ALLEGHENY COUNTY SANITARY AUTHORITY

January 25, 2021

CONTRACT NO. 1729 G, E, H, P

EAST HEADWORKS

ADDENDUM NO. 5

All bidders bidding Contract No. 1729 G, E, H, P shall read and take note of this Addendum No. 5. The Contract Documents for **Contract No. 1729 G, E, H, P – East Headworks** are hereby revised and/or clarified as stated below.

Acknowledgement of Contract No. 1729 G, E, H, P; Addendum No. 5

The Acknowledgement attached to Addendum No. 5 is to be signed and returned immediately via email to Dustin Copenhaver at Dustin.Copenhaver@alcosan.org and acknowledged with the Bidder's Proposal.

Kimberly Kennedy, P.E.
Director – Engineering and Construction

ACKNOWLEDGEMENT OF

CONTRACT NO. 1729 G, E, H, P – EAST HEADWORKS

ADDENDUM NUMBER 5

FIRM NAME: _____

SIGNATURE: _____

TITLE: _____

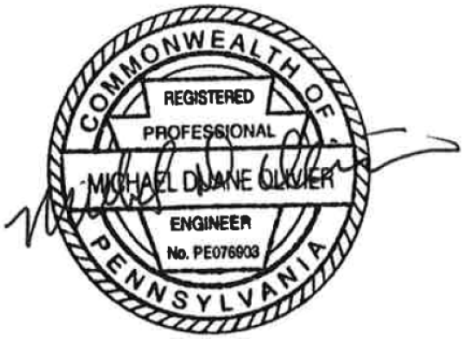
DATE: _____

January 25, 2021

CONTRACT NO. 1729 G, E, H, P

EAST HEADWORKS

ADDENDUM NO. 5



JANUARY 25, 2021

CONTRACT NO. 1729 G, E, H, P

EAST HEADWORKS

ADDENDUM NO. 5

A. Contract Documents – Volume 1

1. No Items

B. Contract Specifications – Volume 2

1. Job Conditions (01 11 20)

    a) 3.1.B – DELETE "Work performed during the Owner-designated holidays and on weekends shall be overseen by the Construction Manager at the sole expense of the Contractor. The Contractor will not be required to reimburse the Owner for the cost of the Owner's employees. Compensation to the Owner for such work for the Construction Manager's time shall be based on his designated rate of pay and shall be processed as a Contractor credit change order to the Owner." and REPLACE with "Work performed between 5:00 p.m. and 7:00 a.m. on weekdays, during the Owner-designated holidays and on weekends shall be overseen by the Construction Manager at the sole expense of the Contractor. The contractor will not be required to reimburse the Owner for the cost of the Owner's employees. Compensation to the Owner for such work for the Construction Manager's time shall be based on his designated rate of pay and shall be processed as a Contractor credit change order to the Owner. Owner will waive Construction Manager costs for work performed during construction constraints that interrupt normal operation as identified in the contract documents."

2. Solid Surfacing Countertops (Section 12 36 61.16)

    a) Paragraph 2.2.C, REVISE to read, “Countertops: ½-inch (12.7 mm) thick, solid surface material.”

    b) Paragraph 2.2.D, REVISE to read, “Backsplashes: ½-inch (12.7 mm) thick, solid surface material.”

C. Contract Specifications – Volume 3

1. Process Valves, Smaller Than Four Inches (Section 40 05 56)

    a) PART 2 – PRODUCTS, ADD paragraph 2.5 as follows:

        2.5 Back Pressure Valves

            A. Provide back pressure regulating valves where indicated on drawings. Provide back pressure regulators of CPVC construction, and having Teflon diaphragms, suitable for the fluid being pumped, to protect upper works of valves from process fluid. Provide spring opposed diaphragms with loading pressures adjustable by means of screw in top works. Field adjust valves to settings required of the system. Setting to be minimum pressure to occur upstream of the valve, as installed in system, while pump is operating.

            B. Back pressure valves shall be as manufactured by Griffco, G- Series, or equal.

2. Chemical Scrubber Odor Control System (Section 44 31 10)

    a) DELETE this specification in its entirety and REPLACE with the attached specification.

D. Contract Drawings

1. No items

E. Questions

54. QUESTION: Reference Section 443110 Chemical Odor Control System, 1.1 J. please clarify that power and control wiring required for the chemical scrubber control system, including replacement pumps, odor control fans, etc., is by the Electrical Contractor not by the General/Mechanical Contractor.

RESPONSE: Confirmed. Field power and control wiring is to be performed by the Electrical Contractor.

55. QUESTION: Having received and reviewed the Response to Question No. 15 presented in Addendum No. 3, we have the following question: Please clarify which items specified in Section 406193 Functional Descriptions are to be furnished by Contract G/M and which items are to be furnished by Contract E:

Knife gate valves G
Slide gates (various types and locations) G
Ultrasonic level transmitters E (except where specified to be included with a manufacturer's package)
Scrubber recirculation pumps G
Scrubber pH controllers G (specified to be included with the equipment)
Scrubber ORP controllers G (specified to be included with the equipment)
Scrubber exhaust fans G
Odor scrubber level switches G (specified to be included with the equipment)
Odor scrubber differential pressure transmitters G (specified to be included with the equipment)
Caustic metering pumps G
Sodium hypochlorite metering pumps G
Sodium hypochlorite injection point ball valve limit switches G (integral with the ball valve)
Inline grinders G
Sample pumps G
Composite type samplers G
Bar racks (various types and locations) G
Screenings conveyor G
Dewatering pre-crusher G
Grit tank submerged grit screws G
Grit tank sump process water motorized butterfly valves G
Grit pumps G
Grit hydrocyclones G
Grit classifier screws G
Grit classifier plant water solenoid valves G (specified to be included with the equipment)

Grit classifier high level switches G (specified to be included with the equipment)
Grit conveyor G
Grit truck scale G
Ultrasonic flow meters E (these have been removed from chemical scrubber odor control system specification)
Differential pressure orifice plate flowmeters E
Sump pumps G
Air lock limit switches E
Differential pressure transmitters E
Combustible gas transmitters and sensors E

RESPONSE: Refer to Section 01 11 00 – Summary of Work and Drawing I-02 ELECTRICAL/GENERAL CONTRACTOR DIVISION OF SCOPE OF WORK. The General Contractor is responsible for furnishing and installing process equipment. Electrical Contractor is responsible for furnishing all instruments, unless they are specified to be provided as part of an equipment package as part of the General Contract. Clarification consistent with this direction is provided to the list above.

56. QUESTION: Can Daikin be approved to bid the equipment in the following sections: 23 81 26-1, 23 73 13.16 and 23 74 16.11.

RESPONSE: ALCOSAN will not be adding any products to the list for any of the listed products during the bid period. Not listed products will have to go through the substitution process if submitted by the successful bidder after the notice to proceed. Reference Article 2 – 2.05 B.3.

57. QUESTION: These safety switches do not appear on the schedule on drawing 530-ES-05 (sheet 560) Please confirm they are to be added and who should Supply them.

