SECTION 11332

ODOR CONTROL SYSTEM – BIOLOGICAL

PART 1 - GENERAL

1.1 SCOPE

A. The work specified herein shall include designing, furnishing and installing all equipment and materials necessary to provide the Owner with a completely operational Biological Odor Control System. The system shall be a completely packaged two-stage, biological absorption/adsorption system. The Contractor shall be responsible for providing a complete Odor Control System that shall include, but not be limited to FRP vessel, nozzles, two independent stages of inorganic treatment media, moisture controls, nutrient supply system, air supply fan, ducting, dampers, and all necessary accessories.

1.2 DESCRIPTION

A. Multi-Stage Package System: The Supplier shall furnish and install a complete "once-through two-stage", pre-piped, wired, odor control system including two integral treatment stages, exhaust fan, valves, fittings, ductwork, and all other equipment and accessories as specified to provide a complete and functioning system. The biological treatment stage shall utilize a granular inorganic media to facilitate absorption and adsorption of odor compounds. The polishing stage shall utilize a granular media that shall be specifically designed to adsorb odorous compounds with the ability to support biological degradation of the compounds. The first stage shall operate with an independently controlled irrigation system to maintain optimum wetted conditions to support unique microbial growth for biological destruction of the odorous compounds and removal of toxic metabolites. Systems using any type of organic media and systems using a single inorganic media shall not be acceptable. Multi-Stage Odor Control Package System shall be Siemans, or approved equal

1.3 REFERENCE STANDARDS

A. PS 15-69: National Bureau of standards Voluntary Product Standard "Custom contact molded Reinforced Polyester Chemical Resistant Process Equipment".

B. ASTM D-883: "Definition of Terms Relating to Plastics"

C. ASTM D-2583: "Test for Indentation Hardness of Rigid Plastics by Means of Barcol

Impressor."

D. ASTM D-2563: "Recommended Practice for Classifying Visual Defects in Glass Reinforced Plastic Laminate Parts."

E. ASTM D-4097-82: "Standard Specifications for Contact Molded Glass Fiber Reinforced Thermoset Resin Chemical Resistant Tanks."

1.4 QUALITY ASSURANCE

A. **Manufacturer:** The products furnished under this section shall be by a manufacturer who has been regularly engaged in the design and manufacture of the equipment and who has a minimum of 5 years experience in design, fabrication and testing of biological odor control systems of the type specified. The equipment supplier shall provide a list of a minimum of 10 identical installations of the type specified that have been in operation for a minimum of 5 years. Demonstrate to the satisfaction of the ENGINEER that the quality is equal to equipment made by those manufacturers specifically named herein. Any manufacturer whose main business is FRP manufacturing shall not be accepted as a supplier of the complete system.

B. **Guarantee:** Guarantee the Odor Control System will meet with the requirements as specified herein when operated in accordance with the suppliers operation instructions.

C. **Inspection and Testing Requirements:** The ENGINEER reserves the right to reject delivery of any or all pieces of equipment found, upon inspection, to have any or all of the following: blisters, chips, crazing, exposed glass, cracks burned areas, dry spots, foreign matter, surface porosity, sharp discontinuity or entrapped air at the surface of the laminate. Any item that does not satisfy the tolerances as below shall be rejected:

Defect	Inside Surface	Outside Surface
Blister	None	Max. dimensions: 1/4" diameter by 1/8" high; Max density: 1 per sq. ft.; Min. separation: 2" apart
Chips	None	Max. dimension of break: 1/4" and thickness no greater than 10% of wall thickness; Max. density: 1 per sq. ft.

Crazing	None	Max. length: 1/2"; Max. density: 5 per sq. ft.; Min. separation: 2″
Cracks	None	None
Exposed Glass	None	None
Scratches	None	Max. length: 1″; Max. depth: 0.010″
Burned Areas	None	None
Surface Porosity	None	None
Foreign Matter	None	None
Sharp Discontinuity	None	None
Pits	Max. 1/8 inches, dia. by 1/32 inches deep; Max: 10 per ft^2	Max. 1/8″ dia. by 1/16″ deep; Max: 10 per sq. ft.
Dry Spot	None	2 sq. in. per sq. ft.
Entrapped Air	None at the surface 1/16 inches and 10 per square in. max	1/8″ and 4 per sq. in. or 1/16″ and 10 per sq. in. within laminate

D. The Engineer reserves the right to be present at the fabricators facility for visual inspection of equipment to be supplied.

