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Project, Client, Location Prime Contract F11623-94-D0024 Delivery Order RL52 Washrack Filtration System McChord AFB, WA	Specification Title Washrack Wastewater Treatment Unit
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<input type="checkbox"/> In-House Review <input type="checkbox"/> Client Approval <input checked="" type="checkbox"/> Other	<input checked="" type="checkbox"/> Entire Specification Attached
<input type="checkbox"/> Company Standard	<input type="checkbox"/> Revised Sheets Only Attached

Rev	Date	By	Ck	Approvals				Remarks
				Section	Project Engineer		Client	
A	5/13/99		JW		JdG			Issued for Government Review
B	11/15/99							Incorporates design changes

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SECTION 11300

WASHRACK WASTEWATER TREATMENT UNIT

PART 1 - GENERAL

1.1 DESCRIPTION. Furnish one (1) washrack wastewater treatment unit complete, as indicated on the Drawings (See Drawings F-1, M-1, and I-1) and specified herein, including the following: emulsion breaking system with pH adjustment, dissolved air flotation system, neutralization system, polishing system, piping, instrumentation, controls, electrical system, structural steel skid base, anchoring system, all necessary appurtenances, and chemical supplies for six months operation. The work includes but is not limited to fabrication of the skid-mounted washrack wastewater treatment unit, shop testing, and delivery of the unit to Building 1178 at Mc Chord AFB, Tacoma, WA, as directed by the CONTRACTOR for unloading, installation, field testing, start-up, commissioning services and turn over to the CONTRACTOR .

SUBCONTRACTOR shall be responsible for proper operation of the entire washrack wastewater treatment unit.

1.2 SUBMITTALS. Submit shop drawings showing fabrication, assembly, foundation, and installation, together with detailed specifications and data covering performance and materials of construction, equipment, parts, devices, controls and other appurtenances forming a part of the washrack wastewater treatment unit in accordance with the requirements of Section I, Statement of Work, and supplementary requirements specified herein. Data and specifications for the equipment shall include, but shall not be limited to the following:

A. Emulsion Breaking System Data

a. Pump Data

1. Feed pumps and polymer metering pump curves indicating total head, flow rate, compressed air consumption and supply pressure required, and power consumption respectively, shutoff head.
2. Pump specifications including materials of construction, suction lift capability, maximum diameter solids, and dimensional drawings showing piping connections, and location relative to the other system components and skid base footprint.
3. Electrical and control data.
4. Operation and maintenance manual.
5. List of spare parts.

b. Reactor Chamber #1: Emulsion Breaking Tank

1. Tank performance data, specifications including materials of construction, structural and seismic calculations and dimensional drawings showing piping connections, mixer mounting support, power and control conduit/wiring, instrumentation, protective coating data, tank weight, and tank location relative to the other system components and skid base footprint.
2. Mixer data, specifications including materials of construction, variable speed range, electrical rating of the motor, variable speed reducer data and dimensional drawings and supporting calculations.
3. Electrical and control data.
4. Operation and maintenance manual.
5. Spare parts.

c. Reactor Chamber #2: pH Adjustment Tank

1. Tank performance data, specifications including materials of construction, structural and seismic calculations and dimensional drawings showing piping connections, mixer mounting support, power and control conduit/wiring, instrumentation, protective coating data, tank weight, and tank location relative to the other system components and skid base footprint.
2. Mixer data, specifications including materials of construction, variable speed range, electrical rating of the motor, variable speed reducer data and dimensional drawings and supporting calculations.
3. Chemical metering pump data and specifications including materials of construction, output flow range, maximum discharge pressure, stroke frequency and length ranges, motor power rating and dimensional drawings showing piping connections, and location relative to the other system components and skid base footprint.
4. Instrumentation data.
5. Electrical and control data.
6. Operation and maintenance manual.
7. Spare parts.

d. Chemical Mix Tank

1. Tank performance data, specifications including materials of construction, structural and seismic calculations and dimensional drawings showing piping connections, mixer mounting support, power and control conduit/wiring, instrumentation, protective coating data, tank weight, and tank location relative to the other system components and skid base footprint.
2. Mixer data, specifications including materials of construction, speed range, electrical rating of the motor, speed reducer data, and dimensional drawings and supporting calculations.