NUMBER	EQUIPMENT DESCRIPTION		
PCA001-420 NFSS	FEEDING CAUSTIC METERING PUMPS - PCA001 DISCONNECT SWITCH		
PCA002-420 NFSS	FEEDING CAUSTIC METERING PUMPS - PCA002 DISCONNECT SWITCH		
PCA003-420 NFSS	FEEDING CAUSTIC METERING PUMPS - PCA003 DISCONNECT SWITCH		
PCA004-420 NFSS	FEEDING CAUSTIC METERING PUMPS - PCA004 DISCONNECT SWITCH		
PCB001-420 NFSS	FEEDING CAUSTIC METERING PUMPS - PCB001 DISCONNECT SWITCH		
PCB002-420 NFSS	FEEDING CAUSTIC METERING PUMPS - PCB002 DISCONNECT SWITCH		

PCB003-420 NFSS	FEEDING CAUSTIC METERING PUMPS - PCB003 DISCONNECT SWITCH		
PCB004-420 NFSS	FEEDING CAUSTIC METERING PUMPS - PCB004 DISCONNECT SWITCH		
PHF001-420 NFSS	FEEDING SODIUM HYPOCHLORIDE METERING PUMPS - PHF001 DISCONNECT SWITCH		
PHF002-420 NFSS	FEEDING SODIUM HYPOCHLORIDE METERING PUMPS - PHF002 DISCONNECT SWITCH		
PHF003-420 NFSS	FEEDING SODIUM HYPOCHLORIDE METERING PUMPS - PHF003 DISCONNECT SWITCH		
PHF004-420 NFSS	FEEDING SODIUM HYPOCHLORIDE METERING PUMPS - PHF004 DISCONNECT SWITCH		
SRP001-420 NFSS	SCRUBBER T1S1 RECIRC PUMP SRP-001 - DISCONNECT SWITCH		
SRP002-420 NFSS	SCRUBBER T1S2 RECIRC PUMP SRP-002 - DISCONNECT SWITCH		
SRP003-420 NFSS	SCRUBBER T2S1 RECIRC PUMP SRP-003 - DISCONNECT SWITCH		
SRP004-420 NFSS	SCRUBBER T2S2 RECIRC PUMP SRP-004 - DISCONNECT SWITCH		
SRP005-420 NFSS	SCRUBBER T3S1 RECIRC PUMP SRP-005 - DISCONNECT SWITCH		
SRP006-420 NFSS	SCRUBBER T3S2 RECIRC PUMP SRP-006 - DISCONNECT SWITCH		
GOF001-500 NFSS	SLIDE GATE GOF001 - DISCONNECT SWITCH		
KGV501-500 NFSS	KNIFE GATE VALVE DISCONNECT SWITCH 501		
KGV502-500 NFSS	KNIFE GATE VALVE DISCONNECT SWITCH 502		
KGV601-500 NFSS	KNIFE GATE VALVE DISCONNECT SWITCH 503		
KGV602-500 NFSS	KNIFE GATE VALVE DISCONNECT SWITCH 504		
GSD001-514 NFSS	SLIDE GATE 514GSD001 - DISCONNECT SWITCH		
GSD001-515 NFSS	SLIDE GATE 515GSD001 - DISCONNECT SWITCH		
GSD002-515 NFSS	SLIDE GATE 515GSD002 - DISCONNECT SWITCH		
CST001-530 NFSS	SCREENINGS CONVEYOR - DISCONNECT SWITCH		
PGT401-530 NFSS	GRIT PUMP #7 - DISCONNECT SWITCH W/AUX CONTACT		

RESPONSE: All safety switches shown in the Contract Drawings regardless if they are specifically identified in a schedule, shall be provided by the Electrical Contractor.

58. QUESTION: Reference Instrumentation Drawings:

a. Who supplies solenoid valves? Solenoid valves shall be provided by the General Contractor as part of Section 40 05 00 – Common Work Results for Process Interconnections.

b. Who supplies valve position switches since these would have to be integrated? General Contractor shall provide position switches integral with the valves.

c. Who supplies pressure gauges? Pressure gauges shall be provided by the Electrical Contractor as part of Section 40 70 00 – Instrumentation.

d. Who supplies seal water monitoring units? Seal water monitoring units shall be provided by the General Contractor as part of Section 40 05 00 - Common Work Results for Process Interconnections.

e. Should ALL disconnect switches that are fed from a VFD have an auxiliary contact? Disconnect switches shall be provided with auxiliary contacts as shown in the control diagrams in the Contract Drawings.

RESPONSE: See responses to individual questions above.

59. QUESTION: Please provide Instrument Data Sheets – Instrumentation companies need the sheets to quote.

RESPONSE: Prospective bidders shall be responsible to provide the instrumentation companies with applicable contract documents as required for bidding purposes.

60. QUESTION: Reference Specification 12 36 61.16 Solid Surface Countertops: Spec requires 3/4-inch thickness. Material has only been available in half-inch thickness for the past 10 years. Please confirm this is acceptable.

RESPONSE: 1/2-inch material is acceptable.

61. QUESTION: The only notes we can find on the 120-inch pipe are those that are on the drawings. There is no specification for the pipe in Division 33 or 40. Since this pipe is such a significant part of this project, can a specification be provided?

RESPONSE: Prestressed concrete cylinder pipe is specified in Section 22 13 13 – Facility Sanitary Sewers.

62. QUESTION: Is the elevated steel pipe rack structure from the existing odor control facility to the new East Headworks building classified as "structural steel framing" or "metal fabrications"? In other words, is an AISC certification required for the fabrication and erection of it?

RESPONSE: The elevated steel pipe rack structure from the existing odor control facility to the new East headworks building (i.e. Facility 420) is classified as structural steel and AISC certification is required for fabrication and erection.

63. QUESTION: Please confirm that, similar to the previous North End Expansion bid, and due to the thousands of entries, that it is acceptable to track and report the MBE-WBE solicitation and participation with the use of an Excel spreadsheet, as long as it captures all off the required data that's requested on the MBE-WBE document in the specifications.

RESPONSE: This is acceptable as long as it captures all of the required data.

64. QUESTION: Reference drawings 420-M-01, 420-M-02, 534-M-01: There are self-contained control valves ranging from 1" to 2" in size within the effluent flushing and caustic soda systems that do not have tag numbers or a specification referenced. Please provide specification for self-contained control valves.

RESPONSE: Self-contained valves depicted on 420-M-01, 420-M-02, 420-M-03 and 534-M-01 are mechanically actuated valves which do not require power, nor do they have powered instrumentation. Therefore, they do not have tag numbers.
The self-contained valves depicted on 420-M-01 and 534-M-01 in Effluent Flushing Water (EWF) service depict a pilot line to downstream of the valve, indicating a pressure reducing valve. Pressure reducing valves 3-inches and smaller shall be provided as specified in Section 40 05 56 - Process Valves, Smaller Than Four Inches, Paragraph 2.1.
The self-contained valves depicted on 420-M-02 and 420-M-03 in Caustic (sodium hydroxide- CAS), and Sodium Hypochlorite (SHC) service depict a pilot line to up-stream of the valve, indicating a back pressure valve. Back pressure valves 3-inches and smaller in CAS and SHC service shall be provided as specified in Section 40 05 56 – Process Valves, Smaller Than Four Inches, Paragraph 2.5.

65. QUESTION: Reference Articles 3.76 & 3.77: There is an exemption list on the DGS.PA.gov site which accepts various equipment (including some valves) from the domestic sourcing requirements. Please confirm that it is acceptable that, in accordance with the 2020 List of Exempt Machinery and Equipment Steel Products, that we can price: Butterfly Valves, Cast Steel Gate Valves, Control Valves, and Globe Valves (Steam) as available.

