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Date: July 1st, 2011

Proposal No: QT02646, Rev 3

Proposal For: Tim Mahoney
TerraTherm, Inc
10 Stevens Road
Fitchburg, MA 01420
tmahoney@terratherm.com
Phone: (978) 343-0300 ext. 220

Job Reference: SRSNE Superfund Site
Southington, CT

Application: Chlorinated Vapor Treatment

Proposed Equipment: Single Thermal Oxidizer Model HGTO 2500 HD with HCl Acid Gas Scrubber

Thank you for the opportunity to provide the following proposal for your project. The HGTO HD Thermal Oxidizer and HCl Acid Gas Scrubber represent some of our best technology. The HGTO HD with Scrubber design is further advanced and far more reliable than any Chlorinated Thermal Oxidizer with Scrubber currently available and represents our commitment to provide high quality air correction solutions.

Should you have any questions regarding this information, please contact me at 715-568-2882. If for some reason I am unavailable, please feel free to contact any of the following individuals:

Catalytic Combustion Contacts		
Chris Bartels	Applications/Sales	CBartels@catalyticcombustion.com
Lori Coenen	Director of Engineering	lcoenen@catalyticcombustion.com
Steve Pitsch	Director of Industrial Service	spitsch@catalyticcombustion.com

Best Regards,

Keith Herbert
Vice President - Sales

TerraTherm should select CCC to design/supply this oxidizer/scrubber system because:

1. CCC will design, manufacture, assemble and shop test the thermal oxidizer system within our new fabrication facility. We will subcontract the quencher/scrubber package to Bionomics and we will have Bionomics ship their equipment to our facility for a shop checkout and then we will ship the entire oxidizer/scrubber system to the jobsite. We invite you to visit our offices and manufacturing facility whenever you like.
2. CCC is a UL508A listed industrial control panel fabrication facility. The oxidizer/scrubber control system is designed, manufactured, and listed by Underwriter Laboratories in our fabrication facility.
3. CCC has an extremely strong field service team with field service technicians experienced in electrical systems, control panels, PLC programming, and combustion equipment such as fuel gas fired burners, catalytic and thermal oxidizers, scrubbers, concentrators and RTO's. Our team is also very experienced at installing and operating our equipment.
4. Our service department has a 24/7/365 phone service support line that is answered by one of our field service technicians. Catalytic Combustion does not subcontract field service work. Because of our company commitment to safety both inside the workplace and in the field our technicians maintain the following certifications:
 - a. Fall Protection
 - b. Confined Space
 - c. Lockout/Tagout
 - d. Hazardous Communications
 - e. Hazwoper
 - f. Fire Safety
5. CCC builds quality equipment to chemical and pharmaceutical plant standards. We supply a quality package using experienced vendors and components to insure we meet the required DRE's and HCl removal efficiencies and reliable up time performance while being considerate of system costs.
6. CCC has been in business since 1950, we have extensive experience in the supply of custom combustion equipment and HCl acid gas scrubbers and PLC control systems for remediation and industrial applications. We are committed to our clients and we stand behind the equipment we supply to insure client satisfaction and meeting all performance guarantees.

PROPOSAL NOTES

The equipment proposal we have provided in this document is based on our understanding of your requirements. The following sections review the design of the system and detail the overall system configuration.

Delivery Schedule:

Standard shipping schedule is 16-18 weeks after submittal approval. A submittal package will be provided within 3-4 weeks after order placement. The drawings will be available in autocad format.

Terms and Conditions:

This quotation is offered in accordance with CCC's standard terms and conditions of sale, using CCC's standard engineering and manufacturing procedures. CCC's pricing does not include any sales or use tax, so it will be the responsibility of the purchaser to remit, to the proper taxing authority, any applicable sales or use tax resulting from the purchase of equipment.

Performance Guarantees:

CCC guarantees:

99% DRE overall destruction efficiency in the thermal oxidizer

99% HCl removal efficiency in the quencher/scrubber

99% run time with the additional redundant parts option and the two spare parts options.

Gas Fired Thermal Oxidizer Model HGTO 2500 HD

The HGTO 2500 HD is a direct fired natural gas or propane fired Thermal Oxidizer designed to treat chlorinated hydrocarbon contaminated air streams from SVE systems, groundwater air strippers or industrial process applications. The HGTO 2500 HD is designed to process 2500 SCFM as originally specified on 2-10-11 (9926 lb/hr air + 785 lb/hr water + 198 lb/hr COC's). This HGTO 2500 HD is designed to achieve 99% DRE overall destruction efficiency. These design numbers exceed the latest of 7680/177/198 which is 1785 scfm (2000 scfm design) from the Thermal Oxidizer/Quench/Scrubber specification and P-101 Rev E. The HGTO 2500 HD is designed to operate completely independent of the process and typically requires an enable/disable signal interface with the supply system control panel. **Note: This oxidizer/scrubber system is not designed for process air streams containing fluorinated compounds. The presence of fluorinated compounds that would produce HF would require a review of materials of construction, especially the refractory lining.**

Combustion Chamber – operating at 1600 degrees F as specified

- Fully welded carbon steel combustion chamber
- Internally insulated with Pyro-Bloc R ceramic fiber refractory modules rated to 2,200°F continuous operating temperature (2,400°F max operating temperature).
- Shell temperature to be minimum 250°F to prevent HCl condensation and corrosion
- Externally finished with high temperature two-part epoxy paint
- Expanded metal heat shield to provide a maximum personnel exposure of less than 140°F

309 SS Heat Exchanger

CCC has included a 309 SS shell and tube heat exchanger (309 SS tubes and 309 SS shell) to be installed downstream of the Thermal Oxidizer to recover heat off the Thermal Oxidizer and reduce fuel consumption. The process vapour will flow thru the tube side of the heat exchanger and be preheated to approx 1000 degrees F. The heat exchanger will also be externally insulated.

The heat exchanger will mount on top of the Thermal Oxidizer in a piggyback arrangement.

We have not included any blanking plates or bypass valves. A spare HX can be provided for the same \$65K price.

Natural Gas/Propane Fired Burner

- North American Mfg. Company burner with refractory block, 3.5 MM BTU/Hr capacity, 2.75 MM BTU/Hr operating
- Dual installed AirPro direct drive centrifugal combustion air blowers, 770 scfm, 10 hp each
- Dungs NFPA 86 gas train, double block & bleed, with pilot fuel train
- Honeywell self checking flame scanner (Qty.2)
- Visual peep site on burner and opposing combustion chamber end for viewing flame
- Note: natural gas supply pressure needs to be 3-5 psig minimum

Piping, Ducting, and Valving

- Carbon steel, schedule 40 (0.375" wall), two-part epoxy painted process air piping
 - Externally insulated ducting to prevent condensing water vapour
-

- Insulation is Firwin 1” FW1200 fiberglass insulation with silicone impregnated fiberglass outer cover, vermiculite coated fiberglass inner layer and silicone straps “D” ring fastening system. High temperature sewn construction.
- Dwyer DS-400-12 Air flow sensor with Dwyer magnehelic pressure indicator

Thermal Relief Valve

- One 8” refractory lined automated BFV thermal relief valve to be located on the crossover between the thermal oxidizer and the Bionomics scrubber complete with hand wheel/chain.