3. Chemical metering pump data and specifications including materials of construction, output flow range, maximum discharge pressure, stroke frequency and length ranges, motor power rating and dimensional drawings showing piping connections, and location relative to the other system components and skid base footprint.
4. Instrumentation data.
5. Electrical and control data.
6. Operation and maintenance manual.
7. Spare parts.

B. Dissolved Air Flotation Tank

1. Tank performance data, specifications including materials of construction, structural and seismic calculations and dimensional drawings showing piping connections, mixer mounting support, power and control conduit/wiring, instrumentation, protective coating data for all components, tank weight, and tank location relative to the other system components and skid base footprint.
2. Float separation chamber data, specifications including materials of construction, skimmer speed, electrical rating of the motor, and dimensional drawings and supporting calculations.
3. Float storage chamber data, specifications including materials of construction and dimensional drawings and supporting calculations.
4. Effluent chamber data and specifications including materials of construction and dimensional drawings and supporting calculations.
5. Recycle pump data and specifications including materials of construction, capacity, total head, air consumption and supply pressure required, dimensional drawings showing piping connections, and location relative to the other system components and skid base footprint.
6. Sludge pump data including pump curves indicating flow rate, total head, compressed air consumption and supply pressure required, shutoff head, and sludge pump specifications including materials of construction, suction lift capability, maximum diameter solids, and dimensional drawings showing piping connections, and location relative to the other system components and skid base footprint.
7. Compressed air requirement data including supply air flow and pressure, and dimensional drawings showing air piping connections, and location relative to the other system components and skid base footprint.
8. Instrumentation data.
9. Electrical and control data.
10. Operation and maintenance manual.
11. Spare parts.

C. Neutralization Tank

1. Tank performance data, specifications including materials of construction, structural and seismic calculations and dimensional drawings showing piping connections, mixer mounting support, power and control conduit/wiring,

instrumentation, protective coating data, tank weight, and tank location relative to the other system components and skid base footprint.

2. Mixer data, specifications including materials of construction, fixed speed, electrical rating of the motor, speed reducer data, and dimensional drawings and supporting calculations.
3. Chemical metering pump data and specifications including materials of construction, output flow range, maximum discharge pressure, stroke frequency and length ranges, motor power rating and dimensional drawings showing piping connections, and location relative to the other system components and skid base footprint.
4. Instrumentation data including pH probe.
5. Electrical and control data.
6. Operation and maintenance manual.
7. Spare parts.

D. Skid Assembly. Complete general arrangement drawings, structural and seismic calculations together with detailed specifications and data covering materials of construction, total weight of the skid, weight distribution, parts, devices, single power supply connection, electrical and control data and diagrams, and other accessories forming a part of the skid assembly shall be furnished. The skid shall be all welded construction. Upon completion of welding, the complete skid shall be sandblasted and coated with chemical resistant epoxy as specified in Section 09900, Painting and Protective Coatings.

Weld sufficient number of eye bolts to allow for unit lifting in one piece for transportation and final setting in the field.

For steel requirements refer to section 05500, Structural Steel. In addition, drawings, specifications, and other data required to be submitted hereunder shall be the following:

1. Anchor bolt layout and size requirements.
2. Materials of structural steel construction.
3. Lifting and handling instructions.

1.3 DESIGN CONDITIONS. Design the washrack wastewater treatment unit for fixed wastewater flow conditions

Treated liquid	Aircraft washwater from existing 7,000 gal equalization tank.
Inluent/effluent connection	1 ½ -inch
Number of units	1
Design Flow Range	5 gallons per minute (gpm) average, 10 gpm maximum.
Inlet Wastewater	Temperature 40-70°F Refer to Table 2, Untreated Washrack Wastewater Quality in Section II-1, Washrack Wastewater Treatment Unit Process Description.

Discharge Requirements The WWTU shall operate and produce effluent below the discharge limits provided in Table 1, WA POTW Industrial Wastewater Discharge Limits, on page 1 of Section II-1, Washrack Wastewater Treatment Unit Process Description.