RESPONSE: The 2020 List of Exempt Machinery and Equipment specifically excludes 'Cast Steel Gate Valve'. Gate valves are specified in Section 23 05 23.15 - Gate Valves for HVAC Piping, Section 33 14 16 - Water Utility Distribution Piping, Section 40 05 56 - Process Valves, Smaller than Four Inches and Section 40 11 00 - Steam Process Pipe. The Knife Gate Valves in the project are a separate type of equipment than gate valves. Knife gate valves are specified in Section 40 05 61.43 - Knife Gate Valves, and shall meet the Steel Products Procurement Act. Cast Steel Gate Valves, Butterfly valves, Control Valves, and Globe Valves in steam service, may be submitted that do not comply with the Steel Products Procurement Act as they are in the 2020 List of Exempt Machinery and Equipment Products, but shall comply with all of the other requirements in the Contract Documents.

66. **QUESTION:** Reference specification 32 31 13: Please confirm that there is no permanent fence required for this project and that this specification is for temporary construction fence only.

    RESPONSE: There is no permanent fence required for this project, only applies to temporary construction fencing.

67. **QUESTION:** Please verify that the concrete saddle under the 120-inch influent pipe is to be a "continuous" saddle.

    RESPONSE: Yes. The saddle is continuous under the 120-inch influent pipe.

68. **QUESTION:** Specification 10 51 13 Section 2.4.C for metal lockers states for the bench pedestals to be movable. Given the length of the benches (both ADA with backs and standard benches), movable bench pedestals are not recommended as the benches can be a tipping hazard. Please advise if fixed pedestals are acceptable for these benches.

    RESPONSE: The specified benches are a standard manufactured item. The intent is for the pedestals (bench supports) to be permanently anchored to the bench top. The pedestals shall be constructed of stainless steel in either 1/8-inch-thick by 3-inch-wide channel or 1/4-inch-thick by 3-inch-wide bar stock, shaped into trapezoidal form; with nonskid pads at bottom as specified. Fixed pedestals are not acceptable.

69. **QUESTION:** We have located Section 28 20 00 Video Surveillance which gives us the types of cameras to be provided and the hanging methods to be utilized. Please provide us with the locations by Drawing Numbers of all the cameras required and also Details of the hanging methods to be utilized.

    RESPONSE: CCTV camera locations are shown on sheet 530-TY-10 and camera mounting details are located on sheet 530-TYD-01.

70. QUESTION: There are self-contained control valves ranging from 1" to 2" in size within the effluent flushing and caustic soda systems that do not have tag numbers or a specification referenced. Please issue specifications for these self -contained control valves.

RESPONSE: See response to Question 64.

71. QUESTION: Regarding the Alcosan project out to bid, can you please confirm who is supposed to be providing the controls for the screens? Also, please advise where in the specs or drawings we can find details?

RESPONSE: The Bar Rack VFD Control Panels must be provided by the Electrical Contractor. Refer to Drawing 530-EM-01 for details.

72. QUESTION: Please provide a "Line List" for the various piping systems which would provide our vendors accurate information regarding operating temperatures and pressures, flow rates, fluid information, etc. for pricing various regulating valves. If this is not available, please provide the inlet and outlet operating pressures for the following:

		EFFLUENT FLUSHING SYSTEM - EWF - *See Spec 23 22 16*
1	1	Self-Contained Control Valve (420-M-01)
1	1-1/2	Self-Contained Control Valve (534-M-01)
1	2	Self-Contained Control Valve (420-M-01)
4	1	(4) 1” Sodium Hypochlorite valves
		CAUSTIC SODA SYSTEM - CAS - *See Spec 23 22 16*
		(CPVC Mat'l)
8	1	Self-Contained Control Valve (420-M-02)

RESPONSE: Self-Contained Valves indicated on ‘M’ Drawings including those on 420-M-01, 420-M-02, 420-M-03 and 534-M-01 shall be provided as specified in SECTION 40 05 56 Process Valves, Smaller Than Four Inches.

Note the self-contained valves depicted on 420-M-01 and 534-M-01 in Effluent Flushing Water (EWF) service depict a pilot line to downstream of the valve, indicating a pressure reducing valve.

The self-contained valves depicted on 420-M-02 and 420-M-03 in Caustic (sodium hydroxide- CAS), and Sodium Hypochlorite (SHC) service depict a pilot line to up-stream of the valve, indicating a back pressure valve.

The specified valves' pressure set point is field settable, and are suitable for the range of working pressures. Therefore the inlet and outlet pressures, and flowrates are not required to provide the specified valves.

73. QUESTION: Contract drawing change No. 1 from Addendum No. 3, indicates to DELETE keynote No. 6 on drawing C-21 and replace the text as indicated. Please confirm that the change should have been to keynote No. 15 and not No. 6.

RESPONSE: Confirmed. This was clarified in Addendum No. 4.

F. Clarifications

Attachments:

Specifications:

Section 44 31 10 – Chemical Scrubber Odor Control System

Drawings:

None

*** * * * END OF ADDENDUM NO. 5 * * * ***

SECTION 44 31 10 - CHEMICAL SCRUBBER ODOR CONTROL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish, install and test one 2-stage chemical scrubber odor control system designed to treat up to 46,800 cubic feet per minute (cfm) of air, including all labor, materials, equipment, and incidentals. The 2-stage chemical scrubber odor control system shall be of the same basic design and dimensions as the existing scrubbers to fit into the space provided. It shall otherwise be like the two existing systems and remove hydrogen sulfide (H_2S) and other odorous compounds from the wastewater treatment process foul air stream. Chemicals used in the scrubber system for chemical reactions with odorous compounds include 12.5 percent to 15 percent (percent by weight) sodium hypochlorite solution and 50 percent (percent by weight) sodium hydroxide (caustic) solution.

B. Contractor shall furnish and install the 2-stage chemical scrubber odor control system equipment including vessels complete with packing media, interconnecting ductwork, irrigation system, recirculation pumps, chemical feed systems along with instrumentation and controls for a fully functioning system.

C. Contractor shall replace four existing scrubber recirculation pumps with new seal-less magnetic drive centrifugal pumps.

D. Instrumentation identified herein is detailed in Specification Section 406193, Process Control Descriptions and Section 407000, Instrumentation and Control for Process Systems but shall be provided as part of the odor control system manufacturer’s equipment package.

E. Contractor shall replace six existing sodium hydroxide metering pumps, valves, instruments, and piping.

F. Contractor shall replace three existing sodium hypochlorite metering pumps, valves, instruments, and piping.

G. Contractor shall replace one existing hydrochloric acid pump used to periodically wash the scrubber packing.

H. Contractor shall furnish and install three odor control fans in accordance with 443160 “Odor Control Fans”.

I. Manufacturer shall provide shop drawings and Operation and Maintenance manuals.

J. Manufacturer shall provide startup and performance acceptance testing service specified herein in accordance with Section 017500 “Facility Startup”.

K. Placement, installation, bolting to the pad and connection of ductwork, irrigation piping, recirculation piping, drainage piping, power and control wiring provided by Contractor.

L. The new chemical scrubber odor control system shall be comprised of the following major components:

1. Two (2) 12 ft. diameter chemical scrubber vessels.
2. Packing media, media support systems and water distribution splash plates.
3. Internal mist eliminator in the top of the first stage vessel capable of removing moisture droplets 5 microns or larger from the air.
4. An external mist eliminator downstream of the second stage vessel to remove moisture droplets 5 microns of larger from the outlet air.
5. Two (2) recirculation pumps for chemical injection.
6. Chemical injection piping, valves, fittings, and instruments as indicated on the drawings and specified herein.

1.2 CONTRACTOR RESPONSIBILITY

A. The Contractor shall be responsible for the installation of all Manufacturer supplied equipment and components, which includes among others, placement and bolting of all equipment to the concrete pads, chemical piping, and drainage piping, all in accordance with the Manufacturer's installation instructions.