E. Upon completion of the installation, each piece of equipment and each system shall be tested for satisfactory operation without excessive noise, vibration, overheating, etc. Compliance shall be based on the equipment manufacturer's specifications and all applicable costs and standards. All equipment must be adjusted and checked for misalignment, clearances, supports, and adherence to safety standards.

F. The Contractor shall be responsible for the successful startup and testing of each odor control facility. The Contractor shall provide all necessary facilities, manpower, tools, instrumentation, and laboratory testing services required during this phase of the work.

1.5 SUBMITTALS

A. The Contractor shall submit complete Shop Drawings for the System, together with all piping, ductwork, valves, and control for review by the ENGINEER.

B. The Contractor shall submit the following information for approval before equipment is fabricated:

1. Letters of Certification of Compliance on materials, equipment, etc.

2. Final Certified Drawings showing outline dimensions, foundation layout or mounting information, and other pertinent dimensions.

3. Field erection instructions, assembly drawings and/or diagrams, detailed reference drawings lists, and lists of erection details.

4. Schematic and wiring diagrams of power, control, and piping systems with all devices, terminal, and wires uniquely numbered. Clearly indicate between factory and field wiring. All field wiring shall be included for each diagram to describe all modes of operation of the system indicated. Where the integrated system requires interlocking and control and other components in normal operation, these components shall be included in the description of operation.

5. Drawings of system showing assemblies, arrangements, piping, electrical, mounting details, equipment outline dimensions, fitting size and location, motor data, operating weights of all equipment and sufficient information to allow the ENGINEER to check clearances, connections, and conformance with the specifications

6. General bulletins and catalog cuts describing complete apparatus including operating principles and fundamentals.

7. Renewal parts list with diagrammatic or cross-section drawing showing part identification. Material analysis or trades designation for each significant part is to be noted on parts lists or on a separate sheet.

8. Materials of construction of all equipment.

9. The formal test protocol for use during performance testing, if required.

10. Recommended list of spare parts and safety equipment along with price and ordering information. Spare parts at a minimum shall include the equipment listed in Paragraph 2.10 of this Specification.

11. Control panel layouts with devices and nameplate engraving. Panel drawings shall indicate all equipment including inside and outside of the panel. Drawings shall indicate location of all alarms, lamps, and devices on the panel for ENGINEER'S approval.

12. Complete instrumentation, control, logic and power wiring diagrams in sufficient detail to allow installation of the instrumentation, controls, and

electrical components.

13. Electrical equipment rating and data sheets for all devices.

14. Quality assurance information in accordance with Paragraph 1.2 of this Specification.

15. Warranties in accordance with Paragraph 3.4 of this Specification.

16. Manufacturer shall submit a color chart with submittal for color selection of odor control units for ENGINEER'S approval.

17. Materials of construction of all equipment.

18. Shop Drawings and design calculations. Calculations shall be certified by a Registered Professional Engineer in the State of Arizona with demonstrated experience in the design of these systems.

19. Pump data and performance curves showing flow, pressure, and horsepower.

20. Manufacturer's list of similar systems in operation.

21. Manufacturer's catalog data, operating literature. Specifications, performance data, and calibration curves for exhaust fan and auxiliary components.

22. Manuals: Furnish manufacturer's installation, operation and maintenance manuals, bulletins, and spare parts lists.

C. Submit complete Operation and Maintenance Manuals in conformance with Section 01100, Submittals, including all material safety data sheets, equipment installation instructions, startup instructions, equipment maintenance procedures and troubleshooting guide. Individual operation and maintenance information on each major system component shall be included.

D. Submit the odor system manufacturer on-site representative's complete signed report of results of the inspection, operation, adjustments, and tests. Include the manufacturer's certificate that equipment is ready for permanent operation, the OWNER'S personnel have been trained in accordance with Part 3 of this Specification, and that nothing in installation will render manufacturer's warranty null and void.

1.6 MANUFACTURER'S SERVICES

A. The system manufacturer's representative shall be present at the job site for the following time period; travel time excluded:

1. Sixteen hours for inspection of the installation and training of Owner's staff in operation of the system.

2. Provide one trip for two days for these tasks.

1.7 QUALIFICATIONS

A. The company Specializing in the manufacture of products specified in this Section shall have a minimum five years documented experience and at least 10 identical installations of similar applications of service. All listed vendors must still meet the requirements of the Specifications.