Performance Guarantees

1. SUBCONTRACTOR shall guarantee the Discharge Requirements specified for the operation of the WWTU at the design flow rates and conditions provided.
2. SUBCONTRACTOR shall guarantee the WWTU hydraulic performance.

Service Indoor, Tacoma, WA

Electrical Classification 18 inches above finished floor: Class 1, Division 2 Hazardous Area; Above 18 inches off finished floor: Unclassified. Materials and installations in hazardous locations shall comply with Articles 500 and 501 of the National Electrical Code.

Electrical Supply Single point of connection rated for 480V, 3 phase, 60 Hz.

1.4 **QUALITY.** All equipment furnished under this Section shall be:

- A. Of design and manufacture that has been used in similar applications.
- B. Quality as demonstrated to the satisfaction of the CONTRACTOR equal to equipment made by those manufacturers specifically named herein.

1.5 **CODES AND STANDARDS.** The latest issue of the following codes, standards, and regulations shall be considered a part of this specification.

Unless specified otherwise, the latest issue of a code or standard shall be defined as the issue (including latest published addenda) in force for the project at the date of award of the purchase order and as determined by the regulatory agency having authority at the location where the equipment is to be installed.

1. American Institute for Steel Construction (AISC)
AISC Manual of Steel Construction
2. American Society of Civil Engineers (ASCE)
ASCE 7 Minimum Design Loads for Buildings and Other Structures
3. American Welding Society (AWS)
AWS D1.1 Structural Welding Code
4. National Fire Protection Association (NFPA)
NFPA 78 Lightning Protection Code
5. American National Standards Institute (ANSI)
6. American Society for Testing and Materials (ASTM)
7. American Society of Mechanical Engineers (ASME)

8. Occupational Safety and Health Association (OSHA)
9. Uniform Building Code (UBC)
10. Steel Structures Painting Council (SSPC)
11. National Electrical Manufacturing Association (NEMA)
12. Underwriters Laboratory (UL)
13. Factory Mutual (FM)
14. National Electric Code (NEC)

PART 2 - PRODUCTS

2.1 GENERAL. Provide pumps and mixers rated for continuous duty and capable of pumping and mixing the specified flow range. Provide complete units which, when assembled and operating, are free of air or liquid leaks over the range of operation.

2.2 MANUFACTURERS. Provide seven (7) air driven pumps: two feed pumps, one duty and one stand-by; one sludge pump; two recycle pumps, one duty and one stand-by; and two discharge pumps, one duty and one stand-by, manufactured by Wilden Pump and Engineering Company or UL-listed approved equal from Marlow ITT Pumps or ARO.

Provide five (5) chemical metering pumps, four duty and one stand-by, one each for sulfuric acid service for pH adjustment in the neutralization tank, sodium hydroxide for pH adjustment in the pH adjustment chamber, polymer for emulsion breaking tank, and oxidizing agent for the neutralization tank. The pumps shall be manufactured by Liquid Metronics, Inc., A-series, Wallace & Tiernan, series 45 or approved equal.

2.3 DESIGN OPERATING CONDITIONS FOR PUMPS.

The feed pumps shall have 5 gpm average to 10 gpm maximum capacity at 30 psig head as measured at the inlet to the emulsion breaking tank.

The sludge pump shall have 5 gpm average to 10 gpm maximum capacity at 30 psig head as measured at the inlet to the 2,500 gallon sludge storage tank.

The recycle pumps shall have 2.5 gpm average to 5 gpm maximum capacity at 70 psig head as measured at the inlet to the DAF tank.

The discharge pumps shall have 5 gpm average to 10 gpm maximum capacity at 30 psig head as measured at the inlet to the polishing filter.

2.4 MATERIALS.

A. General materials of construction:

1. Pump chambers, inlet/outlet manifolds- polypropylene.
2. Elastomer- Teflon PTFE.
3. Clamps, piping nipples - 316 stainless steel.
4. Air Valves – Brass, Teflon coated.

