

SECTION 11332.1

ODOR CONTROL SYSTEM – CHEMICAL

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 complete skid-mounted Air Scrubbing System for the control of atmospheric hydrogen sulfide and other sewer odors. The system shall consist of three modular stages, configured to eliminate short-circuiting of the air stream and to provide intimate contact with chemical solution for removal of hydrogen sulfide and other sewer odor causing compounds. The Contractor shall be responsible for providing a complete Odor Control System that shall include, but not be limited to all system appurtenances, blower, skid, control system, recirculation and metering pumps, and chemical storage tanks shall also be provided, in accordance with these specifications.

1.2 DESCRIPTION

- A.** Multi-Stage Package System: The Supplier shall furnish and install a complete "once-through three-stage", pre-piped, wired, odor control system including three treatment stages, exhaust fan, valves, fittings, ductwork, and all other equipment and accessories as specified to provide a complete and functioning system. The contaminated air shall enter the first module, termed "Stage 1", between the packed bed tower and sump section and contact the liquid counter-currently. After treatment in Stage 1, the air shall be transported by duct from the top of Stage 1 to the second module, termed "Stage 2", between the packed bed tower and sump section. After treatment in Stage 2, the air shall be transported by duct to the third module, termed "Stage 3", between the packed bed tower and sump section. After treatment in Stage 3, the air shall pass through a mist eliminator to remove entrained liquid. In each stage, the aqueous solution shall be continuously recirculated from the sump to nozzles at the top of the packed bed. Make-up water shall be continuously fed into the sump reservoirs to flush contaminants out of the system and into the drain. Sodium hydroxide shall be added to stage 2 under the control of a pH controller to aid the mass transfer of hydrogen sulfide from the air stream into the liquid phase via acid-base neutralization. Sodium hydroxide shall be added to stage 3 under the control of a pH controller and sodium hypochlorite shall be added to stage 3 under the control of an ORP controller to oxidize the remaining odor causing compounds. Greater than 80 percent of the inlet hydrogen sulfide shall

be removed by Stages 1 and 2. The Multi-Stage Odor Control Package System shall be Siemens, or approved equal.

1.3 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 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.
- 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 noted 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
Defect	Inside Surface	Outside Surface

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.

1.4 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 2.14 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 1.4 of this Specification.
 - 15.** Warranties in accordance with Paragraph 3.6 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 01330, 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.

1.5 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.

1.6 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, and 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.

1.7 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°F. The three-stage, once-through, skid mounted packaged system shall be of MODULAR 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 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 (H₂S) 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.

<u>INLET</u>	<u>OUTLET</u>
1-10 ppm H ₂ S	0.1 ppm H ₂ S
Greater than 10 ppm H ₂ S	1% of inlet

4. Maximum Pressure Drop: The pressure drop across the odor control system shall not exceed 6.5 in.w.c. at the maximum air flow rate specified above.

2.3 MULTI-STAGE PACKAGED CHEMICAL ODOR CONTROL SYSTEM:

- A. General: The gas treatment system shall be a THREE-STAGE, ONCE THROUGH SKID-MOUNTED PACKAGED ODOR CONTROL SCRUBBER OF MODULAR CONSTRUCTION, designed to remove a minimum of 99% of H₂S vapor in a single pass. The system shall consist of three stages of gas absorption, an individual integral sump for each stage, mist eliminator, exhaust fan, exhaust stack, recirculation and metering pumps, piping, valves, fittings, instrumentation and controls to create a functional system.

An air exhaust fan will pull foul odorous air from the wet well through the scrubber via a network of ducting and passes through the scrubber system. The gases pass through three packed bed sections. The foul air enters the first stage and contacts a recirculation stream including the chemical blowdown from stage 2.

The second stage, will contact the odorous gas counter-currently with a combination of NaOH solution and blowdown from stage 3. Stage 3 consists of a final polishing process where the gas is contacted counter-currently with fresh NaOH/NaOCl solution.

The composition of the chemical sumps is maintained by injecting NaOH and NaOCl, respectively. Sodium hydroxide injections are automatically controlled with pH controllers. Sodium hypochlorite injections are automatically controlled with an ORP controller. Water losses due to evaporation and blowdown are compensated by adding water via a manual rotameter. An overflow above the liquid level assures that the chemical sump can never be overfilled.