B. The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality, type of system, and the configuration desired. The design of the Odor Control System and equipment is based on the parameters as shown on the Drawings and as listed in this Specification. Systems offered by other interested manufactures will be considered, provided that Specification requirements are met and that all necessary structural, electrical, mechanical, and layout changes required are submitted in detail. The CONTRACTOR shall bear all costs for revisions to the piping, structural, electrical, instrumentation, equipment, labor, and any other portions of the Work that may be required to adapt the general layout and details shown on the Drawings to the equipment actually furnished. All necessary design revisions shall be made at the CONTRACTOR'S sole expense. All redesign information prepared by the CONTRACTOR shall be submitted to the ENGINEER for review and approval prior to incorporating the redesign into the Work.

1. Siemens
2. Approved equal.

C. The manufacturer shall provide a list of 10 similar odor control systems associated with municipal wastewater. The list shall include correct names, phone numbers, length of service and design criteria.

D. If any modifications to the Odor Control System Drawing are necessary as a result of the equipment chosen by the CONTRACTOR, the CONTRACTOR is responsible for any changes, and construction costs associated with any design changes. All design changes shall be submitted to the ENGINEER for review and

approval.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Materials are to be marked or tagged with part number and order number for field assembly requirements.

B. Touch-up paint with instructions for applications is to be supplied by the manufacturer for application by erection personnel.

C. All supports, members, and miscellaneous parts shall be packaged for shipment in such manner to prevent abrasion or scratching.

PART 2 - PRODUCTS

2.1 GENERAL

A. The CONTRACTOR shall provide an odor control system specified which shall treat in a single pass the odorous air from the contaminated areas. The system shall be designed for continuous, automatic operation and also be capable of manual operation. Access manways shall be provided to allow access to the internals of the system. The system shall be designed to withstand a temperature up to 120^{o}F. The multi-stage packaged FRP system shall be of UNITARY CONSTRUCTION, as specified in Section 2.3. The module and all accessories shall be factory mounted, piped, and wired to the maximum extent possible. The system shall be provided by Siemens, Poway, California, or pre-approved equal.

B. The system shall be designed for installation in a Class 1, Division 2, Group D area.

2.2 DESIGN AND PERFORMANCE CRITERIA

A. Design and Performance Criteria:

1. Criteria: The system shall be capable of removing foul air at a rate no lower than the rate shown on the following table.

2. Foul air removed from the facility will have an average and peak concentration of hydrogen sulfide (H_2S) and design air flow rate as listed in the Special Provisions

3. System Performance: The odor control system shall demonstrate following performance when operating under design flow conditions listed above.

INLET	OUTLET
1-10 ppm H_2S	0.1 ppm H_2S
Greater than 10 ppm H_2S	1% of inlet

4. Maximum Pressure Drop: The pressure drop across the odor control system shall not exceed 5.0 in.w.c. at the maximum air flow rate specified above.

2.3 MULTI-STAGE FRP PACKAGED BIOLOGICAL ABSORPTION/ADSORPTION SYSTEM:

A. General: The gas treatment system shall be a TWO-STAGE, ONCE THROUGH BIOLOGICALLY ACTIVE ODOR REMOVAL SYSTEM OF UNITARY CONSTRUCTION, designed to remove minimum of 99% of H_2S vapor in a single pass. The system shall consist of a humidifier, one biological gas conditioning/treatment stage, and one vertical gas polishing stage in series. After humidification, the first stage shall facilitate biological destruction of odor compounds absorbed by the liquid in the system and adsorbed on the inorganic media. The biological section shall include a spray header to distribute liquid evenly over the media. The complete treatment vessel shall be fabricated of premium grade FRP.

1. The air shall enter the vessel through the humidification section. After humidification, the first treatment stage shall contain media specifically designed to support biological growth for degradation of odor compounds. This stage shall provide absorption of odors from the air stream. The second polishing stage shall contain media specifically designed to adsorb odor compounds and to support biological degradation of those compounds. This stage shall provide final removal of odors to the specified level. Overall media depth shall be a minimum of 48 inches.

2. The first stage of media shall be wetted with fresh potable or re-use make-up water.

3. The overall system size, including the fan, controls, and appurtenances shall not exceed the dimensions shown on the contract drawings. Access manways shall be provided to allow access to the system internals. As a minimum, access manways shall be provided between the treatment stages. A portion of the system top shall be removable for access to the top of the second stage.