Control System

- NEMA 4, UL508A listed control panel
- Specified Voltage – 460/3/60
- Lockable main disconnect with panel door interlock
- Allen Bradley PLC
- ProFace color-touch screen HMI
- Allen Bradley Powerflex 400 VFD’s for the combustion air blowers

System Combustion Air Blowers

- Two centrifugal combustion air blowers for the thermal oxidizer
 - 770 SCFM , 10 hp each
- Note: we have not included any booster blowers

Crossover Duct between Oxidizer and Quench Section

- Refractory lined (6” of ceramic fiber modules) CS crossover duct with alloy expansion joints.
- Flanged for removal/replacement
- Mechanical supports as required

HCl Acid Gas Scrubber

CCC is willing to substitute a Bionomics supplied quencher/scrubber and to integrate their equipment within our package with no price impact on the price quoted to TerraTherm.

CCC's approach to integrating the Bionomics equipment:

CCC will supply a complete package and will integrate the Bionomics equipment.

CCC will coordinate with Bionomics to complete the process design and CCC will provide a complete submittal package to TerraTherm using Bionomics as a supplier to CCC.

Bionomics will ship their scope of supply to CCC.

CCC will then completely check out the system (just as we do with our own scope of supply) and then CCC will host TerraTherm for the FAT.

After the FAT has been successfully concluded then CCC will break down the scrubber components as needed for shipment along with the rest of the CCC equipment. The quencher vessel and the scrubber tower will be shipped laying down.

Derakane 470HT vs 411

Bionomics informed me that the first TerraTherm unit used Derakane 411 . They commented that the thermal resistance of 470 is actually lower than 411 when caustic is present. Bionomics shows 411 on their approved drawings. 470 HT would add significantly to the price.

BIONOMICS EQUIPMENT DESCRIPTION

Scrubber System to include:

One (1) Series 1000 , all-alloy, direct contact quencher, fully wetted wall, spray type, including tangential wall wash headers, retractable center spray nozzles and headers, pressure taps, T/C connection, and flanged inlet and outlet. Vessel is 10 gauge C-276 alloy for the first 4'-0" and 10 gauge AL6XN for the remainder. C-276 faced stainless steel flanges as required. Emergency spray header with nozzle. External hardware 18-8 stainless steel. Gaskets EPDM, full faced.

Series 5000, Packed tower absorber in vinyl ester FRP construction, external pigmented gel coat. Includes retractable FRP liquid distribution header with Teflon low pressure full cone liquid distribution nozzle. Dumped type, high efficiency, stainless steel packing for the first foot then PVDF(Kynar) packing for the rest. Packing depth up to 8'-0". FRP packing support grating. Polypropylene mesh type droplet eliminator with back flush spray. Two (2) 20" bolted access doors. One (1) 18" by 24" access door (mesh pad access). Integral recycle sump.

Two (2) recirculation pumps, one (1) running, one (1) spare. Shop assembled or equal. FRP construction. Fibroc FRP or equal. Pumps serve both the lower quencher spray headers and the absorber recycle. Motors are premium efficiency, 3600 rpm, 3/60/230-460 volt TEFC enclosure, Baldor/Reliance or equal. Pumps are skid mounted and prepiped using CPVC piping and 316 valves from the pump suction to the pump outlet connection. Shop assembled piping, for shop testing then knocked down for site assembly by others. Customer to connect the absorber connection to the pump combined pump suction and from the combined pump discharge to the single absorber inlet header. Pump skid includes pre-wired NEMA 4 local wiring junction box.

Shop assembled critical piping components consisting of three (3) vortex shedding flow meters, one (1) 316 blowdown control valve and one (1) make up water solenoid valve (316). Pumps are equipped with Y strainers. Site piping reconnection by customer.

Control components consisting of two (2) pH probes in by-pass arrangement (probe and local connector mounted in piping), Rosemount electronic level control and pressure indicator with chemical isolation seal for the pump discharge line. NEMA 4 junction box mounted on scrubber vessel with terminal strip for connecting from pump skid to the junction and to customer's main control panel. Also includes T/C (elements only) for temperature protection and system shut down. T/C fitting provided in quencher outlet and absorber outlet. Components will be shop fitted as much as possible. Other components to be shipped shop assembled for field installation by customer.

ENGINEERING SUBMITTAL PACKAGE

The proposal includes the following engineering submittal package:

1. Three (3) sets of general arrangement dimension drawings.
2. Three (3) complete Operation and Maintenance (O & M) manuals.

Pricing is based on Bionomic standards for all submittals including drawings, details, information and O & M manuals, unless otherwise noted.

Scrubber Specifications

- Air Flow Design: 3020 SCFM at 950 Deg. F
- Specified Voltage: 460/3/60
- HCl Design Removal Efficiency: 99% (see details above)

Note: we have not included the caustic tank.

Water Quality: the TerraTherm/CCC team should review the quality of the make-up water to be sure there are not high levels of hardness that can cause plugging and fouling in piping and instrumentation. Water pre-treatment may be required.

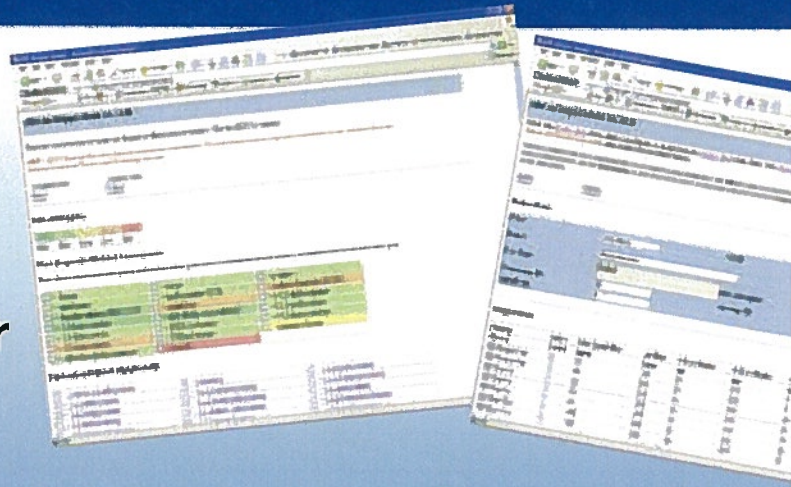
Certifications

UL508A Listed Control Panels: CCC is a certified, listed UL control panel fabrication facility. The control panels are UL listed to 508A standards and is rated NEMA 4. The entire system including the control panel is designed for outdoor use. The control panels will have a UL listing label on the panel door. Standard electrical controls items include an Allen Bradley main disconnect with circuit breaker, Allen Bradley Compact Logix PLC, Proface color touch screen operator interface, hour meter and cycle counter, Watlow digital temperature controllers with 4-20 mA retransmit signals for inlet and exit temperatures, standard enable/disable interlocks, and Great Lakes Instruments pH and Conductivity Controllers.