The chemical sump and absorption column for each stage is housed in a single HDXLPE chamber with threaded access ports for easy and quick access to any part of the system. The individual modules are pre-connected and tested at the factory. The spray nozzles in each section are easily removable.

1. 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.
2. All components of the scrubber system shall be compatible with the conditions and chemicals for which they are subjected during the normal

operation of the system. Compounds with which the materials must be compatible include, but are not limited to:

1. Hydrogen sulfide
2. Sodium hydroxide
3. Sodium hypochlorite
4. Acids

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

Packing:	2" polypropylene Jaeger Tri- Packs® or equal
Mist Eliminator:	Polypropylene Kimre™ mist eliminator or equal
Spray Nozzles:	Teflon or PVC two per stage

4. The system shall have all components pre-mounted and piped on the system, except for the chemical tanks. The system shall be shipped as a single piece.

B. Material of Construction:

1. The vessel and accessories shall be manufactured by the rotational molding process in accordance with ASTM D 1998-91 Standard Specification for Polyethylene Upright Storage Tanks, Type 1 only. Any material of construction other than High-Density Cross linked Polyethylene HDXLPE will not be allowed.
2. The molding powder used shall be Marlex CL-250 or CI-200 as manufactured by Phillips 66 or powders of equal physical and chemical properties. The plastic shall contain no fillers. The plastic shall contain an ultraviolet stabilizer and shall be compounded in the polyethylene.
3. Grounding Lug: Each scrubber tower shall be equipped with a titanium or hastelloy grounding lug. The lug shall be connected to a grounding rod providing an earth ground for the system.
4. Scrubber Manway Covers: Shall be 12" diameter minimum with a threaded or bolted cover and gasket.

5. Miscellaneous:

- a. Plastic fittings shall be "bulk-head" or "two-flange" style and shall be constructed of PVC.

- b.** Stainless Steel fittings shall be manufactured from 316 grade stainless steel.
- c.** Openings cut into the vessel to install fittings shall not have sharp corners.
- d.** All flanged fittings shall be ANSI/ASME B-16.5 for 150 psi pressure class.

2.4 EXHAUST FAN

- A.** General: Fan shall be centrifugal design with cast, baked enamel crated carbon steel radial bladed wheel. The wheel shall be statically and dynamically balanced. Air stream components shall be fabricated of carbon steel and coated with a two-part elastomeric coating for corrosion resistance. Housing shall be fully welded. The fan shall be mounted on the skid.
- B.** Fan shall be supplied with an OSHA weather cover covering the entire shaft/bearing/v-belt drive and motor assemblies. Fan shall have slip inlet and outlet, and a drain with plug. Fan shall have adjustable V-belt drive or be direct driven as required, and a TEFC, 3600 RPM motor with 1.15 service factor suitable for 3/60/480V service. Fan bearings shall be heavy-duty ball type, grease lubricated, self-aligning with minimum of 100,000 hour B-10 life. Fan shall be tested and rated in accordance with AMCA and shall bear the AMCA seal.
- B.** Performance: The fan shall be tested and rated in accordance with AMCA and shall bear the AMCA seal. The fan shall be designed for specifications listed in the Special Provisions.
- D.** Fan shall be manufactured by New York Blower, Hartzell, or equal. The motor shall be manufactured by WEG, Baldor, Reliance or approved equal.

2.5 Recirculation Pumps

- A.** General: Furnish seal-less vertical pump constructed of CPVC for each stage. Include motor and mounting plate.
- B.** Performance: Pumps shall supply 20 GPM of recirculation flow with a head of 25 feet.
- C.** Construction:

Housing	CPVC
Impeller	CPVC
Shaft	Sleeved Stainless Steel

- D.** Motor: Motor shall be C-face, 480 volt, 60 HZ, three-phase, TEFC rated for continuous duty, and sized as necessary for the operating conditions. Bearings shall be sealed, ball type, and permanently lubricated.
- E.** Suction and Discharge: Suction ports shall be 1 1/4" FNPT and discharge ports shall be 1 1/4" MNPT. PVC unions or union-type ball valve shall be provided to allow removal of pump without disturbing chemical recirculation piping.
- F.** Pump Support: Support vertical pumps on a stainless steel support stand with adequate opening to permit access.