- B. Fasteners. Type 316 stainless steel bolts and cap screws. Anchor bolts, nuts, and washers of Type 316 stainless steel, and of sufficient length.
- C. Nameplates. Type 316 stainless steel plate, permanently attached to the pump frame, into which the following information is impressed, engraved, or embossed: manufacturer's name, pump size, serial number, impeller diameter, capacity, head rating, speed, and project pump name and tag number. Also include information unique to each item of equipment and device to identify its function as described herein. Furnish nameplates approximately 1 inch by 3 inches in size, with letters of function titles not smaller than 1/4-inch high.

2.5 PUMP CONSTRUCTION. Provide air-operated, positive displacement, self-priming, double diaphragm pumps, capable of being serviced without disturbing piping connections. All pumps shall be of non-sparking construction, UL-listed.

2.6 SPARE PARTS. Furnish and deliver the following spare parts for each pump:

- A. One pair of 316 stainless steel clamps for air chamber and inlet/discharge manifold.
- B. One set diaphragms.
- C. One set valve seats and seat o-rings.

2.7 COMBINATION FILTER-REGULATOR-LUBRICATOR UNITS. Provide two plug-in general purpose combination filter-regulator-lubricator units for compressed air service as manufactured by Norgren model M4H-661-A3DA type 13 series, Balston, Maremont or approved equal.

Units shall be designed and manufactured for maximum inlet pressure of 250 psig and temperature range of 0° to 175° F. Units shall have zinc bodies and bowls, neoprene and nitrite elastomers, and brass and Acetal valve assemblies.

2.8 TWO-WAY SHUT-OFF COUPLINGS. Provide one (1) two-way shut-off brass coupling at each compressed air manifold. The couplings shall be as manufactured by Hansen series 3-HK model LL3-H-8 with metal plug dust cap PDC-3-HK, Duff-Norton series H, McMaster-Carr No. 5316K15/24 sockets and 5316K51/42 plugs or approved equal.

2.9 CHEMICAL METERING PUMPS. Provide five (5) chemical metering pumps, four duty and one stand-by, one each for sulfuric acid service for pH adjustment in the Neutralization Tank, sodium hydroxide for pH adjustment in the pH Adjustment Chamber, polymer for Emulsion Breaking Tank, and oxidizing agent for Neutralization Tank. The pumps shall be positive displacement, Liquifram type. Construct pump housing from chemically resistant PVC, ball type, with Teflon ball seating on combination Teflon valve seat and Teflon seal ring, Teflon face Liquifram, and hydraulically backed diaphragm. The pump drives shall be totally enclosed with no exposed moving parts. Fully encapsulate solid-state electronic pulsers with no exposed printed circuits. House electronics in chemical resistant enclosures at the rear of the pumps for maximum protection against chemical damage. Electrical power consumption shall not exceed 22 Watts at maximum speed and 120V, 1-phase, 60 Hz rating. Stroke length shall be adjustable from 0 to 100 percent and stroke frequency shall be adjustable from 10 to 100 strokes per minute. Furnish injection check valve, suction and discharge tubing, and diaphragm type anti-siphon/pressure release valve, circuit breakers and thermostatic overheat protection for each metering pump.

2.10 MIXERS. Provide fixed and variable speed mixers for 100 gallon capacity chemical treatment tanks containing aircraft washrack wastewater (water with additions of detergent and PD-680 solvent). Construct mixer impellers, shafts and shaft couplings of ANSI 316 stainless steel, and gear reducer and ball bearing housing of aluminum.

The gear reducer shall be highly efficient, lubricated-for-life polymeric gear running against a metal pinion.

The propeller shall be three-blade, left hand, square pitch, marine type with stabilizer ring.

The fixed speed mixer for neutralization system service shall have 360 rpm impeller speed, 1,800 rpm nominal motor speed.

The variable speed mixer for emulsion breaking system service shall have 50 rpm to 425 rpm impeller speed range, 1,800 rpm nominal motor speed.

The motor shall be 1/4 Hp rated for 120 V, 1-phase, 60 Hz totally enclosed type.

Provide mixers manufactured by Chemineer, model LTG-2 series for fixed speed and model PGA-2V-425/50 for variable speed or approved equal.

2.11 CONTROLS. For pump and mixer controls refer to Section 13200, Control Panel and Panel Mounted Instruments.

2.12 COATING.

- A. Refer to Section 09900, Painting and Protective Coatings.