B. Supply and installation of all fiberglass odorous air ductwork including flex connectors and dampers as shown on the drawings and as specified in Section 401016.

C. Site preparation and clearing.

D. Supply and installation of system anchor bolts.

E. Chemical, recirculation, and drain piping, valves, and instrumentation and external from the filter vessels and panels, except as specifically noted on the drawings.

F. Installation of any additional items as noted on the contract drawings.

1.3 PROCESS DESCRIPTION

The odor control system shall remove H_2S, reduced sulfur compounds and other odorous compounds from the wastewater treatment process foul air stream. The 2-stage chemical scrubber will be part of a three (3) train odor control system that consists of three 2-stage chemical scrubbers. Each 2-stage system will be capable of treating 46,800 cfm. There will be three (3) 46,800 cfm foul air fans downstream of the odor control vessels that pull the foul air through the systems. The foul air will enter the bottom of each vessel and flow upward through the media. Sodium hydroxide (caustic) will be injected into the recirculated water to maintain an elevated pH. The recirculated water will be sprayed onto the media bed in each stage of the odor control system. A sodium hypochlorite solution will be plumbed such that it can be injected into the suction piping of the recirculation pumps that feed either the 1st or

2nd stage of each odor control system train. The hypochlorite solution will oxidize the odorous compounds in the foul air as it flows upward through the media.

1.4 REFERENCES

A. National Fire Protection Association (NFPA): 820 Standard for Fire Protection in Wastewater Treatment and Collection Facilities.

1.5 REQUIRED SCRUBBER SYSTEM SUPPLIER QUALIFICATIONS

A. The Scrubber System Supplier shall be one recognized and established in the design, manufacture, and furnishing of chemical scrubber odor control systems. However, the Scrubber System Supplier may subcontract fabrication of the vessels themselves using approved FRP fabricators with minimum experience of 10 years fabricating vessels for the Scrubber System Supplier. Submit qualifications of the FRP fabricator for review and approval.

B. The Scrubber System Supplier shall have designed, manufactured, and furnished round vertical tower scrubber vessel units of a similar size and in similar process conditions that have been in successful operation for at least 10 years at 10 separate wastewater facilities in the United States. This experience requirement shall be demonstrated by providing the following material:

1. Owner name.
2. Facility name.
3. Location (City and state).
4. Date placed into service.
5. Contact person with phone number and email address.
6. Summary of design criteria including:
   a. Design flow rate per scrubber in cfm.
   b. Design inlet and outlet odor concentrations in ppm.
   c. Type of media.
7. Operational inlet and outlet odor concentrations.

C. The referenced systems shall bear the Scrubber System Supplier and/or manufacturer’s current name confirming them as the singularly responsible system supplier.

1.6 SUBMITTALS

A. Shop drawings shall be submitted to the engineer for evaluation and approval in accordance with Section 013300 “Submittals”. Fabrication of equipment and ordering of system components shall not begin until the Engineer has approved the shop drawings. The shop drawings shall include at least the following:

1. Certified shop and erection drawings showing important details of construction, dimensions, materials, and anchor bolt locations.

2. Descriptive literature, bulletins and/or catalogs of the equipment.

3. A complete bill-of-materials.

4. Complete assembly, foundation, and installation drawing together with detailed specifications and data covering materials, parts, and other accessories.

5. Odor control electrical details

B. Operating and maintenance manuals shall be furnished to the engineer in accordance with Section 013300 “Submittals”. The manuals shall be prepared specifically for this installation and shall include detailed operating and maintenance instructions and specifications relative to the assembly, alignment, lubrication, adjustment and maintenance of the unit furnished under this contract, together with complete parts lists of shop drawings, certified dimension drawings and design calculations. The manual shall be approved by the Engineer, prior to equipment start-up and testing.

1.8 QUALITY ASSURANCE

A. The Scrubber System Supplier shall be responsible for the chemical scrubber odor control system including scrubber vessels, vessel internals, media packing, spray liquid distribution, recirculation pumps, metering pumps, instrumentation, ductwork, and other components of the odor control system.

B. The Scrubber System Supplier shall assist with installation, start-up, testing, training, and to warrant the system design and performance.

C. The Scrubber System Supplier shall provide one or more qualified representatives at the site to advise the CONTRACTOR in the proper unloading at the site, setting the equipment at the site, other installation Work, connections to other parts of the Work, initial check out, device calibration, pre-start-up testing, control parameter settings, performance testing and correction of problems occurring during this period.

1.9 WARRANTIES AND GUARANTEES

A. System shall be warranted and guaranteed in accordance with Section “017836” Warranties and Guarantees.

1.10 INSPECTION

A. Manufacturer must allow the Engineer and/or Owner to inspect the vessels at the factory during manufacture. The inspections will be at the manufacturer’s facility during critical phases of manufacturing and upon completion, prior to shipment from the factory. As part of the manufacturer’s submittal, the inspector shall provide an

Inspection/Quality Control protocol for the Engineer's review and approval, which incorporates all referenced and relevant standards.

1.11 DELIVERY, STORAGE & HANDLING

A. The equipment shall be packaged to minimize possible damage from moisture, temperature variations and impact due to shipping conditions. Exposed threads shall be protected with tape or caps, openings shall be closed by caps or plugs. Detailed installation instructions shall accompany the equipment.

B. The Contractor shall inspect the equipment when it is delivered to ensure that it is not damaged. Store the equipment in a dry location and maintain the equipment per Manufacturer's recommendations.

C. Dispose of packing materials in accordance with state and federal regulations.

1.12 SCRUBBER SYSTEM SUPPLIER'S SERVICES

A. Coordinate field service Work with the Manufacturer's Representative, ALCOSAN, and the Engineer prior to initiating such Work.

B. Contractor shall furnish a qualified Scrubber System Supplier's Representative to provide field services as specified in Specifications section 017500 "Facility Start-up".

C. Require Scrubber System Supplier's Representative to perform the following services as described below and as specified in Specifications section 017500 "Facility Start-up". The specified durations are the minimum required time on the jobsite. Additional services and/or longer durations shall be provided as needed at no cost to ALCOSAN to meet the required quality of Work:

1. Installation Assistance: As required.
2. Installation Inspection: 1 workday.
3. System Balancing and Checking: 2 workdays.
4. Start-Up/Testing Assistance: 5 workdays.
5. Training: As specified herein.
6. Final Acceptance and Checkout: 1 workday.

1.13 MANUFACTURER'S INSPECTION AND START-UP

A. The Contractor shall furnish the services of the equipment manufacturer's qualified field representative to inspect the equipment after installation, provide startup services, and supervise all initial start-up operations and functional testing as specified in Section 017500 "Facility Startup". Services shall be provided as required to ensure complete and fully operational system.

B. In the event the equipment does not perform as specified, the Contractor, at no additional expense to the Contract, Owner or the Owner's representative, shall make provisions for the field representative to stay on site until all problems are resolved to the Owners satisfaction.

1.14 MANUFACTURER'S CERTIFICATE

A. The Contractor shall furnish the Engineer with a Manufacturer's Certificate, signed by an authorized representative of the Manufacturer, certifying that the equipment is installed in a complete and satisfactory manner and has been functionally tested such that it is ready for operation.

