacturer/supplier by writing in the substitute and writing in the amount of deduct for the substitute manufacturer/supplier. Should a write-in substitute be disallowed by the Owner as "not equal" or "not desired", then the Bidder shall supply the circled manufacturer/supplier.

A substitute manufacturer/supplier will be deemed equal provided the proposed substitute is explicitly demonstrated by the Bidder to be equivalent to or better than the product named and described in the Specifications in form function performance reliability quality and general configuration. Determination of equality in reference to the project design requirements will be made by the Owner after award of the contract.

Changes by the Bidder to items listed in the Major Equipment Schedule will not be considered after receipt of Bids.

Specification Section	**Equipment Description**	**Vendor**
44 31 31	Bio-Trickling Filter Odor Control System	A. BioAir Solutions B. BioRem C. Xylem Incorporated
	Substitute	
	Deduction	**$**

COMPANY NAME _____

FAILURE TO RETURN THIS PAGE AS PART OF YOUR BID DOCUMENT MAY RESULT IN REJECTION OF BID.

Certification Of Non-Collusion in Bid Preparation _____
Signature Date

In compliance with the attached specifications and O.C.G.A. §36-91-50, the undersigned acknowledges all requirements outlined in the "Instructions to Vendors" and all documents referred to therein, if this bid is accepted by the Board of Commissioners within sixty (60) days of the date of bid opening, to furnish any or all of the items upon which prices are quoted, at the price set opposite each item, delivered to the designated point(s) within the time specified in the fee schedule. By submission of this bid, I understand that Gwinnett County uses Electronic Payments for remittance of goods and services. Vendors should select their preferred method of electronic payment upon notice of award. For more information on electronic payments, please refer to the Electronic Payment information in the Instructions to Vendors.

Legal Business Name _____

Address _____

Does your company currently have a location within Gwinnett County? Yes ☐ No ☐

Representative Signature _____

Printed Name_____

Telephone Number _____ E-mail address_____

Contact Person (if someone other than the authorized representative listed above)

_____

Telephone Number _____ E-mail address_____

SECTION 44 31 31
BIO-TRICKLING FILTER ODOR CONTROL SYSTEM

PART 1 – GENERAL

1.01 THE REQUIREMENT

A. The Vendor shall furnish all equipment and appurtenances required to install and test, and place into operation an odor control system for the control of atmospheric hydrogen sulfide and other noxious odors as specified herein. Odor control system shall be a pre-engineered bio-trickling filter system consisting of a FRP vessel with biological media, media support system, irrigation system, exhaust fans, nutrient feed system, water panel, control panel, piping and valves, and other appurtenances required for a complete operating system.

B. One (1) biological odor control system shall be provided. The system shall consist of one (1) 6,000 cfm treatment train.

C. All electrical equipment located within three (3) feet of any component of the biological odor control system that is under positive pressure including, but not limited to, the structure itself, ductwork, humidification system, and exhaust fans shall be suitable for installation in a NEC Class I, Division 2, Group D hazardous location.

D. All materials and equipment furnished under this Section are to conform to the material requirements specified herein or in other Specification Sections, whether specifically noted or not. Applicable installation and testing requirements specified in other Sections shall apply to materials and equipment furnished under this Section.

1.02 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Section 01 33 00 – Submittal Procedures

B. Section 01 42 00 – References

C. Section 01 65 00 – Product Delivery Requirements

D. Section 05 05 23 – Metal Fastening

E. Section 09 90 00 - Painting

F. Section 26 05 60 – Low Voltage Electric Motors

G. Section 40 05 36.13 – FRP Ductwork for Odor Control Service

H. Section 40 05 51 – Valves, General

I. Section 40 61 21.72 – Field Testing

J. Section 40 70 00 – Instrumentation for Process Systems

K. Section 40 71 43 – Variable Area Flow Meters

L. Section 40 71 79.16 – Flow Switches (Thermal)

M. Section 40 73 13 – Pressure and Differential Pressure Gauges

N. Section 40 73 36 - Pressure and Differential Pressure Switches

O. Section 40 75 13 – pH Analyzers

P. Section 40 76 21 – Single Point Gas Monitoring Systems

Q. Section 40 79 00 – Miscellaneous Instruments, Valves, and Fittings

R. Section 46 00 00 – Equipment General Provisions

S. Section 46 07 01 – Packaged Control Panels

T. ASTM D 4167-97 – Standard Specification for Fiber-Reinforced Plastic Fans and Blowers

U. ASTM C 582-02 – Standard Specification for Contact-Molded Reinforced Thermosetting Plastic (RTP) Laminates for Corrosion-Resistant Equipment, latest edition.

V. U.S. Department of Commerce Voluntary Product Standard PS-15-69

1.03 SUBMITTALS

A. In addition to the submittal requirements specified in Section 01 33 00 – Submittal Procedures and Section 46 00 00 – Equipment General Provisions, submit the following:

1. Performance Affidavit, Guarantee, and Warranty.

2. Operations and Maintenance Manual.

3. Complete electrical schematic wiring diagram drawings.

4. Manufacturer's literature, illustrations, specifications and engineering data, including dimensions, materials, size and weight of all components and complete assembly.

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5. Drawings showing plans and sections of the equipment to demonstrate proper coordination between components, fabrication methods, assembly, and accessories.

6. Total weight of the equipment plus the approximate weight of the shipped materials.

7. Process and instrumentation diagrams.

8. Description of laminate and type of reinforcing to be used and a letter from the Manufacturer stating the laminate reinforcing material used will provide chemical resistance at least equal to the published chemical resistance for the resin for the intended application, and the resin will meet the performance requirements stated and is suitable for the service conditions specified herein and the fabrication technique proposed. Manufacturer shall also submit certification of applicable wind load design in accordance with current edition of the Georgia State Minimum Standard Building Code, latest edition.

9. Complete erection, installation, and adjustment instructions and recommendations.

10. Testing procedures and testing results.

11. Complete design calculations and structural calculations for the FRP vessel and media support system, sealed by a Registered Professional Engineer registered in the State of Georgia.

12. Anchor and tie-down system design calculations signed and sealed by a Registered Professional Engineer in the State of Florida. Shall include, but not be limited to, anchor calculations for design of fastening system to concrete pad to withstand applicable wind load criteria and other loadings discussed herein. Shall include size, embedment, and installation design criteria for anchor bolts and tie downs.

13. A description of the proposed quality control program that will be used during the manufacturing of the System and the fiberglass vessel. Include the resume of the quality control manager.

14. Factory test certifications indicating the quality control, testing, and inspection has been completed and standards specified herein have been met prior to shipment to jobsite.

15. Written instructions as to the recommended methods for unloading, storing, and installing the fiberglass vessels and recommended lifting and handling procedures.

16. Chemical composition of recommended nutrients along with non-proprietary supplier contact information.

17. Complete electrical schematic wiring diagram drawings and interconnection diagrams. Literature showing the electrical rating, model, and manufacturer of all major electrical components.

18. Product data for selected model fans and motors, including specialties, accessories, and the following:

    a. Fan performance curves with specified operating point clearly plotted.

    b. Sound power levels for both fan inlet and outlet at rated capacity.

    c. Motor ratings and electrical characteristics plus motor and fan accessories.

    d. Materials gages and finishes, including color charts.

19. Fan drawings detailing equipment assemblies and indicating dimensions, weights, required clearances, components, and location and size of field connections.

20. Fan Motor wiring diagrams that detail power, signal, and control wiring. Differentiate between manufacturer-installed wiring and field-installed wiring.

21. List of all recommended spare parts.

1.04 VENDOR'S RESPONSIBILITY

A. The Vendor shall be responsible for coordination of the design and fabrication of the biological odor control system specified herein.

B. The Vendor shall coordinate and review installation procedures under other Sections and coordinate the installation of items that must be installed to comply with the requirements of the Work specified under this Section.