2.6 CHEMICAL FEED PUMPS

- A.** General: Provide three (3) bellows pumps of polypropylene plastic construction Siemens Water Technologies' Bellows Pump or equal. One pump shall be provided for stage 2 sodium hydroxide feed, one pump shall be provided for stage 3 sodium hydroxide feed, and one pump shall be provided for stage 3 sodium hypochlorite feed. Include motor, base, flexible coupling and check valve filters for each pump.
- B.** Performance: The pump rates shall be sized to supply a minimum of 150% of the chemical feed rate predicted at maximum design conditions. The pump rate shall be adjustable to 10% of upper limit. Each pump shall have a maximum discharge pressure of 40 psi.
- C.** Construction:

<u>Reference</u>	<u>Material</u>
Bellows	Polypropylene
Poppet valves	Kel-F® or EPT
O-rings	Kel-F® or EPT
Springs	Hastelloy C
- D.** Motors: Motor shall be 120 volt, 60 HZ, single-phase TEFC and shall be rated for continuous duty.

2.7 ELECTRICAL CONTROLS

- A.** General: The operation of the Odor Control System shall be controlled from a control panel, mounted remotely. All equipment control switches, pilot lights, controllers, motor starters, etc., shall be housed in the control panel. The

control panel shall be UL Listed and bear the "UL Listed Enclosed Industrial Control Panel" Label. A 480V/3 Ph/60 Hz power supply shall be supplied to the control panel. The electrical control panel shall be factory tested to full operation prior to shipment.

- B.** Enclosure: The control panel enclosure shall be constructed of stainless steel and shall be rated NEMA 4X. It shall be equipped with a door with 2 hinges. The hinged door shall have one latch.
- C.** Components: The electrical control panel shall include the following:
 - Main power disconnect
 - Surge protector
 - IEC motor starters
 - EC motor circuit protectors
 - On/off fan, recirculation and metering pump switches and indicating lights
 - pH controllers
 - ORP Controller
- D.** Standards: All control system design, fabrication, and wiring shall conform to the standards of Underwriter's Laboratories, National Electrical Code, and any other applicable federal, state, or local codes.
- E.** System Operation:
 1. Recirculation Pumps: Each recirculation pump shall be activated and deactivated manually by a two-position ON/OFF switch. A pilot light shall be provided to indicate when the pump is running.
 2. Blower: The blower shall be activated and deactivated manually by a two-position ON/OFF switch. A pilot light shall be provided to indicate when the blower is running.
 3. Chemical Feed Pumps: Each chemical feed pump shall be controlled by a three-position HAND/OFF/AUTO switch. When in the "AUTO" position the pump shall be controlled by the pH/ORP controller. The controller shall turn the pump on and off based upon preset limits of pH/ORP in the scrubber solution. When in the "HAND" position the pump shall run, regardless of the action of the controller.
- F.** pH Controller: The pH controller system shall consist of a pH sensor and a controller. The sensor shall be mounted in the recirculation piping of scrubber stage number two and three. The sensor shall send a 4-20 mA signal to the controller. The controller shall be face mounted on the control panel and shall display the signal in pH units. The controller shall have two relays with adjustable

set points. One relay shall be used to control the action of the sodium hydroxide pump. The pH controller shall be Hach SC-100 (formerly Great Lakes Instruments).

- G.** ORP Controller: The ORP controller system shall consist of a ORP sensor and a controller. The sensor shall be mounted in the recirculation piping of scrubber stage number three. The sensor shall send a 4-20 mA signal to the controller. The controller shall be face mounted on the control panel and shall display the signal in ORP units. The controller shall have two relays with adjustable set points. One relay shall be used to control the action of the sodium hypochlorite pump. The ORP controller shall be Hach SC-100 (formerly Great Lakes Instruments).
- H.** Other Components: All other components (motor starters, motor circuit protectors, switches, pilot lights, etc.) shall be appropriately sized as required to operate the scrubber equipment as specified elsewhere in this section.