4. The system shall be included with all piping, valves, and internals. The material of construction of internals shall be as follows:

Packing Media Support:	HDPE and FRP

Liquid Distributor:	PVC
Spray Nozzles:	PVC
Humidifier Nozzles:	316 SS

5. The system shall have all components pre-mounted and piped on the unitary constructed system, except for the control panel. The system shall be shipped as a single piece.

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Liquid Distributor:	PVC
Spray Nozzles:	PVC
Humidifier Nozzles:	316 SS

6. The system shall have all components pre-mounted and piped on the unitary constructed system, except for the control panel. The system shall be shipped as a single piece.

B. <u>Material of Construction:</u>

1. The vessel and accessories shall be contact molded manufactured in accordance with NBS PS 15-69, ASTM D 4097 for contact molding. Any material of construction other than FRP with premium grade resin will not be allowed.

2. Resin used in the system liner shall be a premium vinyl ester type such as Hetron 922 by Ashland Chemicals, Derakane 411 by Dow Chemical, Vipel F010 by AOC, or approved equal. The resin shall be reinforced with an inner veil of a suitable synthetic organic fiber such as Nexus 111-00010.

3. Reinforcement: Glass fiber reinforcement used shall be commercial grade corrosion resistance borosilicate glass.

a. All glass fiber reinforcement shall be Type C, chemical grade, Type E electrical grade.

b. Surfacing veil shall be 10 mil Nexus 111-00010 or equal.

c. Mat shall be Type "E" (electrical grade) glass, 1 1/2 oz. per sq. ft with a nominal fiber length of 1.25 $\pm$ 0.25 inches, with a silane finish and styrene soluble binder.

d. Continuous glass roving, used in chopper gun spray-up applications shall be type "E" grade with chrome or silane coupling agent.

e. Alternate layers of mat and woven roving used for reinforcement.

4. Miscellaneous:

a. Stainless Steel: Unless otherwise specified, all fasteners, and metal attachments, such as anchors, brackets etc shall be ANSI 316SS.

b. Gaskets: Unless otherwise specified, all gaskets shall be EPDM.

C Fabrication:

1. General: Fabrication shall be in accordance with NBS PS 15-69, ASTM D 3299 and ASTM D-4097. All non molded surfaces shall be coated with resin incorporating paraffin to facilitate a full cure of the surface. All cut edges, bolt holes, secondary bonds shall be sealed with a resin coat prior to the final paraffinated resin coat. All voids to be filled with a resin paste.

2. Corrosion Liner: The inner surface of all laminates shall be resin rich and reinforced with one NEXUS 111-00010 with a minimum thickness of 10 mils. The interior corrosion layer shall consist of two layers of 1 1/2 oz. per sq. ft. chopped strand mat. If the application is by chopper gun spray up the glass fiber shall be 1/2 to 2 in length. The total corrosion liner thickness shall be a minimum of 100 mils and have a resin to glass ratio of 80/20. All edges of reinforcement to be lapped a minimum of one inch.

3. Structural Laminate: Structural laminates shall consist of alternating layers of 1-1/2 oz per sq. ft mat or chopped glass and 24 oz per sq. yard woven roving applied to reach a designed thickness. Actual laminate sequences shall be per the laminate tables shown on fabrication drawings. The exterior surface shall be relatively smooth and shall have no glass fibers exposed. The exterior shall be surface coated with gel coat containing ultra violet light inhibitors.

D. Accessories:

Air inlet, air outlet, spray headers, baffles, media support, drain and all connections shown on the drawings shall be provided by the manufacturer. Tie down lugs shall be integrally molded into the walls of the vessel. All external bolts shall be 316SS and designed for the specified loads. Interior fasteners shall be of corrosion resistant materials such as PVC or FRP.

E. **<u>Neoprene Pad</u>:**

A 1/4" thick, 60 durometer neoprene rubber sheet must be placed underneath the vessel.

2.4 EXHAUST FAN

A. General. Fan shall be centrifugal design manufactured of FRP with a radial blade wheel. The wheel shall be statically and dynamically balanced. The fan inlet shall be slip type and the fan outlet shall have a flanged nozzle. The fan will be provided with a neoprene shaft seal.

B. Fan shall be supplied with a TEFC motor with 1.15 service factor suitable for three-phase, 60 Hz, 480 volt service and rated for Class 1, Div. 2, Group D installation. The fan shall be direct driven. The motor shall be inverter-duty, suitable for use with a Siemens Micromaster VFD or equal.

C. Performance. The fan shall be tested and rated in accordance with AMCA and shallbear the AMCA seal. The fan shall be designed following the specifications listed in the Special Provisions.