C. The services of the Vendor's representative shall be provided in accordance with Section 46 00 00 – Equipment General Provisions for a period of not less than four (4) days for each system provided as follows:

    1. The Vendor shall ensure that all mechanical equipment, equipment control panels, local control panels, field instrumentation, control system equipment and related equipment provided in this Section or in conjunction with that specification are tested for proper installation, adjusted and calibrated on a loop-by-loop basis prior to control system startup to verify that each is ready to function as specified. Each test shall be witnessed, dated, and signed off by both the Vendor (or designee) and the Engineer upon satisfactory completion.

    2. At least one (1) trip of two (2) days to check the installation of the odor control system (including the media), supervise functional testing, supervise initial startup and operation, and instruct the Owner's personnel in proper

operation and maintenance of the equipment. Training session shall include both classroom and field training.

3. At least one (1) trip of one (1) day for the first performance testing.

4. At least one (1) trip of one (1) day for the second performance testing.

D. Any additional time required to achieve successful installation and operation shall be at the expense of the Vendor.

E. A written report covering the representative's findings and installation approval shall be mailed directly to the Engineer covering all inspection and outlining in detail any deficiencies noted. Written report shall state that the equipment has been properly installed and tested to the Vendor's satisfaction and that all required final adjustments have been made.

F. The times specified exclude travel time to and from the facility and shall not be construed as to relieve the Vendor of any additional visits to provide sufficient service to place the equipment in satisfactory operation.

G. The Vendor shall be responsible for any license fees that may apply to this system.

1.05 WARRANTY

A. The odor control vessels, media support system, and synthetic media shall be warranted for a period of ten (10) years from final acceptance. The warranty for the vessel, media support system, and media shall be a full replacement warranty and not prorated.

PART 2 – MATERIALS

2.01 ACCEPTABLE VENDORS

A. All components of the odor control system shall be supplied by a single Vendor, fully experienced, reputable, and qualified in the manufacture of the equipment to be furnished.

B. The biological odor control system Vendor is responsible for the coordination of all equipment specified herein. The complete odor control system shall be provided and shall operate as required by these Specifications. Systems shall be manufactured by Xylem Incorporated, BioRem, BioAir Solutions, or approved equal.

C. The biological odor control system Vendor shall be experienced in the design, construction and successful operation of biological odor control systems designed to remove hydrogen sulfide from ventilated air. The biological odor control system Vendor shall have a minimum of five (5) years of experience producing substantially similar equipment and shall show evidence of at least five (5) installations in

satisfactory operation for at least five (5) years in the United States. Within one month after Award of this Contract and prior to submission of Shop Drawings, the biological odor control system Vendor shall submit records and data to demonstrate his experience and qualifications.

D. Being named does not relieve the Vendor of meeting the specified requirements.

2.02 OVERALL SYSTEM REQUIREMENTS

A. The operating conditions for the biological odor control systems shall be as follows:

	Odor Control System
Number of Units	1 Duty
Number of Stages per Unit	1
Type	Biotrickling filter
Air Flow Rate, Total (scfm)	6,000
Air Flow Rate, Each (scfm)	6,000
Diameter (feet)	12
Height, Maximum (feet), Excluding Stack	34
Inlet H_2S Concentration, Average (ppm)	160
Inlet H_2S Concentration, Peak (ppm)	550
H_2S Removal Efficiency, Minimum	99.5%
Minimum Detention Time (seconds)	15
Maximum Pressure Drop through System (inches W.C.)	8
Maximum Instantaneous Water Requirement	25 gpm @ 70 psi
Number of Fans	2 (1 Duty/1 Standby)
Exhaust Fan Design Capacity, Each (scfm)	6,000
Static Pressure (inches W.C.)	11
Maximum Fan Speed (rpm)	2,300
Minimum Fan Inlet Diameter (inches)	24
Maximum Motor Horsepower (hp)	20
Maximum Motor Speed (rpm)	1,800
Drive	Belt

Number of Recirculation Pumps	2 (1 Duty/ 1 Standby)
Recirculation Pump Capacity, Max (gpm)	50
Total Dynamic Head (feet)	60
Maximum Pump Speed (rpm)	1,800
Minimum Pump Efficiency at Design Point	70%
Maximum Motor Horsepower (hp)	10
Maximum Motor Speed (rpm)	1,800
Drive	Direct
Grease Filter/Mist Eliminator	Yes, 1

B. The odor control systems shall consist of the principal components listed below along with any associated appurtenances required for a complete and operational system and shall include the following components.

1. One (1) Single-stage Bio-trickling filter with FRP vessel.

2. Synthetic media.

3. Two (2) FRP fans, duty/standby configuration.

4. One (1) inlet and one (1) exhaust mist eliminator/grease filter.

5. One (1) recirculation (acclimation) systems with two (2) recirculation pumps (1 duty/ 1 standby). Recirculation (acclimation) system and tanks shall remain on the site permanently after startup.

6. One (1) nutrient system, including nutrient storage tank and two (2) nutrient feed pumps (1 duty/ 1 standby). Nutrient systems shall be skid-mounted with their associated water panels.

7. All FRP ***transition pieces with NBS PS 15-69 flanges*** ~~**duct, expansion joints, dampers,**~~ duct supports as needed to provide ***for*** the following:

   a. ***Biotrickling Filter inlet transition piece to connect to 24" ductwork,***

   b. ***Fan inlet*** transition piece ~~**from**~~ ***to connect to*** ~~**existing**~~ ***24"*** ductwork ~~**to the fan inlet**~~,

   c. ***Fan outlet*** transition piece ~~**form**~~ ***to connect to 24" ductwork*** ~~**fan outlet to the Biotrickling Filter inlet**~~, and

d. ~~**transition piece from the**~~ Biotrickling Filter discharge ***transition piece*** to connect to existing ***30"*** ductwork ~~**for the existing Plant chemical odor control system**~~. [ADD NO. 3]

8. One (1) water panel to house water/irrigation and recirculation piping, valves, and nutrient pumps. Water panels shall be housed in type 316 stainless steel NEMA 4X enclosures. Water panel designation is 21:FCP-OC-1.

9. Irrigation system for scrubber, including water panel, water piping (including recirculation piping), drain piping and nozzles.

10. Equipment, instrumentation, stainless steel tubing, controls, and panel as specified to properly operate and monitor the biological odor control system and fans, including continuous H_2S monitoring sensors.

11. Panel, electrical contacts, controls, and appurtenances required for heating of water supply piping.

12. One (1) Control Panel (one for vessel and fans).

13. Instrumentation and ControlsOperation and Maintenance Manuals

C. All materials shall be new, and both workmanship and materials shall be entirely suitable for the service to which they are subjected. Specifically, all wetted parts must be corrosion resistant to the blow-down stream made up of water containing up to 2.5% sulfuric acid (at a pH down to 1.5) and hydrogen sulfide, dimethyl sulfide, dimethyl disulfide, and methyl mercaptans in varying quantities.

D. No metallic wetted parts shall be allowed except for internal bolting parts constructed of either FRP, stainless steel, or Hastelloy C.

E. Sizes and capacities of equipment components specified shall be understood to establish minimum requirements only, and do not relieve the equipment supplier of responsibility for providing a properly functioning system.

F. The odor control system facilities shall be capable of removing hydrogen sulfide and other reduced sulfur compounds from the foul air stream using a bio-trickling filter operating in a counter-current fashion.

G. The foul air shall enter the system at the bottom of each scrubber and flows upward through the media layer. The media layer is irrigated from above using potable or recirculated water and a sump is provided to collect the blow down from the media layer. The hydrogen sulfide is oxidized by the biological media. The odor-free air is released to the atmosphere through the exhaust stack.

H. The blow-down solution will drain from the bottom of each layer in each scrubber to the recirculation tank, which will either be recirculated or will drain back to the treatment plant for treatment.

2.03 VESSEL CONSTRUCTION

A. The biological scrubbers shall be of the vertical, counter-current type consisting of one counter-current stage. The scrubber shall be designed to support the required number of media layers and treatment stages. Each free standing tower shall consist of a minimum of one (1) media beds and one (1) media bed irrigation systems.