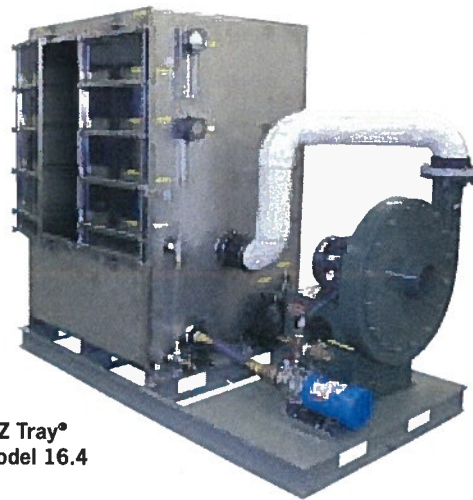
The QED VOC Removal Advantage

Proven equipment, expert help with its selection and installation, and support you can count on.

Exclusive Online Performance Modeler has been developed to assist you in selecting the most effective air stripping package for your groundwater cleanup project



**E-Z Tray®
Model 6.4**



**E-Z Tray®
Model 16.4**



**E-Z Tray®
Model 24.4**

Air Stripper Specifications

Model No.	Maximum Flow Range	Dry Weight	Operating Weight	Shell Dimension (LxWxH)	Trays Per Tier
4.4	1-50 gpm (4-189 Lpm)	630 lbs. (286 kg)	985 lbs. (447 kg)	29 x 27 x 82 in. (74 x 69 x 208 cm)	4 x 29 lbs. (4 x 13 kg)
4.6	1-50 gpm (4-189 Lpm)	780 lbs. (354 kg)	1,219 lbs. (553 kg)	29 x 27 x 102 in. (74 x 69 x 259 cm)	6 x 29 lbs. (6 x 13 kg)
6.4	1-65 gpm (4-246 Lpm)	790 lbs. (358 kg)	1,285 lbs. (583 kg)	37 x 27 x 82 in. (94 x 69 x 208 cm)	4 x 40 lbs. (4 x 18 kg)
6.6	1-65 gpm (4-246 Lpm)	978 lbs. (443 kg)	1,591 lbs. (722 kg)	37 x 27 x 102 in. (94 x 69 x 259 cm)	6 x 40 lbs. (6 x 18 kg)
8.4	1-75 gpm (4-284 Lpm)	955 lbs. (433 kg)	1,580 lbs. (717 kg)	49 x 27 x 82 in. (124 x 69 x 208 cm)	4 x 50 lbs. (4 x 23 kg)
8.6	1-75 gpm (4-284 Lpm)	1,182 lbs. (536 kg)	1,956 lbs. (887 kg)	49 x 27 x 102 in. (124 x 69 x 259 cm)	6 x 50 lbs. (6 x 23 kg)
12.4	1-120 gpm (4-454 Lpm)	1,165 lbs. (528 kg)	2,105 lbs. (955 kg)	73 x 27 x 82 in. (185 x 69 x 208 cm)	4 x 60 lbs. (4 x 447 kg)
12.6	1-120 gpm (4-454 Lpm)	1,442 lbs. (654 kg)	2,606 lbs. (1,182 kg)	73 x 27 x 102 in. (185 x 69 x 259 cm)	6 x 60 lbs. (6 x 447 kg)
16.4	1-150 gpm (4-566 Lpm)	1,625 lbs. (737 kg)	2,870 lbs. (1,302 kg)	49 x 52 x 84 in. (124 x 132 x 213 cm)	8 x 50 lbs. (8 x 23 kg)
16.6	1-150 gpm (4-566 Lpm)	2,011 lbs. (912 kg)	3,553 lbs. (1,612 kg)	49 x 52 x 104 in. (124 x 132 x 264 cm)	12 x 50 lbs. (12 x 23 kg)
24.4	1-250 gpm (4-946 Lpm)	2,100 lbs. (953 kg)	3,980 lbs. (1,805 kg)	73 x 52 x 84 in. (185 x 132 x 213 cm)	8 x 60 lbs. (8 x 27 kg)
24.6	1-250 gpm (4-946 Lpm)	2,599 lbs. (1,179 kg)	4,926 lbs. (2,234 kg)	73 x 52 x 104 in. (185 x 132 x 264 cm)	12 x 60 lbs. (12 x 27 kg)
48.4	1-500 gpm (1,893 Lpm)	5,000 lbs. (2,268 kg)	12,500 lbs. (5,670 kg)	98 x 71 x 84 in. (249 x 180 x 213 cm)	16 x 60 lbs. (16 x 27 kg)
48.6	1-500 gpm (1,893 Lpm)	5,500 lbs. (2,495 kg)	13,000 lbs. (5,897 kg)	98 x 71 x 104 in. (249 x 180 x 264 cm)	24 x 60 lbs. (24 x 27 kg)
96.4	1-1,000 gpm (3,785 Lpm)	11,000 lbs. (4,990 kg)	25,000 lbs. (11,340 kg)	142 x 98 x 84 in. (361 x 249 x 213 cm)	32 x 60 lbs. (32 x 27 kg)
96.6	1-1,000 gpm (3,785 Lpm)	11,500 lbs. (5,216 kg)	30,000 lbs. (13,608 kg)	142 x 98 x 104 in. (361 x 249 x 264 cm)	48 x 60 lbs. (48 x 27 kg)

Standard construction is 304 SS, other alloys upon request. *Allow additional space for accessory components. (blower, piping, etc.)