1.15 TRAINING

A. Provide the service of a qualified manufacturer's representative to thoroughly train Owners personnel in the operation and maintenance of the equipment installed. Classroom and hands-on training shall be provided on different days and different shifts, and as required to ensure Owner's operations and maintenance personnel understanding of equipment and shall follow the requirements in Section 017500 "Facility Start-Up". Training shall include:
   a. Two (2) two (2) hour sessions of training for operations personnel
   b. Two (2) two (2) hour sessions of training for maintenance personnel

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Scrubber system materials, equipment, components, and accessories specified in this section shall be products of one of the following:
   1. Daniel Company.
   2. ECS Environmental Solutions.
   3. Evoqua Water Technologies.
   4. Or approved equal

B. Manufacturer's not listed shall submit requested information in accordance with specification Section 012513 "Product Substitutions".

C. Scrubber manufacturer shall have a minimum of 10 years of experience in the manufacturer of equipment similar to that specified.

D. The Equipment Manufacturer shall provide a list of at least ten (10) U.S. installations where equipment similar to that proposed to be furnished has been in successful operation.

E. The term "installation" shall mean individual projects/contracts. Multiple equipment units for a project shall be considered as one (1) installation toward meeting the experience requirements. Each installation information shall include, but not be limited to, the following:
   1. Name and location of the installation.
   2. Name of person in direct responsible charge for the equipment.
   3. Address and phone number of the person in direct responsible charge.
   4. Month and year the equipment was placed in operation.

5. Capacity of Equipment

2.2 DESIGN CRITERIA

A. Design the system for the following criteria:

Daily peak inlet H_2S	50 parts per million (ppm)
Daily average inlet H_2S	0.1 - 1 ppm
Minimum H_2S removal efficiency	99 percent or <0.05 ppm outlet, whichever is greater
Design air flow through each scrubber train	46,800 cfm
Total number of scrubber stages	2
Vessel diameter	12 feet (both vessels)
Vessel height	Contractor to field measure existing vessels and match
Packing depth	17 feet
Mist eliminator packing depth (ft)	2
Maximum pressure drop across each vessel (in. w.c.) at design flow	1.5
Internal pressure design criteria	13 inches w.c. positive and 13 inches w.c. vacuum.
Wind and Seismic design criteria	As specified in Specifications section 018110, Wind and Seismic Design Criteria.

B. Piping and ducting:
1. Provide flanged connections, per specification 4010 6, for external connections to the system. Provide flexible couplings at the connection points and as indicated on the design drawings, per specification 401016.
2. Support independently from equipment to avoid loads to equipment nozzles.
3. Isolate loads due to thermal expansion of piping from equipment.
4. Piping and fittings: Schedule 80 CPVC, unless indicated otherwise on the plans.
5. Ducting: FRP as indicated on the plans and in specification 401016.

C. Electrical and instrumentation:
1. Area classification: Class 1, Division 2, Group D if within 3 feet of the fan, vessel, and odor control ducting; within any fan enclosure; or within 3 feet of fittings, flanges, or other openings in accordance with NFPA 820.
2. Terminations: Terminate wiring for external control and power connections in junction boxes.
3. Meet the component requirements for electrical systems and control systems as specified in the Contract Documents, Division 26.

D. Accessibility:
1. Locate equipment and instrumentation so that it is accessible and visible from off the ground or platform without having to stand on other piping or

equipment.

2.3 SCRUBBER SYSTEM

A. Vessel:

1. The chemical scrubber vessel shall be a free standing and vertical "tower" configuration. The vessels and accessories shall be FRP and manufactured in accordance with ASTM D3299 and subsection 2.3 B.
2. Miscellaneous:
   a. Stainless steel: Unless otherwise specified, all fasteners, and metal attachments, such as anchors, brackets, etc., shall be ANSI Type 316 stainless steel. Use Loctite anti-seize compound on all bolt threads.
   b. Gaskets: Unless otherwise specified, all gaskets shall be EPDM.

B. Fabrication:

1. The FRP vessels shall be filament-wound, manufactured in accordance with ASTM D3299. The visual defects, per ASTM D2563, shall not exceed Level II on the vessel interior and Level III on the vessel exterior. The resin used shall be Dow 510-A, Ashland Hetron FR 992, or approved equal suitable for continuous exposure to saturated water vapor, hydrogen sulfide gas, and their associated acidic products. The resin system should provide a class 1 flame spread rating. Antimony, Nyacol or any other additives are not allowed. A permanent wax containing resin coating, formulated according to the resin manufacturer's most recent recommendations (or other Engineer-approved method) shall be used for surface protection and to prevent air inhibition of resin curing. Contact molded accessories shall be manufactured in accordance with NBS PS15. The completed vessel shall be translucent until it is gel coated. The final gel coat color shall be selected by the owner or engineer. A certificate from the resin manufacturer listing the nomenclature, composition, and characteristics of the resin shall be furnished with the vessel. Stainless, PVC, HDPE, PP or other non-reinforced plastic vessels will not be acceptable.
2. An inner corrosion barrier shall be provided consisting of no less than three laminated layers. The inner corrosion layer shall be resin rich. Resin to glass ratio shall be 90% resin and 10% glass and a minimum thickness of 10 to 15 mils.
3. The inner corrosion layer shall be followed by at least two layers of chopped-strand mat or two passes of chopped roving to a total of 3 ounces per foot. Should the chopped roving technique be employed, the chopped fibers shall be 1/2 inch to 2 inches in length. The intermediate structural layer shall be 30 percent +/- 5 percent glass by weight per ASTM D2584. The total corrosion barrier shall total 100 mils minimum
4. The structural aspects of the vessel shall be sufficient to meet recommended requirements, including seismic requirements for all conditions during the design life. Manufacturer shall include with the shop drawings, detailed calculations illustrating the seismic characteristics of the proposed vessels. Calculations shall be signed and stamped by a registered structural engineer

licensed in the state of Pennsylvania.

5. FRP supports shall be supplied integral to the vessel. Quantity and design shall be determined in the PE stamped vessel calculations.
6. Gel coating shall be applied during the manufacturing process, with a minimum thickness of 20 mils, and shall be sufficiently cured using Methyl Ethyl Ketone Peroxide (MEKP) catalyst. The gel coat shall be applied using a two-coat application process. A pigmented gel coating containing UV inhibitor shall be applied as the final layer. All laminated field joints on above grade ductwork shall be similarly coated by the installer. The color of the gel coating shall be selected by the Owner, from the manufacturer's standard colors during the submittal process.

C. Media support system:
1. Packing in each vessel shall be installed and have its own support system. Media support panels and grating shall be FRP and rated for the required loads or a minimum of 150 lbs/ft^2, whichever is the greater value shall govern. The mid-span supports shall be suitable to support the weight of the media and entrained liquid solution. The media bed support system shall consist of FRP grating having openings and structural strength suitable for supporting the media. The grating shall be supported by FRP box beams and side wall angles that are integral to the wall. The support system shall be readily deconstructed when necessary for maintenance and cleaning. The support shall be designed to distribute the inlet air flow evenly across the media bed.