B. Vessel housing shall be designed for full bottom support and shall be provided with a minimum of four Type 316 stainless steel hold down lugs. All hold down lugs shall be designed to account for all anticipated loads and shall comply with local code requirements. Furnish all anchor bolts, nuts, and washers, which shall be Type 316 stainless steel.

C. Tanks shall be designed in accordance with ASME RTP-1 and shall meet all specific manufacturing detail requirements of that standard. Tanks do not need to be fabricated by an RTP-1 certified vendor. Provide a letter from the odor control system Vendor, signed by an officer of the company, certifying that the fiberglass is designed and fabricated in accordance with ASME RTP-1.

D. The biological odor control scrubber shall be designed and constructed from fiberglass reinforced plastic (FRP) materials with ample structural strength and rigidity for the service required. All integrally molded connections shall be manufactured of the same material. All materials of construction shall be corrosion resistant.

E. Fiberglass Reinforced Plastic (FRP) Vessel Construction:

1. Vessel shall be of flexible chemical barrier construction, consisting of a filament-wound FRP body with 100 mils of chemical resistant interior liner.

2. Closed top tanks shall have a head knuckle radius of 1.5 inches as a minimum. Flat bottom tanks shall have a bottom knuckle radius of 2 inches as a minimum. Extend reinforcement of the knuckle-radius area up the vertical wall a minimum of 12 inches.

3. Vessel wall thickness shall be as required by the structural design, but not less than ¼ inch.

4. Resins:

    a. Resins used in laminate shall be premium corrosion resistant, suitable for the intended service, and fire retardant brominated bisphenol A vinylester

resins to achieve a 25 or less flame spread rating in accordance with NFPA 91.

1) Resin shall be Hetron FR992 or FR992SB, as manufactured by Ashland Chemical Company, DeraKane 510A or 510C, as manufactured by INEOS Composites, Dion 9300 FR, as manufactured by Reichold, Vipel K022-CC, or K022-CN, as manufactured by AOC, or approved equal.

2) Antimony trioxide may be added to the structural layer, if required to obtain the required Class 1 flame spread rating of 25 or less. Antimony trioxide addition shall not exceed 3% and shall not be added to the interior liner of the vessel.

3) Selected resin shall be used for fabrication throughout the entire vessel. Use of more than one resin during fabrication is not acceptable.

4) No dyes, pigments or colorants shall be used except in the exterior coat.

5) The resin shall not contain fillers or thixotropic agents unless otherwise specified.

b. Ultraviolet absorbers shall be added to the surfacing resin to improve weather/UV resistance of the vessel. No fillers or thixotropic agents shall be added. Exterior coating shall not be applied until after inspection of the laminate has been completed.

c. All cut edges shall be sealed with a resin coating of the same resin as used in the fabrication. The resin shall contain paraffin.

5. Curing System: Vessel shall be cured using an MEKP procedure and in accordance with the recommendations of the resin manufacturer. Follow resin manufacturer's recommendations for post cure temperatures and times. Provide letter from the resin manufacturer, stating that the resin will meet the performance requirements stated herein, that the resin is suitable for the service conditions specified herein and fabrication technique proposed and recommended post-cure method.

6. Reinforcement:

a. Synthetic surface veil shall be Veil-Nexus 1012 (apertured) as manufactured by Burlington Industries.

b. Chopped strand mat shall be Type E glass, minimum 1-1/2 ounces per square foot, with silane finish and styrene soluble binder.

c. Continuous roving used in chopped gun shall be Type E glass.

d. Woven roving shall be Type E glass, nominal 24 ounces per square yard, with a 4 by 5 weave and a silane type finish.

e. Continuous roving used for filament winding shall be Type E glass, nominal 110 strands per pound, with a silane type finish.

7. Laminates:

a. Laminates shall consist of a corrosion resistant resin-rich inner surface, an interior corrosion barrier, an exterior structural layer, and an exterior layer. Composition specified for inner surface and interior corrosion barrier is intended to achieve optimum chemical resistance.

b. Laminates shall meet the requirements of the mechanical properties and visual acceptance criteria in ASTM D2563, Level II.

c. Corrosion resistant resin-rich inner surface shall be reinforced using a single apertured Nexus synthetic veil. Minimum resin-rich inner surface thickness shall be 10-20 mils. Thixotropic agents shall not be used for this service. Glass content of resin-rich inner surface shall be 10 percent plus or minus 5 percent by weight. Resin content of the inner surface shall be a minimum of 80 percent by weight.

d. Interior corrosion barrier shall be a minimum of 100 mils of Type E chopped strand mat to a total of 3 ounces/sq. ft. The interior corrosion barrier shall be applied by either the hand laid up technique, filament winding or chopper gun. Chopper gun is only permitted if an automated process is used. Manual operation of chopper gun shall not be permitted. Glass content of interior corrosion barrier shall be 27 percent plus or minus 5 percent by weight.

e. Exterior structural layer shall be fabricated using a filament wound technique with continuous strand roving. Glass content of exterior structural layer shall be between 50 and 80 percent by weight.

f. Exterior layer shall be reinforced using a single “A” glass veil with a layer of chopped strand mat followed by a clear resin rich 10 mil thick coating similar to the inner surface. Topcoat shall be pigmented parafinated gel-coat with ultraviolet inhibitors. The pigmentation color shall be as directed by the Owner. There shall be no glass fibers exposed.

g. Vessel wall shall be reinforced around all openings and connections.

8. Packing Support:

a. The packing support shall be a slotted beam or a vinyl ester FRP grate, suitable for supporting a bed of tower packing under all conditions of operation, including a flooded bed condition. Packing support system shall be constructed of corrosion-resistant materials.

b. The free area shall be greater than of 95 percent of the cross-sectional area of the tower. The opening size shall not allow the passage of any packing media.

F. Each vessel exhaust shall be fitted with a high velocity discharge stack stub promoting dispersion.

G. Provide a minimum of four (4) support tiedowns or anchor clips to secure each vessel to the concrete pad and a minimum of four (4) lifting lugs. Vessel anchoring shall be designed to meet the Georgia State Minimum Standard Building Code, Latest Edition.

H. Bolts and fasteners for wetted internal service shall be of either FRP or Hastelloy C construction. 316 stainless steel shall be used for anchor bolts and flanged pipe joints.

I. Exhaust Mist Eliminator: Provide a high efficiency, chevron-type mist eliminator at the discharge of the system. The mist eliminator is to remove 99% of all mist particles 40 microns and larger and 90% of all mist particles 10 microns and larger.

J. Plastic Fittings. Plastic fittings shall be "bulk-head" or "two-flange" style and shall be constructed of PVC. There shall be 4 bolts on flanges up to and including 3 inch, 8 bolts on fittings 4 inch - 8 inch diameter, and 12 bolts on 10 inch - 12 inch fittings. All bolts shall be all thread design with heads completely encapsulated in polyethylene. The polyethylene encapsulation shall fully cover the bolt head and a minimum of 1/4" of the threads closest to the bolt head. The polyethylene shall be color coded to distinguish bolt material: Green-316 grade S.S., Red-Hastelloy "C", Blue-Monel, Black-Titanium. Each bolt shall have a gasket which is on the inside of the vessel. Gasket material shall be compatible with dilute sulfuric acid solution. All plastic fittings shall be conform to standard US sizes.

K. Stainless steel fittings shall be manufactured from 316 grade stainless steel, compression type with 4 bolts up to 2 inch diameter fittings, 8 bolts for 3 inch - 4 inch diameter fittings, 12 bolts for 6 inch diameter fittings, and 14 bolts for 8 inch diameter fittings. Nipple and studs shall be welded to back plate of fitting. Gasket shall be used between outside flange and inside flange. Gasket material shall be compatible with dilute sulfuric acid solution.

L. Openings that are cut in vessel to install fittings shall not have sharp corners. Holes shall have minimum clearance to ensure best performance of fittings.

M. For all flanged connectors, the flange drilling and bolting shall be in accordance with NSB PS-1569 for access ports and air connections and ANSI 150 psi pressure class for all liquid handling nozzles. All vessel connections shall straddle the principle centerline of the vessel.