COMPONENTS

Direct Driven Axial Fan with Galvanized Steel PVC Coated Screen Guard



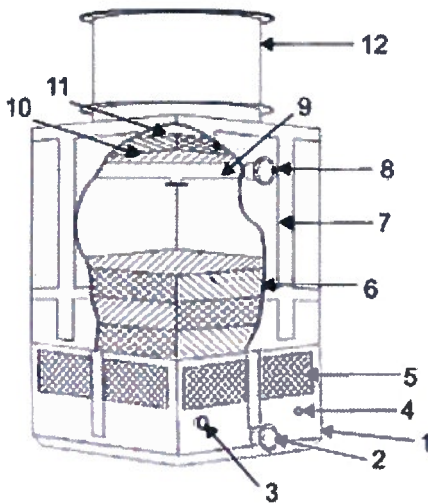
2 1/2" N.P.T. ABS-Spray nozzles with interchangeable internal devices

Fiberglass-reinforced-polyamide adjustable pitch blades with Die Cast Aluminum Hub



PVC Fill and Drift Eliminator

DIMENSIONS

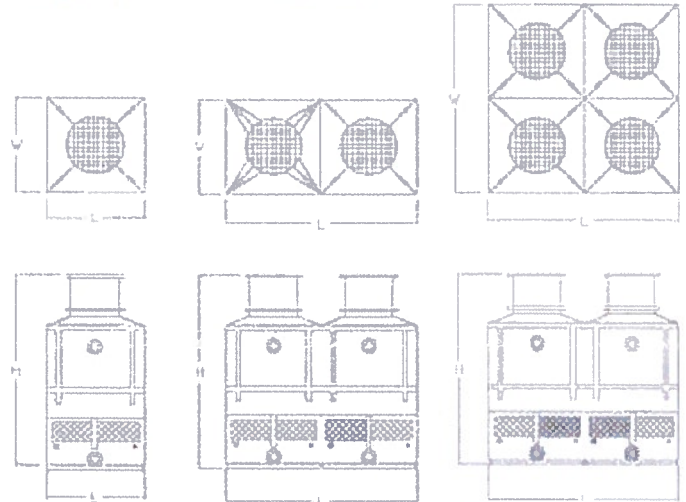


1. Basin Section
2. Cold Water Outlet
3. Overflow
4. Water Make up
5. Air Inlet Louvers
6. Cellular Fill
7. Body Section
8. Hot Water Inlet
9. Spray Nozzle Manifold
10. Drift Eliminator
11. Plenum
12. Fan Section
13. Drain (back side)
14. Purge (back side)

Single Fan

Double Fan

Quadruple Fan



HRFG MODEL	DIMENSIONS			CONNECTION DIAMETER						BASIN CAP.	WEIGHT	
	L	W	H	2	3	4	8	13	14		SHIPPING	OPERATING
3031	36	36	108	2 1/2	2	1/2	2 1/2	2	1/2	92	727	1427
4041	48	48	121.5	4	2	1/2	2 1/2	2	1/2	143	1022	2234
5051	61	61	126.5	4	2	1/2	4	2	3/4	206	1366	3189
6061	72	72	126.5	6	2	1/2	4	2	3/4	281	1890	4415
7071	84	84	135.5	6	2	1	6	2	3/4	337	2553	5624
7081	96	84	135.5	8	2	1	6	2	3/4	380	2717	6230
7091	108	84	135.5	8	2	1	6	2	3/4	425	2912	6863
7142	168	84	135.5	2-6	2-2	2-1	2-6	2-4	2-3/4	674	4674	10818
8081	96	96	156	8	2	1	6	2	3/4	431	2986	6992
8091	96	106	156	8	2	1	6	2	3/4	480	3182	7681
8101	120	96	156	8	2	1	6	2	3/4	530	3548	8522
8111	132	96	156	8	2	1 1/2	8	2	3/4	580	3801	9256
8121	144	96	156	8	2	1 1/2	8	2	3/4	629	4028	9965
8162	192	96	165	2-8	2-2	2-1	2-6	2-4	2-3/4	828	5476	13213
14144	168	168	135.5	2-8	2-2	2-1 1/2	2-8	4-2	2-1	1992	9349	21637
16164	192	192	165	2-10	2-2	2-1 1/2	2-8	4-2	2-1	2602	10953	26427

1. All dimensions, weights and capacities are in inches, pounds and gallons. Physical dimensions of each tower are approximate and are subject to change.
 2. All double and quadruple models have double fittings and connections.



CARBONE LORRAINE

POLYBLOC II HEAT EXCHANGER SPECIFICATION SHEET

US Units

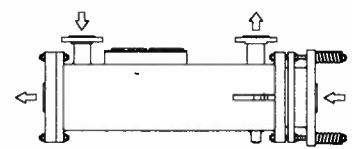
Carbone Quote #: 17308

5	Customer	Terratherm	Reference No	
6	Address		Customer Reference #:	
7	Plant Location		Date	8-Jan-10 Rev 0
8	Service of Unit		Item No	Unit 1
9	Size	PBC24SL-4PU-1-1	Type	PBC hor Connected In 1 Parallel 1 Series
10	Surf/Shell (Gross/Eff)	421.57 ft2	Shell/Unit	1 Surf/Unit (Gross/Eff) 421.57 ft2

PERFORMANCE OF ONE UNIT

		Shell Side		Tube Side	
12	Fluid Allocation	Chilled Water		Humid Air	
13	Fluid Name	282969		10041	
14	Fluid Quantity, Total lb/h	282969		282969	
15	Vapor (In/Out)			3347	776
16	Liquid	282969	282969		2571
17	Noncondensable			6694	
18	Temperature (In/Out) F	40	50	200	130
19	Dew / Bubble point F			172	
20	Density lb/ft3	62.3	62.3	0.047	61.1
21	Viscosity cp	1.572	1.336	0.017	0.555
22	Molecular Weight, Vapor			24.08	27.24
23	Molecular Weight, Noncondensable			28.96	
24	Specific Heat BTU/(lb*F)	1.0031	1.0025	0.3239	1.002
25	Thermal Conductivity BTU/(ft*h*F)	0.331	0.335	0.017	0.363
26	Latent Heat BTU/lb			996	1016
27	Inlet Pressure psi		58.8		14.0
28	Velocity ft/s		3.43		67.16
29	Pressure Drop, Allow/Calc psi	7	0.85	0.181	0.1
30	Fouling Resistance (min ft2*h*F/BTU)		0.001		0.0005
31	Heat Exchanger BTU/h	2,837,613	MTD (Corrected)	111.1 F	
32	Transfer Rate, Service	60.6 BTU/(h*ft2*F)	Dirty	97.4 BTU/(h*ft2*F)	Clean 115.2 BTU/(h*ft2*F)

CONSTRUCTION OF ONE SHELL



		Shell Side		Tube Side	
34		75 / Code		75 / Code	
35	Design/Test Pressure psi	260		260	
36	Design Temperature F	4 (1 Per Block)		1	
37	No Passes per Shell	0.0625		0.0	
38	Corrosion Allowance in	8	150 ANSI	16	150 ANSI
39	Connections In in	8	150 ANSI	12	150 ANSI
40	Size & Rating Out in	150 ANSI		150 ANSI	
41	Intermediate				