D. Each scrubber vessel shall be equipped with the following:
1. Provide access manways as shown on the drawings and as required for media removal from side and top of vessel. Manways shall also be provided to allow access to spray splash plates, and other interior components as indicated on the plans.
2. At least four flanged/bolted manways shall be provided for access and servicing of water distribution splash plates and media at side of the wall. Manways shall be 36-inch in diameter and have 1/2-inch thick Lexan clear observation blind flanges. Bolted manways shall be provided with 1/8-inch thick full-face neoprene gaskets with Type 316 stainless steel bolts. Provide manways as needed and specified for inspection and access to internals of the scrubber vessel units and as shown on the drawings.
3. Clear Lexan or plexiglass 12-inch diameter flanged access handholes for observation and removal of sample of media along the vessel height and length as shown on the plans.
4. Vessel connection flanges shall be compatible with connecting piping and ductwork.
5. Type 316 stainless steel bolts and fasteners. Use Loctite anti-seize compound on all bolt threads.
6. All flanged access manways shall have EPDM gaskets.
7. FRP air distribution ring as recommended by scrubber manufacturer to provide uniform air distribution across the media and to prevent short-circuiting. This shall be placed at a level location as recommended by

Scrubber System Supplier. Scrubber manufacturer shall provide finite element analysis air distribution profile or modeling to show uniformity of air distribution across the bed surface and height.

8. FRP inlet and exhaust/discharge ductwork shall be provided in accordance with Section 401016.
9. An integral sump located at the bottom of the vessel below the air plenum inlet and media support system. The sump shall be sized to hold a reservoir of liquid a minimum of 36 inches deep, sized to meet net positive suction head requirements of the recirculation pumps. Provide a sump sight level gauge and drain piping assembly for each scrubber, and FRP flanged nozzles for connection to recirculation pumps and drains as shown on the Drawings.

E. Scrubber Solution Recirculation System:

1. The scrubber solution recirculation system shall consist of six new pumps. One (1) pump for each new vessel and one pump for each of the four existing vessels. The pumps will recirculate solution from the scrubber sump to the splash plates as indicated on the Drawings. The spray system shall have uniform non-clogging type splash plate assemblies above the top of the packing similar to those in the existing scrubbers. The splash plates shall be constructed of 316 stainless steel.
2. The irrigation pipe header assembly shall be removable from outside of the vessel and shall be designed such that it is supported internally without causing the pipe to vibrate or move from its resting supports. The pipe header nozzle assembly shall be designed for ease of removal, maintenance, and installation.

2.4 MIST ELIMINATOR

A. Housing:

1. Housing shall be manufactured by the same manufacturer as the scrubber vessels using fiberglass reinforced plastic as specified in Section 2.3. B. Alternate stainless or plastic materials are not acceptable. Manufacturer shall confirm the mist eliminators have been manufactured in accordance with this specification and all FRP work meets or exceeds ASME RTP-1 level 2 visual inspection criteria. Housing shall be of the same shape and dimensions as the two existing mist eliminators.
2. Housing shall have machined UMHW guides to prevent stainless frame on filter pad from scratching or damaging the corrosion liner.
3. Mist eliminator housing shall be designed for 14” of negative pressure with a maximum of 1/8” deflection.
4. Housing shall have an access door for pad removal complete with EPDM gasket and blind flange. The mist eliminator is positioned such that the pad is removable from only one side. The system must be manufactured in a way that allows insertion and removal of the pad from only one side.
5. Vessel shall be equipped with a 15” x 30” access hatch with clear Lexan or Plexiglass cover similar to those on existing mist eliminators.
6. Vessel shall be equipped with a single spray nozzle to allow for cleaning of the mesh pad in place. Spray nozzle shall be sized to clean the entire pad.
7. Housing shall be provided with a 2” drain connection at the base and come

from the manufacturer complete with ball valve.

8. For installation, housing shall have equipped with supports to match up with the existing support structure. Housing shall be supported independently of the connecting ductwork, anchored with 316 stainless steel bolts.

B. Housing shall have a differential pressure gauge bracket and be supplied with a Dwyer magnehelic pressure gauge and connections for gauge on either side of filter pad. Gauges shall have a 4" dial. The tubing to the gauges shall be 316 SS with 316 SS valves and condensate drain trap.

C. Filter pad:

1. Pad shall have 2" of stainless mesh followed by 4" of poly mesh. Mesh shall be held together by a stainless-steel frame. Total pad thickness including pads and frame shall be 8".
2. Maximum pad segment width of pads is 24". Pads larger than 24" wide must be segmented to allow easy removal by the owner. Segment width should not exceed 24".
3. Particle removal efficiency shall be 99% of particles 5 microns or larger.

D. Dimensions / Design:

1. End connections shall be sized to match the ductwork shown on the design drawings.
2. Flange dimensions shall match the connecting ductwork. Flange thickness shall not be less than that listed in ASTM 3982.
3. Inlet cone shall be designed so that the airstream can spread evenly over the pad surface. Cone angle shall be a minimum of 60 deg. Cone shall transition smoothly from round to rectangular, with no abrupt changes transitioning to the rectangular filter housing.
4. Housing shall be sized so that air velocity through the filter pad is 400 fpm +/- 50 cfm.

2.5 SCRUBBER PUMPS, PIPING, VALVES, AND CONTROLS

A. Piping, valves, and fittings shall be CPVC per the applicable sections of the specifications and as shown on the plans. Piping shall be configured to allow complete removal through the access port or manways without entering the vessel. All internal and external pipes and valves that are shown in close proximity to the scrubber tank shall be supported from the tank and shall be designed by the scrubber manufacturer. Supports shall be FRP or Type 316 stainless steel and shall be designed to withstand the wind and seismic conditions per specification 018100 – Wind and Seismic Design Criteria.

B. Recirculation Pumps:

1. Provide six new horizontal ANSI magnetic drive centrifugal recirculation pumps. Recirculation pumps shall be Sundyne Model KF6410, or "approved equal" suitable for handing corrosive chemical solutions.
2. Manufacturer's not listed shall submit requested information in accordance with specification Section 012513 – Product Substitutions.

3. Pump Design Criteria:

- Flow = 800 gallons per minute (gpm)
- Total Dynamic Head (TDH) = 47'
- Fluid – Water (specific gravity = 1.0)
- Fluid pH – 9-11
- Fluid Temp – 45 – 80°F (ambient)
- TEFC motor – 20 HP, 460V, 3 phase, 1,750 rpm
- Close coupled
- Seal-less magnetic drive

a. Casing:
   - ANSI/ASME B73.1-1991 dimensions for flange foot position
   - Self-venting and top centerline discharge
   - One-piece solid ductile iron casing, lined with rotomolded ETFE fluoropolymer 0.125 in. minimum
   - Flanges: ANSI/ASME B16.5 Class 150

b. Shaft Support/Thrust Ring
   - Streamlined and internally reinforced for all radial load conditions.
   - Pure sintered silicon carbide thrust ring integral with shaft support.
   - Reinforcement fully encapsulated and hermetically sealed at the factory.

c. Impeller
   - Replaceable, closed type, one-piece construction. Manufactured with carbon fiber filled ETFE fluoropolymer.
   - Coupled to inner magnet by oversized polygon with axial lock mechanism.
   - Replaceable, sintered silicon carbide, mouth ring (pads).

d. Inner Magnet
   - Encapsulated with carbon fiber filled ETFE fluoropolymer.
   - Magnet assembly fully encapsulated and hermetically sealed at the factory.
   - Coupled to impeller by oversized polygon with axial lock mechanism.

e. Main Bushing
   - Rotating, two bearing design, sleeved with CFR-ETFE. Large bearing area for all loads and viscosities. Bearings in sintered silicon carbide (SiC).
   - Press fit installation into impeller bore.

f. Shaft
   - Non-rotating, one-piece, solid construction, sintered silicon carbide (SiC). Fully supported at both ends utilizing front shaft support and rear casing.

g. Rear Casing
   - ANSI/ASME B73.1 Pressure and Temperature Ratings for

Class 150 flanges.