D. Fan shall be manufactured by New York Blower, Hartzell, or equal.

2.5 Water Softener System

A. A water softener shall be supplied if the make-up water hardness defined in Section 1.5 is too high for the proper operation of the biological scrubber as specified by the scrubber manufacturer.

B. The water softener shall have a flow capacity at least equal to the maximum required make-up water rate for the scrubber and shall be capable of removing hardness to no more than 0.5 grains. The unit shall be 115-volt, single phase. The complete water softener system shall consist of one control valve, two mineral tanks, one brine tank, one electromechanical meter, one extra cam and switch, and connecting pipe between vessels and resin.

C. Each mineral vessel shall be a corrosion and UV resistant composite, constructed of a polyethylene shell wound with continuous fiberglass fibers. Each vessel shall be supplied with high capacity cation exchange resin. Each vessel shall include an inlet diffuser to evenly distribute the influent water, to collect backwash water and to introduce the brine regeneration solution.

D. One of the two mineral vessels shall be fitted with a top-mounted, five-cycle multiport control valve to operate the backwash, brining, slow rinse, fast rinse and refill cycles. An additional piston assembly shall be included to control the duty/standby status of the two vessels. A brass control valve including fixed and self adjusting flow regulators shall be provided. A hydraulically balanced teflon coated piston shall be provided to perform the cycles of regeneration.

E. A single salt storage tank shall be provided as part of the softener system. The salt storage tank shall be constructed of corrosion and UV resistant polyethylene. The brine tank shall be equipped with an automatic air eliminator safety valve which shall be attached to the brine line and housed within a chamber inside the brine tank. The brine valve shall automatically open to educt the brine into the softener tank, close to prevent eduction of air, and refill the brine tank with the proper amount of water. The CONTRACTOR shall supply the first charge of salt for the brine tank.

F. The water softener system shall have two modes of operation: service and regeneration. After the regeneration of a softener is complete, it shall go into standby mode until the duty vessel requires regeneration.

G. Each water softener shall have a five year warranty.

H. The water softener package shall come skid mounted, preplumbed and wired.

I. Acceptable manufacturer:

1. US Filter, model KFZST009FXZNAX
2. Approved equal.

2.6 INSTRUMENTATION AND SYSTEM CONTROLS

A. The electrical control panel shall provide electrical control for the exhaust fan and water addition system. A 120 VAC, 1-phase power supply and a 480 VAC, 3-phase power supply shall be supplied to the panel to power the system.

B. The control panel enclosure shall be of fiberglass construction and rated NEMA 4X. The panel shall be remote-mounted by the contractor next to the system assembly at least 3 feet away to comply with requirements of a Class 1, Division 2, Group D installation. The installation and wiring of the local control panel to the biofilter mounted fan, metering pump and solenoid valve will be the responsibility of the Contractor. The control panel shall be factory tested to full

operation with all other components prior to shipment.

C. The panel shall have the following components or capabilities:

1. Fan switch (ON-OFF).
2. Push-to-test button for water valve.
3. Timer relay for on/off control of water valve.
4. Blower VFD
5. Nutrient Pump (ON-OFF-AUTO)

D. The water control cabinet shall be constructed from a NEMA 12 rated FRP cabinet with all internal piping SCH 80 PVC. The cabinet shall be mounted to the system assembly. The cabinet shall contain the following components:

1. Pressure reducing valve.
2. Nutrient Pump (rated for installation in a Class 1, Division 2, Group D area)
3. Irrigation solenoid valve (Explosion-proof rating).
4. Valve for pre-humidification.
5. Irrigation system pressure gauge.

E. Water pressure regulator, solenoid valve, and rotameter shall be provided for control of water application rates. These components shall be mounted in the water control cabinet.

2.7 ACCESSORIES

A. Water Flow 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.

B. Water Distribution System. The first media stage shall be equipped with an independent water distribution system. The system shall be designed to irrigate the top of the first media bed with complete and even coverage via spray nozzles.

C. Nutrient Addition. A nutrient containment and metering system shall be provided with the system. Nutrients supplied as a coating to the support media shall not be allowed.

2.8 PIPING

A. All make-up water and drain piping shall be SCH 80 PVC.

2.9 NUTRIENT RESERVOIR

A. The Nutrient Reservoir shall be integrated into the system sump. Loose external tanks shall not be allowed.

2.10 SPARE PARTS

A. The following spare parts shall be provided:

1. One sets of fan bearings.
2. One sets of fan belts.

B. All special tools and safety equipment required for normal operation and maintenance of the equipment shall be furnished. A list of special tools and safety equipment shall be included in the submittals.