42	Tube No	404	ID	0.63 in	Length	75.9 in
43	Tube Type	Cylindrical holes		Material	Graphite	
44	Shell CS	ID	25.25	OD	26.00 inch	Shell Cover
45	Channel or Bonnet			Channel Cover		
46	Fixed header	Graphite/CS		Floating header	Graphite/CS	
47				Impingement protection	None	
48	Baffles-Cross	PTFE				
49	Expansion Joint	NO		Type		
50	Rho-V2-Inlet Nozzle	815	Bundle Entrance	297	Bundle Exit	275 lb/(ft*s2)
51	Gaskets-Shell Side	PTFE		Tube Side	Graphite filled PTFE	
52	-Floating Head	PTFE				
53	Code Requirements	ASME Code Sec VIII Div 1		TEMA Class	B	
54	Weight/Shell	4147	Filled with Water	4698	lb	

55 Remarks **Carbone Polybloc II Impervious Graphite Cylindrical Block Heat Exchanger:** Graphilor XBS
 56 Model: PBC24SL-4PU-1-1
 57 Approximate Dimensions: 26in[660] OD X 94.9in[2410] Tall

58						
59						
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64						

Physical data



30XA080-500 — ENGLISH

UNIT 30XA	080	090	100	110	120	140	160	180	200	220
OPERATING WEIGHT (lb)*										
Al-Cu Condenser Coils	7,674	9,959	10,186	10,326	10,471	12,760	13,003	13,590	13,712	14,727
Cu-Cu Condenser Coils	8,398	10,924	11,151	11,291	11,436	13,966	14,209	15,037	15,159	16,295
MCHX Condenser Coils	7,234	9,382	9,603	9,738	9,877	12,023	12,255	12,699	12,810	13,748
REFRIGERANT TYPE	R-134a, EXV Controlled System									
Refrigerant Charge (lb) Ckt A/Ckt B/Ckt C	86/86/—	97/97/—	108/108/—	135/108/—	135/135/—	202/115/—	225/135/—	205/205/—	225/225/—	270/225/—
Refrigerant Charge (lb) Ckt A/Ckt B/Ckt C (MCHX)	85/85/—	81/81/—	83/83/—	100/83/—	100/100/—	130/85/—	159/100/—	145/145/—	161/161/—	170/161/—
COMPRESSORS	Semi-Hermetic Twin Rotary Screws									
Quantity	2	2	2	2	2	2	2	2	2	2
Speed (rpm)	3500									
(Qty) Compressor Model Number Ckt A	(1) 06TS-137†	(1) 06TS-137	(1) 06TS-155	(1) 06TS-186	(1) 06TS-186	(1) 06TT-266	(1) 06TT-301	(1) 06TT-266	(1) 06TT-301	(1) 06TT-356
(Qty) Compressor Model Number Ckt B	(1) 06TS-137†	(1) 06TS-137	(1) 06TS-155	(1) 06TS-155	(1) 06TS-186	(1) 06TS-155	(1) 06TS-186	(1) 06TT-266	(1) 06TT-301	(1) 06TT-301
(Qty) Compressor Model Number Ckt C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Oil Charge (gal), Ckt A/Ckt B/Ckt C	5.5/5.5/—	5.5/5.5/—	5.5/5.5/—	5.5/5.5/—	5.5/5.5/—	6.25/5.5/—	6.25/5.5/—	6.25/5.5/—	6.25/5.5/—	6.75/6.25/—
Minimum Capacity Step (%)	15	15	15	14	15	11	11	15	15	14
Standard	9	9	9	8	10	7	8	10	10	10
Optional										
COOLER	Flooded, Shell and Tube Type									
Net Fluid Volume (gal.)	16.5	18.5	18.5	20.0	23.0	25.5	27.5	31.5	34.0	37.0
Maximum Refrigerant Pressure (psig)	220	220	220	220	220	220	220	220	220	220
Maximum Water Side Pressure Without Pumps (psig)	300	300	300	300	300	300	300	300	300	300
Maximum Water Side Pressure With Pumps (psig)	—	150	150	150	150	150	150	—	—	—
WATER CONNECTIONS										
Drain (NPT, in.)	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8
Standard, Inlet and Outlet, Victaulic (in.)	5	5	5	5	5	5	5	6	6	6
Number of Passes	2	2	2	2	2	2	2	2	2	2
Minus 1 Pass, Inlet and Outlet, Victaulic (in.)	5	5	5	5	5	5	5	6	6	6
Number of Passes	1	1	1	1	1	1	1	1	1	1
Plus 1 Pass, Inlet and Outlet, Victaulic (in.)	4	4	4	4	4	5	5	6	6	6
Number of Passes	3	3	3	3	3	3	3	3	3	3
CONDENSER FANS	Shrouded Axial Type, Vertical Discharge									
Fan Speed (rpm) Standard/High Ambient**	850/—	850/—	850/—	850/—	850/—	850/1140	850/1140	850/1140	850/1140	850/1140
No. Blades, Diameter (in.)	9...30	9...30	9...30	9...30	9...30	9...30	9...30	9...30	9...30	9...30
No. Fans (Ckt A/Ckt B/Ckt C)	3/3/—	4/4/—	4/4/—	4/4/—	4/4/—	6/4/—	6/4/—	6/6/—	6/6/—	7/6/—
Total Airflow (cfm) 850 rpm	55,800	74,400	74,400	74,400	74,400	93,000	93,000	111,600	111,600	120,900
Total Airflow (cfm) 1140 rpm	—	—	—	—	—	124,000	124,000	148,800	148,800	161,200
CONDENSER COILS										
No. Coils (Ckt A/Ckt B/Ckt C)	3/3/—	4/4/—	4/4/—	4/4/—	4/4/—	6/4/—	6/4/—	6/6/—	6/6/—	7/6/—
Total Face Area (sq ft)	141	188	188	188	188	234	234	281	281	305
HYDRONIC MODULE (Optional)	Pump(s) with pressure/temperature taps and combination valve. Single or Dual, 3600 rpm.									
Pump	N/A								N/A	
CHASSIS DIMENSIONS (ft.-in.)										
Length	11-10		15-9			19-8		23-7		27-6
Width					7-4 ³ / ₄					
Height					7-6 ⁷ / ₁₆					