2.13 PUMP ACCESSORIES.

- A. Gage Taps. Furnish discharge nozzle of each pump with tapped openings and plugs for the 1/2 in. NPT gages.
- B. Suction Tube Shields. Furnish PVC suction tube straightener assemblies (shields) suitable for standard 55 gallon drum for all chemical metering pumps. Select model matching drum construction material.
- C. Splash guards. Furnish transparent plastic covers for all chemical metering pumps.
- D. Tube Connector Assemblies. Furnish 0.375-inch O.D. x 1/2- inch NPT M, grey PVC for all chemical metering pumps or approved equal.
- E. Spare Parts Kit. Furnish seal rings, valve balls and anti-syphon spring/diaphragm as applicable, one set for all chemical metering pumps.

2.14 EMULSION BREAKING SYSTEM

Tank Dimensions	
Overall length:	8 ft.
Overall width:	2 ft.
Overall height:	4 ft.
No. of Chambers:	2
Material of Construction:	ASTM 304L Stainless Steel
Surface Preparation	SSPC-SP10
Interior Coating:	None
Exterior Coating:	None
Inlet/Outlet Connections:	2 inch
High-Level Shut-Off:	None
Cover:	None
Chamber #1 (Demulsifier Dosing):	
Volume:	100 gal
Mixer:	Variable speed drive (50-425 RPM) with 316 SS shaft and propeller
Demulsifier Mixing Tank:	60 gal, polyethylene, mixer included
Demulsifier Metering Pump:	One duty
Chamber #2 (pH Adjustment):	
Volume:	100 gal
Mixer:	Variable speed drive (50-425 RPM) with 316 SS shaft and propeller
pH Controller:	Micro-processor based, LED readout, 0.01 pH resolution
pH probe:	CPVC housing, removable
Chemical Metering Pump:	One duty
Controls (PLC)	
See Section 13200, Control Panel and Panel Mounted Instruments, and Section 13300, Field Mounted Instruments	
Accessories:	<ul style="list-style-type: none">• Variable speed motor controllers (mixers)
Mount feed pumps on the skid. Elevate chemical tank to ensure gravity flow to the DAF.	
All equipment shall be plumbed, prewired and mounted on a skid. All pumps shall have high level shut-off.	

2.15 DISSOLVED AIR FLOTATION SYSTEM

DAF Unit Tank	
Average Flowrate:	5 gpm (hydraulic loading: 0.62gpm/sq.ft.)
Maximum Flowrate:	10 gpm (hydraulic loading: 1.24gpm/sq.ft.)
Overall length:	10 ft
Overall width:	2 ft, 6 in
Overall height:	5 ft
Material of Construction:	ASTM A-36 Carbon Steel
Surface Preparation	
Interior	SSPC-SP10
Exterior	SSPC-SP6
Interior Coating:	Coal Tar Epoxy (12 DFT)
Exterior Coating:	Primer and Industrial Enamel (6 DFT)
Internal Piping:	ASTM A-53
Components:	<ul style="list-style-type: none">• float storage chamber and float baffle• water baffle with adjustable water weir• sludge hopper• surface float skimmer (1/4 HP variable speed)• clean water effluent chamber• skim ramp
Sludge Transfer Pumps:	One duty
Float/Sludge Holding Tank:	2,500 gallon cone-bottom tank (enclosed with manway and vent). Connection provided for sludge removal by VACuum truck.
Controls (PLC)	
See Section 13200, Control Panel and Panel Mounted Instruments, and Section 13300, Field Mounted Instruments	
All equipment shall be plumbed, prewired and mounted on a skid.	
All pumps and tanks shall have high level shut-off.	