2.04 SYNTHETIC MEDIA

A. Synthetic media shall be composed of high porosity, chemically resistant polyurethane, polyethylene, or polyvinylchloride.

B. Media shall not shrink or swell with varying moisture content.

C. Media installation shall be designed and constructed so that short circuiting does not occur and to enhance mixing and contact between the gas and liquid solutions.

D. Media layers shall be self-supporting, enclosed in a chemically resistant frame or shell and shall be removable for cleaning or inspection. Alternatively, if random media is supplied, media shall be accessible through inspection manways in the side of each reactor tower.

E. Media support system shall be composed of FRP, shall be removable, and shall be supported from the bottom of the biological odor control system.

F. Media and media support system shall be suitable for continuous exposure to a dilute sulfuric acid solution with a pH from 1 to 4. Media composed of organic materials, such as compost, wood, wood mulch, tree bark, lava rock, or activated carbon, shall not be acceptable.

G. Treatment layers shall be designed so that short circuiting does not occur and to enhance mixing and contact between the gas and liquid solutions.

H. The biological odor control system Vendor shall be responsible for providing the proper media content to ensure system meets specified performance.

2.05 IRRIGATION SYSTEM

A. Each reactor shall be configured with a minimum of one (1) fluid inject spray nozzle located above the media layer for proper irrigation. Vendor shall demonstrate that proposed nozzle arrangement provides adequate liquid distribution across the media bed.

B. The nozzles shall be specifically designed to ensure irrigation water is evenly dispersed over the entire media surface.

C. Spray nozzles shall be one (1) piece, shall be non-clog and composed of extra heavy-duty construction. Spray nozzles shall be placed sufficiently above the

packing so that all of the sprayed solution will be evenly distributed over the packed bed.

D. Provide the capability to continuously irrigate the entire vessel only using recirculated bioscrubber liquid, unless using a single pass system. Makeup water shall be continuously added to the recirculation sump. Blowdown shall accumulate in the recirculation sump to be recirculated through the biological media. A small amount of the blowdown shall be wasted through the overflow connection in the sump. The amount of bioscrubber liquid wasted shall be controlled by adding water to the recirculation sump at a continuous rate, controlled by a rotameter. Provide a solenoid valve on the irrigation piping to each biological odor control system to permit timer control of irrigation to the system. Each solenoid valve shall be located in the water supply piping panel dedicated to its specific biological odor control system.

E. All irrigation system piping shall be constructed of Schedule 80 CPVC, US standard sizes. All fittings shall be true union, solvent-welded or threaded. All flange gaskets, union seals, valve seals, and other piping seals shall be fully compatible with the chemicals to be used in the regular operation, maintenance, and cleaning of the odor control system.

2.06 INTEGRATED PROCESS CONTROL SKID

A. The Vendor may provide the components listed under this Section as a single integrated process control skid, pre-piped and pre-wired by the Vendor and delivered to the site as a single unit, or the Vendor may provide the components listed under this Section in pieces.

B. All Irrigation system and drain piping, valves, flow meters, etc. shall be factory skid mounted by the Vendor. The skid shall be pre-piped and factory assembled to include all appurtenances for the operation of the system, including, but not limited to items specified above. All piping shall be pre-piped, with the sole exception of the irrigation and drain piping between the skid and the odor control vessel.

C. Water Supply Piping Panel

1. The panel shall include the above-ground portion of the water supply piping including, but not limited to, nutrient pumps, all valves, flow meters, and instrumentation in a Vendor-provided heated panel, mounted on a skid by the factory.

2. Provide one (1) water supply piping panel per biological odor control system unit. Water supply piping panel shall be a NEMA 4X pedestal-mounted enclosure composed of Type 316 stainless steel.

3. Strainer shall be provided for the W3 water supply line upstream of the water supply piping panel. See Section 40 05 51 – Valves, General for requirements.

4. Vendor shall provide all electrical contacts, controls, and appurtenances required for heating the water supply piping panel.

5. Water supply piping panel shall be installed a minimum of three (3) feet away from any ductwork under positive pressure, the biotrickling filter systems, and the exhaust fans. Provide a minimum of four (4) feet of clearance in front of each water supply piping panel for access.

D. Nutrient Addition System

1. A nutrient addition system shall be provided for each biotrickling filter unit. The system shall utilize the irrigation spray system to automatically apply a liquid nutrient mixture to the media with each irrigation cycle.

2. Provide (2) nutrient feed pumps and all associated piping and equipment necessary to deliver the nutrient solution from the tank to the irrigation system. The nutrient feed pump shall be controlled by the vendor control panel. The amount of nutrient dispensed shall be adjustable and shall be automatically proportional to the flow of irrigation water. The dispenser shall be pre-piped to the irrigation water control assembly.

3. The nutrient feed pump shall be located in the water piping panel, and all piping to the irrigation system shall be factory-installed.

4. Provide one (1) minimum 500-gallon nutrient storage tank per biotrickling filter unit, composed of HDPE or FRP with cover, insulation, and heat tracing or a thermostatically-controlled immersion sump heater shall also be provided.

5. Nutrient feed pumps shall be of the solenoid-operated diaphragm type and shall include factory flow monitors to provide alarm contacts for loss of pump operation.

6. Vendor shall provide all electrical contacts, controls and appurtenances required for heating the nutrient storage tanks and nutrient lines.

E. Recirculation Pumps

1. Each unit shall have two (2) recirculation pumps, suitable for pumping blowdown from the bottom of the biotrickling filter, through the water panel and back to the top of the media. The recirculation pump shall be a horizontal, magnetic drive, seal-less, centrifugal-type pump composed of CPVC, polypropylene or FRP for corrosion resistance and long service life. No seal water shall be required. The pump shall be suitable for solutions having a pH ranging from 1 to 4 and shall have a stainless steel one (1)-piece rotor drive shaft covered with a one (1)-piece sleeve and impeller. Pump shall NOT have any liquid to metal contact, seals, pump bearings, bushings, or wearing parts. The pump shall be mounted on the integrated process skid.

2. All units shall be statically and dynamically balanced throughout, and an analysis of the pump and motor shall be performed to ensure that there are no frequencies of vibration that form harmonic resonance between them as a unit in operation. The vibration allowance in the units shall not exceed 4 mils at any point on the unit while running within 15% above or below the design point on the curve using the head or flowrate for which the units have been designed to function.

3. Recirculation pump capacities shall be as specified herein and shall be verified by the biological odor control system Vendor for proper flow rate and pressure as required for installation. The maximum motor horsepower as specified in Article 2.02, Paragraph A shall be adhered to when selecting the motor horsepower for each recirculation pump. Pump sizing calculations shall be submitted to the Engineer for review.

4. Recirculation pumps shall be Vanton Chem-Gard CGM, Fybroc Series 2530, Iwalki MX Series, or equal.

5. Provide the pump motor in accordance with Section 26 05 60 – Low-Voltage Electric Motors.

Motors	**21:OC-REC-P-1,2**
Rating	460V, 3 ph, 60 Hz
Horsepower, max	10
Speed, max, rpm	1,800
Enclosure	TEFC
Insulation	Class F
Service Factor	1.15
Space Heater	Yes
Motor Winding Temperature Switches	No

F. Accessories

1. Make-up Water Control: The direct reading rotameter shall be a variable area type with a Teflon float, EPR “O” rings, and PVC fittings. The rotameter shall be of the same size as the pipe in which it is installed. The rotameter shall have a direct reading scale.

2. Recirculation Sump Blowdown and Level Controls: The biological odor control system shall be operated with a manual blowdown. The rate of blowdown shall be proportional to the rate of make-up water.

3. Pressure Gauges: A liquid-filled pressure gauge, including an all-plastic activator/isolator and an isolation valve, shall be provided for installation in the discharge piping of each recirculation pump. The gauge shall have a minimum dial size of 3-1/2 inches. The gauge face shall indicate units of measurement and the normal operating reading shall be near the midpoint of the range.