UNIT 30XA	240	260	280	300	325	350	400	450	500	
OPERATING WEIGHT (lb)*										
Al-Cu Condenser Coils	14,887	16,853	17,022	17,362	18,834	19,040	24,578	26,600	26,894	
Cu-Cu Condenser Coils	16,455	18,662	18,831	19,292	21,005	21,211	26,990	29,254	29,547	
MCHX Condenser Coils	13,897	15,720	15,878	16,141	17,467	17,659	23,038	24,901	25,167	
REFRIGERANT TYPE	R-134a, EXV Controlled System									
Refrigerant Charge (lb) Ckt A/Ckt B/Ckt C	270/270/—	375/220/—	375/270/—	415/270/—	375/375/—	415/375/—	270/270/375	415/205/415	415/270/415	
Refrigerant Charge (lb) Ckt A/Ckt B/Ckt C (MCHX)	170/168/—	247/165/—	240/170/—	245/170/—	240/240/—	245/240/—	170/170/215	236/170/227	243/177/227	
COMPRESSORS	Semi-Hermetic Twin Rotary Screws									
Quantity	2	2	2	2	2	2	3	3	3	
Speed (rpm)	3500									
(Qty) Compressor Model Number Ckt A	(1) 06TT-356	(1) 06TU-483	(1) 06TU-483	(1) 06TU-554	(1) 06TU-483	(1) 06TU-554	(1) 06TT-356	(1) 06TU-554	(1) 06TU-554	
(Qty) Compressor Model Number Ckt B	(1) 06TT-356	(1) 06TT-301	(1) 06TT-356	(1) 06TT-356	(1) 06TU-483	(1) 06TU-483	(1) 06TT-356	(1) 06TT-266	(1) 06TT-356	
(Qty) Compressor Model Number Ckt C	N/A	N/A	N/A	N/A	N/A	N/A	(1) 06TU-483	(1) 06TU-554	(1) 06TU-554	
Oil Charge (gal), Ckt A/Ckt B/Ckt C	6.75/6.75/—	7.5/6.75/—	7.5/6.75/—	7.5/6.75/—	7.5/7.5/—	7.5/7.5/—	6.75/6.75/7.5	7.5/6.25/7.5	7.5/6.75/7.5	
Minimum Capacity Step (%)	15	11	13	12	15	15	9	6	7	
Standard	10	8	9	7	10	10	6	4	5	
Optional										
COOLER	Flooded, Shell and Tube Type									
Net Fluid Volume (gal.)	39.0	42.0	44.0	48.5	50.5	53.4	68.0	75.0	83.0	
Maximum Refrigerant Pressure (psig)	220	220	220	220	220	220	220	220	220	
Maximum Water Side Pressure Without Pumps (psig)	300	300	300	300	300	300	300	300	300	
Maximum Water Side Pressure With Pumps (psig)	—	—	—	—	—	—	—	—	—	
WATER CONNECTIONS										
Drain (NPT, in.)	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	3/8	
Standard, Inlet and Outlet, Victaulic (in.)	6	6	6	6	6	6	6	6	6	
Number of Passes	2	2	2	2	2	2	1	1	1	
Minus 1 Pass, Inlet and Outlet, Victaulic (in.)	8	8	8	8	8	8	—	—	—	
Number of Passes	1	1	1	1	1	1	—	—	—	
Plus 1 Pass, Inlet and Outlet, Victaulic (in.)	6	6	6	6	6	6	—	—	—	
Number of Passes	3	3	3	3	3	3	—	—	—	
CONDENSER FANS	Shrouded Axial Type, Vertical Discharge									
Fan Speed (rpm) Standard/High Ambient**	850/1140	850/1140	850/1140	850/1140	850/1140	850/1140	850/1140	850/1140	850/1140	
No. Blades, Diameter (in.)	9...30	9...30	9...30	9...30	9...30	9...30	9...30	9...30	9...30	
No. Fans (Ckt A/Ckt B/Ckt C)	7/6/—	9/6/—	9/7/—	10/6/—	9/9/—	9/9/—	6/6/6	6/6/6	6/6/6	
Total Airflow (cfm) 850 rpm	120,900	139,500	148,800	148,800	167,400	167,400	186,000	204,600	204,600	
Total Airflow (cfm) 1140 rpm	161,200	186,000	198,400	198,400	223,200	223,200	248,000	272,800	272,800	
CONDENSER COILS										
No. Coils (Ckt A/Ckt B/Ckt C)	7/6/—	9/6/—	9/7/—	10/6/—	9/9/—	9/9/—	6/6/6	6/6/6	6/6/6	
Total Face Area (sq ft)	305	352	375	375	422	422	469	516	516	
HYDRONIC MODULE (Optional)	Pump									
Pump	N/A									
CHASSIS DIMENSIONS (ft.-in.)										
Length	27-6		31-5			35-4		39-3		43-2
Width					7-4 ³ / ₄					
Height					7-6 ⁷ / ₁₆					

LEGEND

Cu	—	Copper
Al	—	Aluminum
EXV	—	Electronic Expansion Valve
MCHX	—	Microchannel Heat Exchanger
N/A	—	Not Applicable

*Operating weight includes 2 pumps on models 30XA090-160. No pumps are available on 30XA080 or 30XA180-500. See pages 8-19 for mounting weights for units without pumps and units with single pump packages.

†30XA080 unit does not have an economizer.

**The high ambient temperature option is not available on 30XA080-120 units.

Company: ROOTS Division
 Address: 16240 Port Northwest Drive, Houston, Texas 77041
 Ph: 832-590-2305/1-877-393-7668 Fax: 832-590-2326

ROOTS BLOWER PERFORMANCE SUMMARY : Program Version 6.000 Release Date 2/28/2008
 Program Mode: SELECTION Run Date: 03/01/2010

AMBIENT CONDITIONS:

Gas	AIR	
Relative Humidity	90%	
Molecular Weight	25.381	
k-Value	1.352	
Specific Gravity	.876	
Ambient Temperature	68	deg F
Ambient Pressure	14.59	PSIA
Elevation	200	feet

STANDARD CONDITIONS:

Pressure	14.7	PSIA
Temperature	68	deg F
Relative Humidity	36	%

INPUT CONDITIONS:

Actual Inlet Volume	2600	ICFM	+/-5 %
Standard Volume	1428	SCFM	
Mass/Weight Flow	134.2	#/min	+/-5 %
System Inlet Pressure	13.86	PSIA	
Inlet Pressure Loss	8.0	in H2O	
Blower Inlet Pressure	13.57	PSIA	
Blower Discharge Pressure	15.61	PSIA	
Discharge Pressure Loss	8.0	in H2O	
System Discharge Pressure	15.3	PSIA	
Inlet Temperature	162	deg F	

SELECTED UNIT DETAIL:

Model	600	RAM X	
Speed	2387	RPM	78.3%
Blower Differential Pressure	2.04	PSI	13.6%
Power at Blower Shaft	30.20	BHP	+/- 5%
Temperature Rise	31	deg F	18.4%
Discharge Temperature	193	deg F	
System Discharge Volume	2372	ACFM	
Relief Valve Setting	NO RELIEF VALVE SPECIFIED		
V-Belt: Est. B10 Brg Life:	18814357	hours	
Coupling: Est. B10 Brg Life:	135230524	hours	
Est. Free Field Noise	87.8	dBa	

Measured as sound pressure level per ISO 2151:2004E with +/-3 dBA tolerance.