C. Any additional spare parts required for the first year of operation shall be furnished by the manufacturer.

2.11 PAINTING

CONTRACTOR shall provide finished coat per Section 09900, Painting. Final color selection shall be approved by ENGINEER prior to application.

PART 3 - EXECUTION

3.1 Installation

A. Install in accordance with manufacturer's instructions.

B. Install scrubber systems to interface with ductwork and piping as shown on the Drawings.

C. CONTRACTOR shall place a minimum 1/4 –inch thick, 60 durometer neoprene rubber sheet underneath the scrubber unit.

3.2 SITE AND UTILITIES

A. The system shall be located on a foundation as shown on the drawing. The following utilities shall be provided at the site and located as shown on the drawing.

Site preparation, utility service, and installation are not provided by the Manufacturer under these specifications.

1. Electrical – 120 VAC 1-phase and 480 VAC, 3-phase services are required.

2. Water Supply – a 3/4 inch water supply with backflow preventer are required. Water supply must provide for a minimum of 30 psi continuous pressure at 6.0 GPM and a hardness not to exceed 200 mg/L as calcium carbonate.

3. Drain – a minimum 2 inch P.V.C. gravity drain to sewer with a barometric trap is required.

3.3 FIELD TESTING REQUIREMENTS

A. The performance tests shall be conducted at such time as all anticipated odorous air streams are present in the scrubber inlet. The time of the tests and detailed test procedure shall be submitted for approval prior to the testing period. In the event hydrogen sulfide levels are below anticipated levels, the CONTRACTOR shall augment hydrogen sulfide levels in the influent air stream so hydrogen sulfide is within +/- 2 ppm of design level.

B. During testing, scrubber overflow, recirculation, and scrubber air flowrates shall be held constant. Changes in scrubber system operating conditions shall not be permitted. All fine-tuning of operating conditions shall be performed prior to testing.

C. Design operating conditions shall be maintained for a minimum of six hours. During this time, all pertinent operating parameters shall be monitored and recorded, sufficient sampling and analysis shall be conducted to demonstrate that flow rates, temperatures, and solution concentrations are at design conditions.

D. Hydrogen sulfide concentration shall be measured at the scrubber inlet and outlet. As a minimum, the test shall be conducted for one hour at the average H_2S level, one hour at the peak H_2S level, and four hours on actual plant conditions. Inlet and outlet levels shall be measured once every 15 minutes using a portable H_2S analyzer such as Interscan, Jerome, or approved equal.

E. A description of the performance tests shall be submitted. The hydrogen sulfide compound removal efficiency shall be as specified in the design and performance requirements. Should scrubber system performance not meet any of the above requirements, that system shall have failed the performance tests. The CONTRACTOR shall make any additions or modifications to that scrubber system

as may be necessary, at no additional cost to the OWNER, and the performance tests for the system shall be repeated in its entirety.

3.4 START-UP AND TRAINING

A. The services of a factory representative shall be provided as specified in Section 1.6 to insure proper installation and start-up of the system. The Manufacturer shall make any changes to the system that may be necessary to meet the specified performance under inlet conditions as specified.

3.5 OPERATION AND MAINTENANCE MANUALS

A. Six manuals shall be submitted prior to final acceptance of the equipment.

3.6 WARRANTY

A. Contractor shall warrantee the whole system, both in material and workmanship for a period of one year from the day of beneficial occupancy. This period shall not extend beyond 18 months after delivery of equipment to job site.

3.7 SERVICE CENTER

A. To be an approved odor control system supplier, the system supplier shall have complete ongoing service capability with factory trained personnel. The personnel from the service center shall be able to perform the following task. Media change-out services and disposal services, analytical services, measurement of inlet and outlet hydrogen sulfide concentrations, and general maintenance. A manufacturer's sales representative office shall not be acceptable.

B. Each system supplier shall be capable of furnishing system operational analyses consisting of field H_2S measurements, airflow measurements, odor sampling and analysis, and operational trouble shooting.

PART 4 MEASUREMENT AND PAYMENT

4.1 Measurement

A. No measurement will be made for this item, Odor Control Units

4.2 Payment

A. Payment will be made at the contract lump sum price bid and shall be considered full payment for providing labor and materials to perform this work.

**** END OF SECTION 11332 ****