4. Duct Supports: The biological odor control system Vendor shall be responsible for the design ***and support*** of all ~~**duct and exhaust stack supports, located between the exhaust fans and the odor control systems and furnished as part of the biological odor control system**~~ ***items furnished by the Vendor***. Duct and exhaust stack support details and layout shall be submitted for review as part of the Shop Drawings. [ADD NO. 3]

5. All bolts, nuts, washers, and other fasteners shall be Type 316 stainless steel unless otherwise noted.

6. Provide insulation and a thermostatically-controlled immersion type sump heater for each odor control vessel sump. A sump heater is not required for single pass systems.

    a. The immersion heater shall be rated no more than 2,000-watts. It shall be rated for connection to a 480-volt, 3-phase power source, delta-connected with no 277-volt neutral connection.

G. Make-Up Water Controls

1. General. Irrigation system controls shall be provided to ensure a water flow to each layer of the system of constant pressure and flow rate when required. All irrigation system water controls for each vessel shall be located inside a hinged stainless steel enclosure. Provide one irrigation system per vessel.

2. Each irrigation control system shall consist of (at a minimum):

    a. One main shut-off ball valves.

    b. One back-flow prevention check valves.

    c. One rotameter type flow meters.

    d. One adjustable flow control valves (may be integral part of rotameter).

3. All of the above equipment shall be sized as necessary to provide adequate pressure and flow conditions for system operation as determined by the Vendor.

2.07 FRP FANS

A. Provide fire retardant fans composed of FRP with an epoxy or UV gel coating to protect against ultraviolet degradation. Fans shall be installed complete with motors,

drives, guards, and coatings of sufficient capacity for the duty required. Fans shall operate to draw odorous air from the pump station wetwell and shall exhaust air through the biotrickling filter odor control system.

1. Fans shall be factory-fabricated and assembled, factory-tested, and factory-finished with indicated capacities and characteristics.

2. Basis of fan performance shall be at standard conditions (density of 0.075 lb/ft3).

3. Selected fans shall be capable of accommodating static pressure and flow variations of +/-15% of scheduled values.

4. Fans shall be belt-driven, AMCA arrangement 1.

5. Fans shall be equipped with lifting lugs.

6. Nameplate: Each fan shall be furnished with a permanently affixed stainless steel nameplate with manufacturer’s name, model number, serial number, and electrical data.

7. Mounting: The entire fan and motor assembly shall be mounted on vibration isolators to reduce noise transmission.

8. Rotating Assembly: Rotating assembly shall be statically and dynamically balanced to balance grade G6.3 per ANSI S2.19 and designed for continuous operation at the maximum rated fan speed and motor horsepower.

9. Exhaust fans shall be the same fan model and size for ease of operations and maintenance.

B. Fan shall be constructed such that all surfaces in contact with the corrosive gas stream are made of solid, corrosion-resistant FRP, model FE as manufactured by The New York Blower Company, Series 41 as manufactured by Hartzell or Model CLUB by Ceilcote/Verantis or approved equal. All nuts, bolts, and fasteners in contact with the gas stream shall be Type 316 stainless steel and encapsulated in FRP.

C. Performance: Fan ratings shall be based on tests made in accordance with AMCA Standard 210. Fans shall be licensed to bear the AMCA Certified Ratings Seal for Air Performance. Fans not licensed to bear the AMCA Seal for performance shall be tested, at supplier's expense, in an AMCA Registered Laboratory. Fans shall have a sharply rising pressure characteristic extending throughout the operating range to assure quiet and stable operation. Fan speed and motor size shall be selected by the biological odor control system Vendor to meet the required conditions of air flowrate and pressure drop across the biological odor control system and ducting, including the pressure drop in the ducting upstream of the biological odor control

system inlet. Fan speed shall not exceed 85% of the maximum allowable driven speed of the fan.

D. Provide the fan motor in accordance with Section 26 05 60 – Low-Voltage Electric Motors.

	21:OC-FAN-1,2
Rating	480V, 3 ph, 60 Hz
Horsepower (max)	20
Speed, max rpm	1,800
Enclosure	TEFC
Hazardous Location Rating	Suitable for Class I, Division 2 Environment
Inverter Duty	Yes
Service Factor	1.0
Space Heater	Yes
Motor Winding Temperature Switches	Yes

E. Sound: Fan manufacturer shall provide sound power level ratings for fans tested and rated in accordance with AMCA Standards 300 and 301. Sound power ratings shall be in decibels (reference IOE-12 watts) in eight (8)-octave bands.

F. Bearings: Bearings shall be grease-lubricated, precision anti-friction ball, self-aligning, pillow block design. Bearings shall be designed for a minimum L10 life of 30,000 hours (150,000 hours L50 life) when rated at the fan's maximum cataloged operating speed. Fan bearings shall be visible and accessible for inspection and maintenance. Bearings enclosed within the fan housing where they can be exposed to the corrosive gas stream are not acceptable.

G. Construction: Fan shall be constructed in accordance with the ASTM D-4167 standard specification for FRP fans and blowers to ensure structural integrity. All surfaces exposed to the atmosphere shall be rich in paraffinated resin, shall be stabilized against ultraviolet degradation, and shall include a reinforcement not to exceed 20% “C” grade fiberglass. All parts exposed to the gas stream shall be constructed of, or encapsulated in, an FRP laminate capable of resisting continuous airstream temperatures of 250 degrees Fahrenheit. All resins shall be clear to allow detection of subsurface imperfections. Use of pigments, gel coats, inhibitors, and additives which may disguise flaws in the laminate is prohibited.

1. Housing: Fan housing shall be constructed of a fire-retardant polyester resin or Type II PVC with an ASTM E84 Class I rating. Housing laminate construction shall conform to ASTM Standard C-582. Airstream surfaces shall be smooth to minimize

resistance and prevent buildup of airborne contaminants. Shaft hole openings shall be fitted with a Teflon closure having a maximum clearance of 1/32-inch to minimize leakage. A flanged inlet and flanged outlet composed of FRP construction shall be furnished on the fan. Inlet assembly shall be bolted to permit wheel removal. Fan shall be furnished with an access door, positioned to avoid collection of condensation, and a 1-inch minimum flanged type drain connection, positioned at the lowest portion of the fan scroll.

2. Wheel: Wheel shall be of backwardly-inclined, non-overloading design for increased efficiency. Wheel shall be fabricated of a fire-retardant vinyl ester resin with an A8TM E84 Class II rating no greater than 30. Wheel hub shall be permanently bonded to the shaft and completely encapsulated in FRP to ensure corrosion resistant integrity. Steel wheels coated with FRP or wheels with taper-lock hubs are not acceptable.

3. Shaft: Shaft shall be ASTM A-108 steel, grade 1040/1045, with an FRP sleeve fixed securely and bonded to the wheel backplate. The sleeve shall extend out through the housing shaft hole for corrosion protection. The shaft first critical speed shall be at least 125% of the fan's maximum operating speed. Shaft shall be counter-sunk for tachometer readings.

H. Fan wheel shall have true backwardly-curved, single-thickness, airfoil-type blades which limit load horsepower characteristics so the motor provided with each fan does not exceed the maximum motor horsepower listed in Article 2.02, Paragraph A. Fan wheel shall be made of solid FRP with a stainless steel hub, encapsulated within the impeller, to provide a reliable connection with the drive shaft.

I. Belt Drives:

1. Belt drive components shall be sized based on a service factor of 1.4.

2. Pulleys shall be of the fully-machined cast iron-type and shall be keyed and securely attached to the wheel and motor shafts. Motor pulleys shall be adjustable for final balancing.

3. Belts: Oil-resistant, non-sparking, and non-static.

4. Belt drives shall be factory-mounted with final alignment and belt adjustment made after installation.

5. Belt Guard: Provide an OSHA-compliant belt guard composed of FRP on the outside of the fan cabinet. Belt guard or motor cover shall to completely cover the motor pulley and belt(s).