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sales@catalyticcombustion.com
www.catalyticcombustion.com

Date: July 1st, 2011

Proposal No: QT02646, Rev 3

Proposal For: Tim Mahoney
TerraTherm, Inc
10 Stevens Road
Fitchburg, MA 01420
tmahoney@terra therm.com
Phone: (978) 343-0300 ext. 220

Job Reference: SRSNE Superfund Site
Southington, CT

Application: Chlorinated Vapor Treatment

Proposed Equipment: Single Thermal Oxidizer Model HGTO 2500 HD with HCl Acid Gas Scrubber

Thank you for the opportunity to provide the following proposal for your project. The HGTO HD Thermal Oxidizer and HCl Acid Gas Scrubber represent some of our best technology. The HGTO HD with Scrubber design is further advanced and far more reliable than any Chlorinated Thermal Oxidizer with Scrubber currently available and represents our commitment to provide high quality air correction solutions.

Should you have any questions regarding this information, please contact me at 715-568-2882. If for some reason I am unavailable, please feel free to contact any of the following individuals:

Catalytic Combustion Contacts		
Chris Bartels	Applications/Sales	CBartels@catalyticcombustion.com
Lori Coenen	Director of Engineering	lcoenen@catalyticcombustion.com
Steve Pitsch	Director of Industrial Service	spitsch@catalyticcombustion.com

Best Regards,

Keith Herbert
Vice President - Sales

TerraTherm should select CCC to design/supply this oxidizer/scrubber system because:

1. CCC will design, manufacture, assemble and shop test the thermal oxidizer system within our new fabrication facility. We will subcontract the quencher/scrubber package to Bionomics and we will have Bionomics ship their equipment to our facility for a shop checkout and then we will ship the entire oxidizer/scrubber system to the jobsite. We invite you to visit our offices and manufacturing facility whenever you like.
2. CCC is a UL508A listed industrial control panel fabrication facility. The oxidizer/scrubber control system is designed, manufactured, and listed by Underwriter Laboratories in our fabrication facility.
3. CCC has an extremely strong field service team with field service technicians experienced in electrical systems, control panels, PLC programming, and combustion equipment such as fuel gas fired burners, catalytic and thermal oxidizers, scrubbers, concentrators and RTO's. Our team is also very experienced at installing and operating our equipment.
4. Our service department has a 24/7/365 phone service support line that is answered by one of our field service technicians. Catalytic Combustion does not subcontract field service work. Because of our company commitment to safety both inside the workplace and in the field our technicians maintain the following certifications:
 - a. Fall Protection
 - b. Confined Space
 - c. Lockout/Tagout
 - d. Hazardous Communications
 - e. Hazwoper
 - f. Fire Safety
5. CCC builds quality equipment to chemical and pharmaceutical plant standards. We supply a quality package using experienced vendors and components to insure we meet the required DRE's and HCl removal efficiencies and reliable up time performance while being considerate of system costs.
6. CCC has been in business since 1950, we have extensive experience in the supply of custom combustion equipment and HCl acid gas scrubbers and PLC control systems for remediation and industrial applications. We are committed to our clients and we stand behind the equipment we supply to insure client satisfaction and meeting all performance guarantees.

PROPOSAL NOTES

The equipment proposal we have provided in this document is based on our understanding of your requirements. The following sections review the design of the system and detail the overall system configuration.

Delivery Schedule:

Standard shipping schedule is 16-18 weeks after submittal approval. A submittal package will be provided within 3-4 weeks after order placement. The drawings will be available in autocad format.

Terms and Conditions:

This quotation is offered in accordance with CCC's standard terms and conditions of sale, using CCC's standard engineering and manufacturing procedures. CCC's pricing does not include any sales or use tax, so it will be the responsibility of the purchaser to remit, to the proper taxing authority, any applicable sales or use tax resulting from the purchase of equipment.

Performance Guarantees:

CCC guarantees:

99% DRE overall destruction efficiency in the thermal oxidizer

99% HCl removal efficiency in the quencher/scrubber

99% run time with the additional redundant parts option and the two spare parts options.

Gas Fired Thermal Oxidizer Model HGTO 2500 HD

The HGTO 2500 HD is a direct fired natural gas or propane fired Thermal Oxidizer designed to treat chlorinated hydrocarbon contaminated air streams from SVE systems, groundwater air strippers or industrial process applications. The HGTO 2500 HD is designed to process 2500 SCFM as originally specified on 2-10-11 (9926 lb/hr air + 785 lb/hr water + 198 lb/hr COC's). This HGTO 2500 HD is designed to achieve 99% DRE overall destruction efficiency. These design numbers exceed the latest of 7680/177/198 which is 1785 scfm (2000 scfm design) from the Thermal Oxidizer/Quench/Scrubber specification and P-101 Rev E. The HGTO 2500 HD is designed to operate completely independent of the process and typically requires an enable/disable signal interface with the supply system control panel. **Note: This oxidizer/scrubber system is not designed for process air streams containing fluorinated compounds. The presence of fluorinated compounds that would produce HF would require a review of materials of construction, especially the refractory lining.**

Combustion Chamber – operating at 1600 degrees F as specified

- Fully welded carbon steel combustion chamber
- Internally insulated with Pyro-Bloc R ceramic fiber refractory modules rated to 2,200°F continuous operating temperature (2,400°F max operating temperature).
- Shell temperature to be minimum 250°F to prevent HCl condensation and corrosion
- Externally finished with high temperature two-part epoxy paint
- Expanded metal heat shield to provide a maximum personnel exposure of less than 140°F

309 SS Heat Exchanger

CCC has included a 309 SS shell and tube heat exchanger (309 SS tubes and 309 SS shell) to be installed downstream of the Thermal Oxidizer to recover heat off the Thermal Oxidizer and reduce fuel consumption. The process vapour will flow thru the tube side of the heat exchanger and be preheated to approx 1000 degrees F. The heat exchanger will also be externally insulated.

The heat exchanger will mount on top of the Thermal Oxidizer in a piggyback arrangement.

We have not included any blanking plates or bypass valves. A spare HX can be provided for the same \$65K price.