2.16 NEUTRALIZATION SYSTEM, EFFLUENT SAMPLING TANK AND POLISHING FILTER

Tank Dimensions	
Overall length:	8 ft
Overall width:	2 ft
Overall height:	4 ft
No. of Chambers:	2
Material of Construction:	ASTM 304L StainlessSteel
Surface Preparation	SSPC-SP10
Interior Coating:	None
Exterior Coating:	None
Cover:	None
pH Controller:	Micro-processor based, LED readout, 0.01 pH resolution
pH probe:	CPVC housing, removable
Chamber #3 (Oxidation and Nuetralization):	
Volume:	100 gal
Mixer:	Variable speed drive (50-425 RPM) with 316 SS shaft and propeller
Chemical Metering Pumps:	Two (one for oxidizing agent dosing, one for pH adjustment)
Chamber #4 (Pump Supply/Effluent Sampling Tank)	
Volume:	100 gal
Mixer:	None
Polishing Filter	
Vessel Diameter:	8 inches
Vessel Material:	Carbon Steel, coated
Bag Micron Rating:	15 microns
Operating Conditions:	5 gpm average to 10 gpm maximum at 30 psig head as measured at the outlet of the polishing filter
Filter Feed Pump:	
Number:	Two (one duty and one stand-by)
Average Flowrate:	5 gpm
Maximum Flowrate:	10 gpm
Controls (PLC):	
See Section 13200, Control Panel and Panel Mounted Instruments, and Section 13300, Field Mounted Instruments	
All equipment shall be plumbed, prewired and mounted on a skid.	
All pumps shall have high level shut-off.	

2.17 INLET FEED PUMPS AND TANK LEVEL CONTROLS

Inlet Feed Pumps:

Number: 2 (One duty and one stand-by)
Average Flowrate: 5 gpm
Maximum Flowrate: 10 gpm

Controls:

See Section 13200, Control Panel and Panel Mounted Instruments, and Section 13300, Field Mounted Instruments

PART 3 - EXECUTION

3.1 EQUIPMENT TESTING.

A. Shop Testing

1. General. The unit shall be subjected to a complete shop test as specified herein. Certified test reports, in triplicate, shall be submitted to the CONTRACTOR. No equipment shall be shipped until receipt of the CONTRACTOR's written approval. All costs for the shop tests shall be borne by the SUBCONTRACTOR and shall be included in his Bid Price.
2. Pumps. Each assembled air driven pump and motor driven pump, as applicable, shall be shop tested to determine the following characteristics at the minimum and maximum capacity at which the pumps are to be operated:
 - a. Head-capacity curve
 - b. Compressed air supply pressure
 - c. Compressed air consumption
 - d. Wastewater leakage (none allowed)
 - e. Compressed air leakage (none allowed)
 - f. Stroke characteristics and motor rating
3. All tests shall be performed in accordance with the latest Hydraulic Institute Standards.
4. In the event the washrack wastewater treatment unit does not meet the specified requirements, it shall be modified by the SUBCONTRACTOR to meet the requirements of the Specifications and shall be retested in accordance with the provisions of the Specifications. All costs of shop retesting, including costs for additional witnessing, shall be borne by the SUBCONTRACTOR.

- B. Delivery and Handling. The SUBCONTRACTOR shall deliver the equipment to the job site. All equipment shall be wrapped to prevent damage during shipping. The SUBCONTRACTOR shall provide all labor, equipment, and tools for unloading the equipment at Building 1178. The SUBCONTRACTOR shall provide printed instructions for handling the equipment. Report any damage to the equipment that occurs during shipping or unloading to the CONTRACTOR.
- C. Field Testing. Following completion of the installation and satisfactory start-up of the equipment, the SUBCONTRACTOR (i.e., Equipment Supplier) shall provide the services of his technical representative for field testing the equipment installation. The entire unit and control system shall be operated for one week. The operation shall be free of vibration, noise, leaks and shall produce minimum hazardous waste. For other field testing and operation requirements refer to Section I, Statement of Work. The field assistance of the SUBCONTRACTOR shall not exceed 2 trips and a total of 5 working days.

The unit wastewater treatment performance shall be documented by obtaining concurrent readings showing effluent in total compliance with McChord AFB discharge permit requirements as provided in Section II-1, Washrack Wastewater Treatment Unit Process Description. The compliance shall be documented for at least three samples taken at random time intervals within 48-hour period. The performance shall meet or exceed specified design criteria and regulatory requirements.

- D. In the event any of the washrack wastewater treatment equipment fails to meet the Field Testing requirements, it shall be modified by the SUBCONTRACTOR and retested in accordance with the requirements of these Specifications.

END OF SECTION 11300