6. Furnish one (1) additional complete set of belts for each belt-driven fan.

J. Balance and Run Test: The wheel and shaft shall be dynamically balanced on precision balancers. Prior to shipment, completed fans shall receive a final test balance at the specified operating speed.

K. Final Inspection: All fans shall receive a final inspection by a qualified inspector prior to shipment. Inspection shall include fan description and accessories, balance, welding, dimensions, bearings, duct and base connection points, paint finish, and overall workmanship.

L. The fan and motors shall be factory-mounted on a structural channel subbase with integral motor slide base.

M. Expansion joints shall be provided ***for the inlet and outlet of each fan*** that are suitable for the service (hydrogen sulfide) with multiple layers of nylon fabric impregnated with synthetic compounds and laminated into a strong body by vulcanizing. Stainless steel reinforcing rings or split rings shall be provided for bolting to equipment flanges. Connectors shall be designed to withstand at least two (2) times the operating pressure. [ADD NO. 3]

2.08 DUCTWORK [ADD NO. 3]

A. All ~~**air**~~ duct~~**s**~~ ***transition pieces indicated above*** ~~**from the exhaust fan outlet to the biological odor control system inlet**~~ shall be supplied by the biological odor control system Vendor. Materials of construction shall be FRP as specified in Section 40 05 36.13 – FRP Ductwork for Odor Control Systems.

B. Ducts shall be of sufficient diameter and design to move the air without undue pressure loss. The pressure loss of the combined biological odor control system and the ductwork shall not exceed the maximum pressure available from the exhaust fan at the specified air flowrate operating at non-overloaded conditions.

C. ~~**Provide the required transition pieces at the exhaust fan inlet to connect to existing ducts by others, at the exhaust fan outlet to connect to the as shown on the Drawings to the exhaust fan outlet and the biological odor control system, and at the biological odor control system discharge to connect to existing duct connected the plant existing chemical odor control system inlet. Provide butterfly dampers and expansion joints as specified in Section 40 05 36.13 – FRP Ductwork for Odor Control Systems.**~~

2.09 CONTROLS

A. Provide control panels, electrical components, instrumentation, and wiring for a complete, functional system.

B. The equipment manufacturer/supplier shall provide control panels in accordance with Section 46 07 01 – Packaged Control Panels.

1. One (1) system control panel for the biotrickling filter unit

2. Two (2) combination starters for the odor control fans.

C. Bio-Trickling Filter Unit Control Panel (21:FCP-OC-1)

1. The Vendor shall incorporate all necessary devices in the control panel to completely control the biofilter process and its auxiliary equipment, including but not limited to recirculation pumps, motorized valves, solenoid valves, nutrient pumps, and immersion heaters.

    a. The control panel shall be responsible for the intermittent operation of the spray nozzles and automatic control valves.

    b. The control panel shall be mounted as directed by the Engineer. All components factory tested as a fully operational component.

    c. The control panel shall include 480-volt, 3-phase power distribution to the biotrickling filter immersion heater.

2. Control Panel Features:

    a. Free-standing, NEMA 4X 316L stainless steel.

    b. Contains equipment for control logic described below and motor controllers.

3. Power Supply: 480 volts, three-phase, 65 kAIC RMS Symmetrical. Provide panel with main circuit breaker disconnect, including flange mounted external operating handle. Provide panel with 120 VAC control power transformer and any necessary 24 VDC/VAC power supplies.

4. The panel shall each have the following front-mounted control devices:

    a. CONTROL POWER “ON” pilot light

    b. HAND-OFF-AUTO selector switch for each pump

    c. PUMP RUN pilot light for each pump

    d. PUMP FAIL alarm pilot light for each pump.

    e. PUMP OFF pilot light for each pump.

    f. Elapsed runtime meter for each pump.

    g. OPEN-CLOSE-AUTO selector switch for each motor-actuated valve and solenoid valve.

h. OPEN and CLOSED position pilot lights for each motor-actuated valve.

i. OPEN (solenoid energized) pilot light for each solenoid valve.

j. LOW NUTRIENT TANK pilot light.

k. NUTRIENT PUMP FAIL pilot light.

l. Loss of Recirculation Loop Flow pilot light

m. HIGH PRESSURE DROP pilot light.

n. LOW pH pilot light.

o. Reset pushbutton.

5. Remote Indication and Alarming

a. All tags associated with the signals mentioned below should be available to be communicated over the network to the Plant Control System.

b. The panel shall have the following dry contacts for remote indication. Alarm contacts shall be normally-closed. Status contacts shall be normally-open.

1) System Running Status

2) Common Fault Alarm

c. The panel shall accept the following dry contacts:

1) Loss of flow alarm from the recirculation loop flow switch provided under this Section.

2) Low nutrient level from the nutrient tank provided under this Section.

3) Low sump level from the sump level switch provided under this Section.

4) High Pressure Drop from the differential pressure switch provided under this Section.

5) In Auto status for each pump.

6) Open and closed position status for each motor-actuated valve.

7) Nutrient Pump Loss of Flow contacts from nutrient pumps.

8) Nutrient Tank Thermostat.

9) Odor Control Unit Sump Thermostat.

10) Low nutrient level from the nutrient tank provided under this Section.

11) Low sump level from the sump level switch provided under this Section.

12) Sump Thermostat.

13) Run status for each fan.

14) Fail status for each fan.

15) Low Suction Pressure status for each fan.

16) High Discharge Pressure status for each fan.

17) High Level from Drain Sump Control Panel.

18) Fault from Drain Sump Control Panel.

d. The panel shall accept the following analog signals:

1) pH (manufacturer's cable from pH sensor provided under this Section to pH analyzer provided under this Section).

2) Air Flow

3) Inlet Hydrogen Sulfide

4) Outlet Hydrogen Sulfide

5) Amperage for each fan

e. Provide circuit breakers and 120 VAC power for the following devices powered from panels:

1) Recirculation Low Flow Switch

2) Nutrient Pump

3) Sump immersion heater

4) Nutrient tank heat tracing or immersion heater

5) Water panel heater

6) Air Flow Transmitter

6. Bio-Trickling Filter Unit Control Panel Control Description (21:FCP-OC-1)

a. Recirculation Pumps. The odor control system shall have an associated recirculation pump, which shall recirculate liquid from the odor control system sump through the top of the unit.

1) Under normal operation, the HAND-OFF-AUTO selector switch shall be placed in the Auto position.

2) When HAND has been selected using the associated HAND-OFF-AUTO (HOA) selector switch, the pump shall run.

3) When OFF has been selected using the associated HOA selector switch, the pump shall not run.

4) When AUTO has been selected using the associated HOA selector switch, the pump shall be run. If flow, indicated by the associated recirculation loop thermal dispersion flow switch, is lost for an adjustable period of time, initially set at 30 seconds, the pump shall be stopped, and the loss of flow alarm shall be indicated.

b. Irrigation System. Each odor control system shall have an irrigation system.

c. Nutrient Feed Pump. Each odor control system shall have a dedicated nutrient feed pump which shall draw from a dedicated nutrient supply tank.

1) Under normal operation, the HAND-OFF-AUTO selector switch for the nutrient pump shall be in the AUTO position.

2) When Run has been selected using a pump's HAND-OFF-AUTO (HOA) selector switch, the pump shall run.

3) When OFF has been selected using the HOA selector switch, the pump shall be stopped.

4) When AUTO has been selected using a HOA selector switch, the pump shall be run using sequence timers coordinating pump run with the opening of the irrigation valves for each stage. Nutrient feed duration for each stage shall be set within a time range in accordance with the Vendor's recommendations.

5) If the nutrient pump flow switch indicates loss of flow, the panel shall energize the Nutrient Pump Fail indicating light and open the contacts for remote alarming.

d. Make-up water solenoid valve. Each odor control system shall have a dedicated make-up water solenoid valve to dilute recirculation water in the associated odor control system sump.

1) Under normal operation, the OPEN-CLOSE-AUTO selector switch for the make-up water solenoid valve shall be in the AUTO position.

2) When OPEN has been selected using a valve's OPEN-CLOSE-AUTO (OCA) selector switch, the valve shall be opened.