2.8 WATER

- A.** General: Water controls shall be provided to insure a water flow to the system of constant pressure and flow rate. All make-up water controls shall be located inside a hinged stainless steel enclosure, which shall also be utilized to support the electrical control panel enclosure. The chemical feed pumps shall be housed in this water control box.
- B.** The make-up water control system shall consist of (at a minimum):
 - 1. One main shut-off ball valve.
 - 2. One back-flow prevention check valve.
 - 3. One pressure regulator.
 - 4. One rotameter type flow meter.
 - 5. One adjustable flow control valve (may be integral part of rotameter).
 - 6. One Cartridge-Type Sequestering Agent dosing system
- C.** The scrubber manufacturer shall provide for the continuous flow of a sequestering agent for the purpose of controlling the scale buildup within the scrubber vessel. The system shall be fully self contained, requiring no external power sources or adjustments. The system shall be installed on the makeup water line. The media shall be in stable, replaceable cartridges. No liquid pump delivery system shall be acceptable. Media delivery shall be accomplished by the combination of solubility pressure differential created by two small ports within the Media Delivery Head. As water passes through the Media Delivery

Head a small amount of water shall enter the media sump, wetting the media and slowly dissolving it. The water flow velocity within the Media Delivery Head shall create a venturi as it passes over the two ports, thus allowing a controlled amount of media into the water flow. The system shall not require any type of mixers or mechanical devices assisting with the introduction of media. Delivery amounts shall be factory preset, requiring no infield adjustment. System shall be Hydro-Blend as manufactured by Southeastern Filtration or equal.

- D.** All of the above equipment shall be sized as necessary to provide adequate pressure and flow conditions for system operation as determined by the manufacturer.

2.10 SYSTEM PIPING

- A.** All chemical feed, make-up water, and recirculation piping shall be SCH 80 PVC, gray. All fittings shall be 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 scrubber system

2.11 AIR DUCTS

- A.** All air ducting from scrubber system outlet to blower discharge stack shall be supplied by the Manufacturer. Materials of construction shall be PVC. Ducts shall be of sufficient diameter and design to move the air without undue pressure loss. The pressure loss of the combined scrubber system and the ductwork shall not exceed the maximum pressure available from the blower.

2.12 MOUNTING SKID

- A.** General: All system components as described under Sections 2.01 through 2.11 above shall be supplied pre-mounted on a self-contained skid. The components shall be factory plumbed and wired to limit job site plumbing and wiring to utility and chemical line connections only.
- B.** Construction: The skid shall consist of a deck, completely encapsulated with a corrosion-resistant two-part elastomeric coating. The deck shall be attached to a frame consisting of aluminum I-beams. One lifting lug shall be attached directly to the I-beam frame on each corner of the skid. The skid shall be designed to support the full non-operational weight (i.e., empty sumps) of the scrubber system from the lifting lugs. It shall be designed to support the weight of the system under any conditions of operation when placed on a pad.

- C.** Piping/Conduits: All necessary piping and conduits for connection of scrubber system to utilities and chemical storage equipment shall be routed under the deck to a common side of the skid. All piping and conduits shall be enclosed in a piping chase for protection. Electrical conduit shall terminate at a 4"x 4" junction box for connection of power supply lines to scrubber system lines.

2.13 CHEMICAL STORAGE TANKS

- A.** Chemical storage tanks shall be furnished for containment of 12.5 percent sodium hypochlorite and 50 percent sodium hydroxide solution. The tanks shall be made of high density, cross linked polyethylene and be suitable for storage in direct sunlight. All tanks shall be provided by one manufacturer.
- B.** The sodium hydroxide storage tank shall be a minimum capacity of 300 gallons. The tank accessory materials shall be completely suitable for and inert to liquid sodium hydroxide up to 50 percent solution.
- C.** The sodium hypochlorite storage tank shall be a minimum capacity of 300 gallons. The tank accessory materials shall be completely suitable for and inert to liquid sodium hypochlorite up to 15 percent solution.
- D.** Each storage tank shall be provided with bulkhead pipe connections for tank drain, outlet, inlet, and vent. Flanged connections shall be of the same materials as the tank wall. Threaded connections shall be of standard NPT. The tank details showing the locations of all openings, nozzles, and appurtenances shall be included in shop drawings and submitted for approval before fabrication of the chemical storage tank.

2.14 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.

2.15 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. One 480 volt, 60 Hz, three-phase electrical service shall be required.
 - 2. Water Supply. A 3/4 inch water supply with backflow preventer shall be required. Water supply must provide for a minimum of 30 psi continuous pressure and a hardness not to exceed 100 mg/L as calcium carbonate.
 - 3. Drain - A minimum 2 inch P.V.C. gravity drain to sewer shall be 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 flow rates 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 H₂S level, one hour at the peak H₂S level, and four hours on actual plant conditions. Inlet and outlet levels shall be measured once every 15 minutes using a portable H₂S 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 15 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 H₂S 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 ****