- Injection molded carbon fiber filled ETFE fluoropolymer backed by non-metallic reinforcement.

h. Bearing Frame

- L10 life for 70,000 hrs
- ANSI/ASME B73.1-1991 dimensional

C. Sodium Hypochlorite Pumps:

1. Provide four (4) – 50 gallon per hour (gph) sodium hypochlorite pumps. There will be three (3) duty pumps (one pump for each train) and one (1) standby pump. The pumps shall be Pulsafeeder Eclipse 05 non-metallic mag-drive rotary pumps (Model EH05KBVF-X), or "approved equal" suitable for handling corrosive chemical solutions.
2. Sodium hypochlorite pumps shall be plumbed such that the sodium hypochlorite can be injected into the recirculation pump suction piping for the 1st or 2nd stage of the odor control system, as shown on the Drawings.
3. Pump Design Criteria:

- Maximum Flow = 50 gph
- Maximum Differential Pressure = 100 psi
- 12.5% or 15% sodium hypochlorite
- Seal-less magnetic drive
- PVDF housing
- ¼" NPT suction and discharge connections
- Carbon reinforced ETFE liner
- Silicon carbide bearings
- Viton O-rings
- Alumina ceramic shaft
- Carbon reinforce PTFE gears
- Magnet - Neodymium encapsulated Virgin ETFE
- TEFC Premium Efficiency Motor – 0.5 HP, 3 ph, 1750 rpm, 460VAC, VPWM Inverter ready

D. Sodium Hydroxide Pumps:

1. First-stage Odor Control Vessels
   a. Provide four (4) – 8 gph sodium hydroxide pumps. There will be three (3) duty pumps and one (1) standby pump. The pumps shall be Pulsafeeder Eclipse 02 metallic, mag-drive rotary pumps (Model E02ALUF-B), or "approved equal" suitable for handling 25 or 50% caustic solutions.
2. Second-stage Odor Control Vessels
   a. Provide four (4) – 4 gph sodium hydroxide pumps. There will be three (3) duty pumps and one (1) standby pump. The pumps shall be Pulsafeeder Eclipse 02 metallic, mag-drive rotary pumps (Model E02ALUF-B), or "approved equal" suitable for handling corrosive

chemical solutions.

3. Pump Design Criteria:

- Maximum flow = 8 gph (1st stage) and 4 gph (2nd stage)
- Base material shall be 316L SS
- Carbon reinforce PTFE liner
- ¼" NPT suction and discharge connections
- Carbon bearings
- PTFE O-rings
- 316L SS shaft
- 316L SS gears
- Samarium cobalt magnets
- TEFC Premium Efficiency Motor – 0.5 HP, 3 ph, 1750 rpm, 460VAC, VPWM Inverter ready

E. Hydrochloric Acid Pump:

1. Provide one (1) – 50 gpm hydrochloric acid pump that will be used to pump hydrochloric acid to the sump of any of the chemical scrubber vessels. The pump shall be a ITT Goulds Model 3298 centrifugal magnetic drive pump, or "approved equal" suitable for handling hydrochloric acid.
2. The pump shall be plumbed such that it can pump to any of the six (6) chemical scrubber vessels, as shown on the Drawings.
3. Pump Design Criteria:
   - Flow = 50 gpm
   - Total Dynamic Head = 30 feet
   - Size – 1 x 1.5-5
   - 1.5" suction 150# raised flange, 1" discharge 150# raised flange
   - Ductile iron/Tefzel lined casing
   - Close-coupled
   - Neodymium -iron magnets
   - CFR-Tefzel encloses impeller
   - Viton O-rings
   - Silicon carbide shaft
   - Impeller balance holes
   - Casing drain flanged with blind flange
   - Pump and motor mounted on channel steel baseplate
   - TEFC Premium Efficiency Motor – 2 HP, 3 ph, 3600 rpm, 460VAC.

F. Scrubber Packing

1. The following manufacturers are acceptable:
   a. Lantec Products Inc.
   b. Raschiq USA - Jaeger Tri-Packs
2. Media bed packing shall be 3 to 4 inch Lantec Q-PAC; Jaeger Tri-Packs or equal
3. The Packing for the first stage demisting section shall be Lantec NuPAC

#2, 1" Jaeger Tri-Packs or equal and made of polypropylene material. The diameter of the demister packing shall be as required to provide maximum demisting performance.

G. Dampers:
1. Provide FRP isolation dampers per Specifications section 401016, Fiberglass Ductwork and Dampers.

H. Fans:
1. Fans shall be provided per Specification section 443160, Odor Control Fans.

I. Instrumentation and Controls:

1. Instrumentation and controls for the headworks odor control facility shall be provided as part of the Odor Control System Manufacturer package. Instrumentation shall be per Specification Section 406193, Process Control Descriptions and Section 407000, Instrumentation and Control for Process Systems.
2. Provide each new scrubber vessel with the following instruments as shown on the plans and specified:

   a. Ultrasonic level transducers/transmitter for scrubber sump.
   b. Level switches
   c. Differential pressure indicating transmitters across scrubber packing and mist eliminator
   d. Sight level gauge in sump.
   e. pH and ORP probes and analyzers
   f. Make-up water flow rotameter

J. Motorized actuated valves:

1. Provide each scrubber with the following motorized actuated CPVC ball valves as shown on the plans and specified herein and Specifications section 409213.13 - Electric Motor Actuators and Appurtenances.

   a. Motorized actuated makeup water ball valve.
   b. Motorized actuated hydrochloric acid feed ball valve.
   c. Motorized actuated sump drain ball valve.
   d. Motorized actuated recirculation ball valve.
   e. Motorized actuated demister ball valve.
   f. Others as shown on the plans and specified.

2.6 ACCESSORIES

A. Air inlets, air outlets, spray headers, injection quills, media support, drains, and all connections shall be provided by the Scrubber System Supplier. Tie down lugs shall be integrally molded into the walls of the vessels. All external bolts shall be Type 316 stainless steel and designed for the specified loads. Interior materials shall be of corrosion resistant materials such as PVC or FRP.

B. All exterior water supply, chemical supply, recirculation and drain piping shall be insulated per Section 404213, Process Piping Insulation and heat traced per Section 404113, Process Piping Heat Tracing.

C. Neoprene pad: A 1/4-inch thick neoprene rubber sheet shall be placed underneath the scrubber vessels as required by the Scrubber System Supplier.

D. The scrubber chemical injection, make up water and recirculation systems shall include the following components as a minimum and as shown on the Drawings. These components shall be included in the Odor Control System Manufacturer package. Comply with applicable sections of Division 40 for the valves and piping provided. Comply with applicable sections of Division 40 for the instrumentation provided. These items do not need to be replaced on the existing scrubber systems.
   1. Pressure-reducing valves.
   2. Isolation valves and check valves.
   3. Pressure gauges and transmitters.
   4. Rotameters
   5. pH and ORP sensors and analyzers.
   6. Chemical injection quills.
   7. Flanged connections for possible alternative chemical injections in the scrubber sump. The locations of the connections shall be as recommended per Scrubber System Supplier for proper and efficient mixing of chemicals with the sump solution, as shown on the plans, and approved by ENGINEER. Injection quills shall be of corrosion-resistant material to the application used and shall be sized and provided by the Scrubber System Supplier.
   8. Flanged connections for possible alternative locations of pH and ORP probes at the scrubber sump. The locations and configurations of the connections shall allow the probes to be submerged in the sump solution to a level where it provides proper readings of the pH and ORP solution in the sump as shown on the plans and approved by ENGINEER.