3) When CLOSE has been selected using a valve's OCA selector switch, the valve shall be closed.

4) When AUTO has been selected using a valve's OCA selector switch, the make-up water solenoid valve shall be opened and closed using sequence timers. If the level in the sump drops sufficiently to trip the low level switch, the solenoid valve shall be opened for an adjustable period of time, initially set at 20 minutes after the level rises above the float switch trip point.

D. Vendor Odor Control Fan Combination Starters (21:LST-OC-1 and 21:LST-OC-2)

1. The Vendor shall incorporate all necessary devices in the combination starter to completely control the odor control fans.

a. The starter shall be mounted as directed by the Engineer. All components factory tested as a fully operational component.

2. Enclosure Features:

a. Free-standing, NEMA 4X 316L stainless steel.

b. Contains equipment for control logic described below and motor controllers.

3. Power Supply: 480 volts, three-phase, 65 kAIC RMS Symmetrical. Provide panel with main circuit breaker disconnect, including flange mounted external operating handle. Provide panel with 120 VAC control power transformer and any necessary 24 VDC/VAC power supplies.

4. The panels shall each have the following front-mounted control devices:

a. START pushbutton

b. STOP pushbutton

c. HIGH PRESSURE pilot light

d. LOW PRESSURE pilot light

5. Remote Indication and Alarming

    a. The panel shall have the following dry contacts for remote indication. Alarm contacts shall be normally-closed. Status contacts shall be normally-open.

        1) Run status

        2) Fail status

        3) Low Suction Pressure status

        4) High Discharge Pressure status

    b. The panel shall have the following analog signals for remote indication:

        1) Amperage

6. Odor Control Fan Combination Starter Control Description (21:LST-OC-1 and 21:LST-OC-2)

    a. Under normal operation, the Vendor-supplied local combination starters for the fans will operate via local Start-Stop pushbuttons only. No Start/Stop control will be provided through the PLC.

    b. The local combination starter will interlock the motor utilizing the High Discharge Pressure and Low Suction Pressure switches. The Vendor shall ensure that the switches are set at the appropriate value for the application.

2.10 CONTROL EQUIPMENT

A. Vendor shall provide appropriately-rated instruments of intrinsically-safe barriers as appropriate for the devices located in hazardous areas, as defined in 1.01.C of this specification.

B. Manually-operated dampers shall be provided to allow isolation of each exhaust fan and each biological odor control system.

C. Recirculation flow switch 21:FSL-1911 shall be provided on the recirculation lines in accordance with Section 40 71 79.16 – Flow Switches (Thermal).

D. Recirculation pumps shall each be provided with suction and discharge pressure gauges along with their associated diaphragm seals by the biological odor control system Vendor in accordance with Section 40 73 13 – Pressure and Differential Pressure Gauges. Refer to Section 40 79 00 – Miscellaneous Instruments, Valves and Fittings for the requirements for diaphragm seals, isolating valves, and associated devices.

E. Solenoid valves shall be provided in the water panels to control make-up water for the odor control system sumps and shall be in accordance with Division 40 requirements.

F. Sump low level switch 21:LSL-1911 shall be manufacturer's standard.

G. Nutrient tank low level switch 21:LSL-1910 shall be manufacturer's standard. The switches shall indicate low level when the volume (and corresponding level) in the nutrient tank drops below a specific number of gallons (and corresponding level) as directed by the Engineer during construction. Level switch shall be a horizontal float-type switch. Materials shall be Type 316 stainless steel. Contact rating shall be minimum 20 VA. Provide conduit for wiring connections. Level switch shall be Gems LS7 type 9, or equal.

H. Pressure reducing valves shall be provided in each water panel to reduce upstream water pressure to the range required for the irrigation system. Pressure gauges shall be provided upstream and downstream of the pressure reducing valve. Pressure gauges shall be provided in accordance with Section 40 73 13 – Pressure and Differential Pressure Gauges.

I. Differential pressure gauges shall be provided to measure pressure drop across the media. Differential pressure gauges shall be in accordance with Section 40 73 13 – Pressure and Differential Pressure Gauges:

1. Differential pressure gauges 21:PDI-1911 shall be provided to measure pressure drop across the media for the odor control system as shown.

J. Differential pressure switches shall be provided to measure pressure drop across the media. Differential pressure switches shall be in accordance with Section 40 76 36 – Pressure and Differential Pressure Switches:

K. Differential pressure switches 21:PDSH-1911 shall be provided to alarm on high pressure drop across the media for the odor control system. Alarm setpoint shall be per manufacturer's recommendation.

L. Rotameters shall be provided to measure make-up water for odor control systems' water panels and shall be in accordance with Section 40 71 43 – Variable Area Flow Meters. The rotameter and associated needle valve shall measure and control the amount of make-up water fed to the recirculation sump.

M. pH Sensor and analyzer 21:AE/AIT-1911A, shall be provided in accordance with Section 40 75 13 – pH/ORP Analyzers to measure pH in the recirculation sumps of the odor control system. The analyzer shall be located in the associated control panels. pH sensors shall be removable for cleaning and calibration without taking the odor control system out of service.

N. H2S Sensors and analyzers 21:AE/AIT-1911B and 21:AE/AIT-1911C, shall be provided in accordance with Section 40 76 21 – Single Point Gas Monitoring Systems to measure H2S at the inlet and the outlet of the odor control system. The analyzers shall be located in the associated control panels. H2S sensors shall be removable for cleaning and calibration without taking the odor control system out of service.

2.11 TIE DOWN SYSTEMS

A. Scrubbers, tanks, duct and exhaust stack shall withstand horizontal loadings of 40 pounds per square foot or the maximum wind load at the location in accordance with the latest edition of the Building Code in the jurisdiction where the system will be installed, for the area under the worst condition, whichever is greater. Type 316L stainless steel clips, anchor bolts, and accessories shall be provided to securely anchor the scrubbers, tanks, duct, and exhaust stack to the concrete pad. Scrubbers, tanks, duct, and exhaust stack tie-down systems shall comply with Section 05 05 23 – Metal Fastening.

PART 3 – INSTALLATION

3.01 INSTALLATION

A. All equipment shall be assembled and shipped so that field assembly will be minimized and installation can be completed with little or no field fabrication.

B. The odor control system shall be installed by the ***Contractor*** ~~**Vendor**~~ in accordance with the Contract Documents, the instructions of the Vendor, and Section 46 00 00 – Equipment General Provisions. [ADD NO. 3]

C. Vendor shall provide the Contractor with space and structural requirements, clearances, utility connections, signals, outputs, and features required by for the equipment installation.

D. All electrical and ancillary equipment shall be stored in a climate-controlled building greater than 50 degrees F.

E. All parts shall be properly protected so that no damage or deterioration will occur in transit or during prolonged storage at the site. All openings in equipment shall be protected against entry of foreign objects.

F. Each box, crate, and package shall be properly marked to show its contents and net weight.

G. If not already installed in the fiberglass vessels, media shall be delivered in bags for ease of installation. Long-term media storage is not acceptable.

H. All cut edges of fiberglass shall be coated with the specified resins prior to installation.

3.02 SHOP TESTING

A. Provide the services of an independent FRP Testing Inspector to be present at the point of manufacture, upon completion of fabrication and prior to shipment, to perform or witness the following:

1. Visual inspection to the requirements of ASTM D2563 Level II.

2. Barcol Hardness measurements per ASTM D2583-87.

3. Acetone sensitivity test for all internal secondary bonds.

4. Glass content by ignition loss on three cutouts per ASTM D2584.

5. Hydrostatic leak test: Perform on each vessel. Fill to five (5) feet above bottom of vessel; allow to stand for 2 hours with no visible signs of leakage.

3.03 SYSTEM START-UP AND TESTING

A. Start-up and testing of the biological odor control system shall be performed in accordance with the Vendor's written instructions and as instructed by Vendor at the Site.