Natural Gas/Propane Fired Burner

- North American Mfg. Company burner with refractory block, 3.5 MM BTU/Hr capacity, 2.75 MM BTU/Hr operating
- Dual installed AirPro direct drive centrifugal combustion air blowers, 770 scfm, 10 hp each
- Dungs NFPA 86 gas train, double block & bleed, with pilot fuel train
- Honeywell self checking flame scanner (Qty.2)
- Visual peep site on burner and opposing combustion chamber end for viewing flame
- Note: natural gas supply pressure needs to be 3-5 psig minimum

Piping, Ducting, and Valving

- Carbon steel, schedule 40 (0.375" wall), two-part epoxy painted process air piping
 - Externally insulated ducting to prevent condensing water vapour
-

- Insulation is Firwin 1” FW1200 fiberglass insulation with silicone impregnated fiberglass outer cover, vermiculite coated fiberglass inner layer and silicone straps “D” ring fastening system. High temperature sewn construction.
- Dwyer DS-400-12 Air flow sensor with Dwyer magnehelic pressure indicator

Thermal Relief Valve

- One 8” refractory lined automated BFV thermal relief valve to be located on the crossover between the thermal oxidizer and the Bionomics scrubber complete with hand wheel/chain.

Control System

- NEMA 4, UL508A listed control panel
- Specified Voltage – 460/3/60
- Lockable main disconnect with panel door interlock
- Allen Bradley PLC
- ProFace color-touch screen HMI
- Allen Bradley Powerflex 400 VFD’s for the combustion air blowers

System Combustion Air Blowers

- Two centrifugal combustion air blowers for the thermal oxidizer
 - 770 SCFM , 10 hp each
- Note: we have not included any booster blowers

Crossover Duct between Oxidizer and Quench Section

- Refractory lined (6” of ceramic fiber modules) CS crossover duct with alloy expansion joints.
- Flanged for removal/replacement
- Mechanical supports as required

HCl Acid Gas Scrubber

CCC is willing to substitute a Bionomics supplied quencher/scrubber and to integrate their equipment within our package with no price impact on the price quoted to TerraTherm.

CCC's approach to integrating the Bionomics equipment:

CCC will supply a complete package and will integrate the Bionomics equipment.

CCC will coordinate with Bionomics to complete the process design and CCC will provide a complete submittal package to TerraTherm using Bionomics as a supplier to CCC.

Bionomics will ship their scope of supply to CCC.

CCC will then completely check out the system (just as we do with our own scope of supply) and then CCC will host TerraTherm for the FAT.

After the FAT has been successfully concluded then CCC will break down the scrubber components as needed for shipment along with the rest of the CCC equipment. The quencher vessel and the scrubber tower will be shipped laying down.

Derakane 470HT vs 411

Bionomics informed me that the first TerraTherm unit used Derakane 411 . They commented that the thermal resistance of 470 is actually lower than 411 when caustic is present. Bionomics shows 411 on their approved drawings. 470 HT would add significantly to the price.

BIONOMICS EQUIPMENT DESCRIPTION

Scrubber System to include:

One (1) Series 1000 , all-alloy, direct contact quencher, fully wetted wall, spray type, including tangential wall wash headers, retractable center spray nozzles and headers, pressure taps, T/C connection, and flanged inlet and outlet. Vessel is 10 gauge C-276 alloy for the first 4'-0" and 10 gauge AL6XN for the remainder. C-276 faced stainless steel flanges as required. Emergency spray header with nozzle. External hardware 18-8 stainless steel. Gaskets EPDM, full faced.

Series 5000, Packed tower absorber in vinyl ester FRP construction, external pigmented gel coat. Includes retractable FRP liquid distribution header with Teflon low pressure full cone liquid distribution nozzle. Dumped type, high efficiency, stainless steel packing for the first foot then PVDF(Kynar) packing for the rest. Packing depth up to 8'-0". FRP packing support grating. Polypropylene mesh type droplet eliminator with back flush spray. Two (2) 20" bolted access doors. One (1) 18" by 24" access door (mesh pad access). Integral recycle sump.

Two (2) recirculation pumps, one (1) running, one (1) spare. Shop assembled or equal. FRP construction. Fibroc FRP or equal. Pumps serve both the lower quencher spray headers and the absorber recycle. Motors are premium efficiency, 3600 rpm, 3/60/230-460 volt TEFC enclosure, Baldor/Reliance or equal. Pumps are skid mounted and prepiped using CPVC piping and 316 valves from the pump suction to the pump outlet connection. Shop assembled piping, for shop testing then knocked down for site assembly by others. Customer to connect the absorber connection to the pump combined pump suction and from the combined pump discharge to the single absorber inlet header. Pump skid includes pre-wired NEMA 4 local wiring junction box.

Shop assembled critical piping components consisting of three (3) vortex shedding flow meters, one (1) 316 blowdown control valve and one (1) make up water solenoid valve (316). Pumps are equipped with Y strainers. Site piping reconnection by customer.

Control components consisting of two (2) pH probes in by-pass arrangement (probe and local connector mounted in piping), Rosemount electronic level control and pressure indicator with chemical isolation seal for the pump discharge line. NEMA 4 junction box mounted on scrubber vessel with terminal strip for connecting from pump skid to the junction and to customer's main control panel. Also includes T/C (elements only) for temperature protection and system shut down. T/C fitting provided in quencher outlet and absorber outlet. Components will be shop fitted as much as possible. Other components to be shipped shop assembled for field installation by customer.

ENGINEERING SUBMITTAL PACKAGE

The proposal includes the following engineering submittal package:

1. Three (3) sets of general arrangement dimension drawings.
2. Three (3) complete Operation and Maintenance (O & M) manuals.

Pricing is based on Bionomic standards for all submittals including drawings, details, information and O & M manuals, unless otherwise noted.

Scrubber Specifications

- Air Flow Design: 3020 SCFM at 950 Deg. F
- Specified Voltage: 460/3/60
- HCl Design Removal Efficiency: 99% (see details above)

Note: we have not included the caustic tank.

Water Quality: the TerraTherm/CCC team should review the quality of the make-up water to be sure there are not high levels of hardness that can cause plugging and fouling in piping and instrumentation. Water pre-treatment may be required.

Certifications

UL508A Listed Control Panels: CCC is a certified, listed UL control panel fabrication facility. The control panels are UL listed to 508A standards and is rated NEMA 4. The entire system including the control panel is designed for outdoor use. The control panels will have a UL listing label on the panel door. Standard electrical controls items include an Allen Bradley main disconnect with circuit breaker, Allen Bradley Compact Logix PLC, Proface color touch screen operator interface, hour meter and cycle counter, Watlow digital temperature controllers with 4-20 mA retransmit signals for inlet and exit temperatures, standard enable/disable interlocks, and Great Lakes Instruments pH and Conductivity Controllers.