E. Lifting lugs:

   1. Provide a minimum of 4 lifting lugs per scrubber vessel for use in transporting and placing the vessel. Additional lugs shall be as required per structural calculations requirements, but no less than 4 lifting lugs.
   2. Provide lifting lugs for pumps and other components of the system.
   3. Provide Type 316 stainless steel anchor bolts and in accordance with Specifications section 15050, Common Work Results for Mechanical Equipment.

2.8 FINISHES

A. Paint the odor control system piping and equipment to match existing systems and as specified in Specifications section 099600, High-Performance Coatings. Plastic or fiber reinforced thermoset plastic resin vessels, tanks, and equipment shall be pigmented in a color selected by the ENGINEER and contain ultraviolet light inhibitors. It does not need to be painted.

2.9 SPARE PARTS

A. Provide the following spare parts:
   1. Two pH probes.
   2. Two ORP probes.
   3. Recirculation pump spare parts:
      a. One impeller that can be used for any of the six pumps
      b. One mouth ring (sintered silicon carbide)
      c. One complete set of replacement bearings
   4. Chemical metering pump spare parts:

Description	Sodium Hydroxide Pumps Quantity	Sodium Hypochlorite Pumps Quantity
Bearing	2	2
Liner, Housing	1	1
Gear Assembly, Drive	1	1
Gear Assembly, Idler	1	1
O-Ring Cover	1	1
O-Ring Compression	2	2
Bolts	6	6

B. Spare parts list: Provide a recommended spare parts list that includes part names, part numbers, and telephone numbers for placing orders.

2.10 SOURCE QUALITY CONTROL

A. Factory Test: Perform manufacturer's standard test on equipment. Provide an independent FRP Quality Assurance Inspection report as follows:
   1. Visual inspection to the requirements of ASTM D2563.
   2. Barcol Hardness measurements in accordance with ASTM D2583.
   3. Acetone sensitivity test for all internal secondary bonds.
   4. Glass content by ignition loss on 3 cutouts in accordance with ASTM D2584.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
   1. Provide the following:
      a. Inspect equipment upon delivery to job site.
      b. Install equipment including any adjustments and installation checks for equipment and controls.
      c. Certify alignment and proper control functioning prior to operation.
      d. Conduct start-up of all equipment and perform all required tests including instrument calibration and loop checking and performance testing of components that function as part of the odor control system.
      e. Provide written statement that equipment has been installed properly and is ready for operation by ALCOSAN.

3.2 SYSTEM BALANCING AND CHECKING

A. After the odor control system has been installed, checked-out, controls tested, and it is ready for operation, test and balance the entire foul air collection system as specified in Specifications section 23 05 93, Testing, Adjusting, and Balancing for HVAC.

B. Calibrate and adjust all instruments necessary for each scrubber system operation. Adjust controls to achieve the required performance at the rated design condition.

3.3 FIELD FINISHING (AND/OR CORROSION PROTECTION)

A. Field touch up in accordance with Specifications section 099600, High-Performance Coatings.

B. Damage to pigmented gel coat and/or exterior laminate on any FRP component shall be repaired in accordance with equipment fabricator's recommendations. Exposed surfaces will be restored to a uniform texture and color-matched appearance. Color shall be as selected by the ENGINEER.

3.4 FIELD AND PERFORMANCE TESTING

A. The Scrubber System Supplier and CONTRACTOR shall conduct field and performance testing in accordance with Specifications section 017500, Facility Start-up, and as follows:

1. Alignment: Test complete assemblies for correct rotation, proper alignment and connection, and quiet operation.
2. Field Testing:
   a. Conduct airflow test for all three scrubber trains and all three odor control fans. Flow test equipment shall be certified to provide accuracy to within plus or minus 5 percent of design flow. This testing shall be done in conjunction with balancing of the new air collection ductwork in the East Headworks building as described in Specifications section 230593 – Testing, Adjusting and Balancing for HVAC. Contractor will also be required to balance the amount of air coming from existing sources so the total air from those sources is 66,500 cfm +/- 5%.
   b. CONTRACTOR to balance the airflow in each scrubber train to within plus or minus 5 percent of each other. The total flow shall be within plus or minus 5 percent of the system design performance requirements. Provide test data.
   c. Provide pressure differential reading across each scrubber. Provide equipment and ports as required for ALCOSAN to do monthly operational testing on these locations. Provide ports as required for insertion of H_2S sensors/analyzers at outlets of each unit and the inlet header at each unit.
   d. The following testing procedures shall be performed:

(1) After the scrubbers have been commissioned and passed the Physical Checkout phase as specified in Specifications section 01 75 00, Facility Start-up, the scrubbers will be placed in continuous operation 24 hours per day under actual operating conditions for the Acceptance Test.

(2) The scrubbers acceptance testing will include a minimum of 7 continuous days of operation under actual operating condition. During this period, the four-hour performance testing of the scrubbers will also be conducted as specified.

(3) Performance Tests: A qualified representative of the Scrubber System Supplier shall be available during the entire testing period and shall coordinate tests while being witnessed by the ENGINEER. The CONTRACTOR shall provide detailed sampling and testing procedures to be reviewed and accepted by the ENGINEER prior to performance testing. The instruments used in the 4-hour test shall be recently calibrated within no more than 1 year from start of testing.

(4) The performance testing shall verify that the entire headworks odor control facility along with the associated components and chemical feed system functions properly and meets the emission requirements as specified elsewhere in this Section.

(5) The pH and ORP probe and analyzer system will be used only during the performance testing of the scrubber systems to verify conformance with the emissions requirements of the scrubbers. After the 7-day performance test is successfully completed and accepted by ALCOSAN, the ORP system shall be removed if directed by ALCOSAN or may remain in place. Alternatively, the scrubbers may be operated using the H_2S analyzer and pH control algorithm as described in section 406193, Process Control Descriptions.

(6) If during testing the system fails to perform as specified, the CONTRACTOR shall repeat testing as many times as required without minimum or maximum restrictions and new measurements shall be reported until the system meets the requirements. All failed and repeated tests shall be at CONTRACTOR's cost.

(7) The system will be accepted after the acceptance and performance tests are successfully completed and meet the performance requirements as specified.

(8) Testing to be conducted shall be under actual operating conditions and shall include the following:

(9) Inlet and outlet hydrogen sulfide concentrations shall be measured using recently calibrate H_2S monitors. Inlet concentrations shall be measured throughout the 4-hour testing period using an Odalog or Jerome 631X H_2S analyzer with a range of 0-50 ppm. The Odalog/Jerome shall be

programmed to log readings every 15 minutes throughout the 4-hour period. The scrubber outlet H_2S readings shall be measured after each stage using a Jerome 631X. Outlet readings shall be recorded every 15 minutes throughout the 4-hour test period.

(10) Report the testing results: The report of the performance test results for each unit and the entire system shall be provided for the entire 7-day testing period showing each day the results of the parameters listed. The 4-hour test report include the following:

(a) Inlet and outlet H_2S (recorded every 15 minutes)
(b) pH and ORP readings (recorded every 15 minutes)

The following parameters shall be recorded at the beginning and end of the 4-hour test.

(c) Recirculation pump flow rates
(g) Fan air flow rates
(h) Recirculation pump pressures
(i) Fan pressures (suction and discharge, and differential)
(j) Differential pressures across packing media bed and demister bed.
(k) Sodium hypochlorite chemical pump dosage rate.
(l) Sodium hydroxide chemical pump dosage rate.
(m) Make up water flow rate.
(n) Sump level.
(o) Air temperature.

END OF SECTION