B. System start-up shall be performed by the Vendor and shall commence only after a visual inspection confirming proper installation by the Vendor's representative. Vendor shall provide all material, labor, tools, specialized materials required during start-up, such as inoculums and equipment required to complete equipment checkout and start-up.

C. Do not start up system, unit process, or equipment without submitting acceptable preliminary operations and maintenance manuals by Contractor, in accordance with Section 01 78 23 – Operations and Maintenance Data.

D. All testing shall be done in the presence of the Engineer and the biological odor control system Vendor or their approved representative.

E. The biological odor control system Vendor shall provide services as follows:

1. Field test and calibrate equipment and demonstrate to the Owner that all equipment satisfactorily performs as specified.

2. Submit field testing reports and certification of proper installation to Engineer and Owner.

3. Submit start-up data report to Engineer and Owner.

4. Vendor shall perform the field tests. The Vendor shall provide all test apparatus required.

5. List and recommend corrective action for any deficiencies found.

6. Record inlet air temperature, inlet air relative humidity, inlet airflow rate, media temperature, media differential pressure, inlet and outlet concentrations of hydrogen sulfide, and other data as may be appropriate.

7. All data shall be submitted to the Engineer and Owner in written report form. Field testing report shall include, at a minimum, description of testing procedure, summary of all data collected in tabular form, operational comments, confirmation of compliance with performance requirements, and recommendations/corrective actions (if necessary).

3.04 FIELD ACCEPTANCE TESTS

A. Field acceptance tests shall be required for all biological odor control system equipment specified herein within six (6) months of installation of the equipment. All equipment shall be field tested in accordance with the applicable requirements of Section 46 00 00 – Equipment General Provisions. The biological odor control Vendor shall submit information which fully describes the testing procedure. The biological odor control system Vendor shall provide at least ten (10) days' notice of such tests to the Engineer and the Owner prior to performing the test. The Owner and the Engineer reserve the right to witness the field acceptance tests. In case of failure of any unit to meet the test requirements, the biological odor control system Vendor shall make such alterations as are necessary, and the tests shall be repeated without additional cost to the Owner until the equipment is satisfactory. Certified reports shall be submitted to the Engineer for approval.

B. Mechanical Test: Each entire biological odor control system with other associated equipment such as fans, irrigation system, piping, and controls shall be mechanically tested for at least six (6) hours after initial installation. The test shall be made with recirculation liquid and air being introduced at the design flowrates. All equipment shall show evidence of mechanical soundness, no evidence of liquid or gas leaks, no undue vibration, and generally be structurally rigid when being tested.

1. This mechanical testing shall also include testing to determine if each combined exhaust fan/motor system is free from all objectionable heating and noise. Noise level shall be measured along each side of the enclosure to verify conformance to the limits specified in 2.02 J above. Temperature shall be measured inside the enclosure to verify conformance to the maximum 5 degrees Fahrenheit over ambient temperature requirement. The Vendor shall make such changes or alterations to the fans, motors, enclosures, and/or accessories necessary for satisfactory operation as directed by the Engineer based on the results of the field tests for heating and noise.

C. Performance Test: The biological odor control system Vendor shall test each unit two (2) times to meet the design conditions of service. Submit written documentation indicating the proper operation of all system components to the Engineer prior to performance testing. The first performance test shall occur as soon as possible after the acclimation period, a minimum of six (6) weeks after startup, as determined by the biological odor control system Vendor. The second performance test shall occur following the first performance test and shall occur in the months of July, August, or September. Both performance tests shall follow the procedures specified herein. The ability of the equipment to meet the performance requirement shall be determined by the capability of reducing H_2S by 99.5% or to less than 0.5 ppm by volume, whichever is greater, of the concentration of hydrogen sulfide in the air at maximum inlet H_2S concentration conditions. Each performance test shall be witnessed by the Engineer.

1. At a minimum, the Vendor shall furnish the following items for testing:

    a. Portable manometer with a range of 0 to 10 inches W.C. for differential pressure loss across biological odor control system

    b. Air velocity meter with pitot tube for airflow through each odor control unit

    c. AcruLog 0-1000 ppm H_2S portable gas analyzer with air pump for inlet gas concentrations with data logger

    d. Low range AcruLog (0-50 ppm) H_2S portable gas analyzer with air pump for outlet gas concentrations with data logger.

    e. pH meter.

    f. All water, power, and chemicals required for the tests.

    g. Vendor to provide all labor and equipment that the biological odor control system Vendor's field engineer requires for conducting the tests.

2. H_2S Test Procedures: The test shall be conducted on each biological odor control system unit for a one-week period at design air flowrates. H_2S inlet and outlet samples shall be continuously sampled and the data logged by the instrument data loggers for the one-week period. H_2S sampling methods shall conform to the following standards:

    a. The inlet and outlet H_2S concentrations for each system shall be accurately measured using the H_2S portable gas analyzers specified herein.

    b. Inlet samples shall be taken from the biological odor control system inlet ductwork. Outlet samples shall be taken from the biological odor control system exhaust stack.

c. Record airflow, differential pressure, makeup water rate, and operating pH on a daily basis.

3. The performance testing shall be repeated until satisfactory results are obtained. The Vendor shall make any and all changes required to ensure the odor control systems meet the performance requirements specified above.

D. Fiberglass Vessel Testing: A one (1) inch diameter FRP sample shall be taken at a point in each vessel wall as selected by the Engineer after odor control system has been installed. The Vendor shall provide all labor, tools, and supervision necessary to obtain the FRP sample. The sample shall only be handled by the Engineer and shipped directly by the Engineer to the testing facility with a chain of custody form. The laboratory shall be notified a minimum of one week in advance of the sample delivery and 24 hours prior to shipment. The vessel sample boring shall be patched to original condition with FRP. The analysis shall be performed by Ashland Chemical Co. Analytical Services & Technology Group, Dublin, OH, or equal. The analysis shall use FT-IR spectra and a micro-ATR sampling accessory on a Varian UMA600 IR microscope. The cost of analysis and shipping shall be by the Contractor.

E. The Vendor shall re-examine the media levels after the acclimation period and add additional media to compensate for any settling of the beds.

F. The biological odor control system Vendor's representative witnessing the field tests shall submit a written report to the Engineer certifying that each biological odor control system unit:

1. Has been properly installed and accurately aligned.

2. Is free from any undue stress imposed by connecting piping and/or anchor bolts.

3. Has been operating under full load and reduced loads and that the biological odor control system unit operates satisfactorily.

4. The Vendor has accurately recorded the data obtained during the field test.

G. Any failure or malfunction of equipment or controls shall cause the test to be invalidated, and the test shall be repeated.

H. In the event that the furnished equipment does not meet all requirements of the specified field performance test, the biological odor control system Vendor shall be permitted to make adjustments and/or modifications to the system and repeat the test at the Vendor’s sole expense.

3.05 PAINTING

A. All paint and coatings shall be shop applied in accordance with Section 09 90 00 – Painting.

3.06 EQUIPMENT IDENTIFICATION

A. Each piece of equipment shall be provided with an equipment nameplate, in accordance with Section 46 00 00 – Equipment General Provisions, which shall be securely fastened in a conspicuous place and clearly inscribed with the manufacturer's name, date of manufacture, serial number, capacity in gallons, maximum temperature, design pressure/vacuum, specific gravity, pH, resin, minimum thickness, and vessel name as applicable. Equipment nameplate shall be sealed into the laminate exterior with a clear resin.

3.07 TOOLS, SUPPLIES, AND SPARE PARTS

A. The Vendor shall furnish one (1) set of all special tools required to disassemble, service, repair, and adjust the biological odor control system equipment and appurtenances.

B. The odor control system shall include the following spare parts:

1. One (1) recirculation pump

2. One (1) nutrient feed pump

3. One (1) set of bearings for each fan

4. One (1) set of fan belts for each fan

5. Ten (10) % by volume of extra media

C. The Vendor shall furnish other spare parts as recommended by the various equipment and component manufacturers. All of these materials shall be properly packed, labeled and stored where directed by the Engineer. The Vendor shall furnish start-up lubricants.

END OF SECTION

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