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Project Memorandum

To: George Pendleton, Kleinfelder

From: Mike Macheski, TRC

Subject: APC Equipment Vendor Options to Meet New Emission Limits
TRC Project #192975

Date: 16 January 2014, revised 11 April 2014

CC: Al Wells, Kleinfelder
Ray Topazio, TRC
Rich Kratz, TRC

Attachments: A – Bionomic Industries Mercury Proposal
B – Cameron Great Lakes Mercury Proposal
C – EnviroCare Industries and Alpine Technology Mercury Proposal
D – Bionomic Industries WESP Proposal
E – MEGTEC WESP Proposal
F – Opinion of Total Project Cost

Background

The Borough of Naugatuck's Wastewater Treatment Plant (hereafter Naugatuck) operates a 3.5 dry ton per hour (DTPH) fluidized bed sewage sludge incinerator (SSI) system. The existing system consists of a thermal sludge dryer (TDU), fluidized bed combustor (FBC), air preheater, hot oil heat recovery unit, wet venturi scrubber (VS), multi-stage wet impingement tray scrubber (ITS), induced draft fan, and a wet electrostatic precipitator (WESP).

TRC Environmental Corporation (TRC) was tasked to evaluate the existing incinerator and air pollution control (APC) equipment conditions and operations in accordance with Task 2A – Evaluation of Incinerator, Sub-Task E of TRC's scope of services. These assessments were included in TRC's memos "Naugatuck Sewage Sludge Incinerator and APC Equipment Assessment", dated 9 August 2013, and

“Regulations and Emissions Review, including Mercury Analysis and Control”, dated 10 September 2013.

TRC was also tasked to contact vendors of control equipment to develop options, including budgetary capital and operating costs, in accordance with Task 2A, Sub-Task G. The goal is to reduce stack emissions below the United States Environmental Protection Agency’s (EPA’s) new emission guidelines for existing sewage sludge incinerators, 40 CFR Part 60, Subpart M, promulgated on 21 March 2011. This memo addresses Sub-Task G, and also re-evaluates some of Sub-Task E by looking at more of the data than just from 2012 as was the case in the earlier memo. It should be noted that this assessment is based on the premise that the Naugatuck SSI system is not modified for increased sludge throughput rate, which would change its status from an existing SSI to a new SSI subject to the more stringent emission limits of subpart L. The pollutants whose available data averages are higher than their new emissions guidelines are acid gases, lead, and mercury.

Acid Gases

Sulfur dioxide (SO₂) stack emission data is only available from the 2004 and 2005 compliance stack tests, and averages 39.6 parts per million by dry volume adjusted to 7 percent oxygen (ppmvd at 7% O₂). The new regulatory limit is 15 ppmvd at 7% O₂, so this will require a 62% reduction in SO₂ from the average.

Hydrogen chloride (HCl) data is only available from the 2005 compliance stack test, and was <0.54 ppmvd at 7% O₂. While it could be anywhere between 0 and 0.54 ppmvd, to be conservative the highest was assumed. This type of judgment was used throughout the data review process. The new regulatory limit is 0.51 ppmvd at 7% O₂, so this could require as much as 6% reduction, although there is a strong chance it is already under control because of the data’s uncertainty.

There is additional cause to believe that both acid gases are likely under control now. The wet scrubbers used to operate at a much lower pH and as a result there was serious corrosion damage in the wet electrostatic precipitators and surrounding ductwork. The current plant operator (Veolia Water) now operates the wet scrubbers with the pH maintained closer to neutral using the addition of caustic and soda ash. Therefore, it is likely that SO₂ and HCl are already being emitted at less than the new regulatory limit, but there is no recent stack data to confirm this. TRC recommends both SO₂ and HCl be included in the next stack test to verify.

Best practice for control of acid gases is using wet scrubbers and maintaining proper pH. TRC believes that simply through the additional use of caustic and/or soda ash, the required acid gas reduction can be achieved, if necessary, without the need for any new or modified APC equipment.

Lead

Lead (Pb) stack emission data is available from all stack tests between 2004 and 2013, and averages 0.0105 milligrams per dry standard cubic meter (mg/dscm) at 7% O₂. The new regulatory limit under subpart MMMM is 0.0074 mg/dscm at 7% O₂, so this would require a 30% reduction from the average. The Pb average is severely biased by two outlier emission tests in 2006 and 2011, which were 0.0356 and 0.0609 mg/dscm at 7% O₂, respectively. That is 481% and 823% of the new limit, respectively, while all other years were much lower; none higher than 27% of the new regulatory limit.

Consultation with air pollution control equipment vendors indicated that removal of lead should be readily achieved with a well-designed and properly functioning wet electrostatic precipitator (WESP). Naugatuck's existing WESP, then, was likely either not operational or under-performing at the time of those compliance stack tests. TRC, however, has no corresponding parametric operating data or records available to validate this conclusion. That same vendor also suggested checking if particulate matter (PM) emissions increased during those stack tests because Pb and PM typically trend together since they both depend on WESP performance. PM emission data was also not available for those years. The 2004 and 2005 compliance stack tests do, however, have data for Pb and PM with the WESP both on and off, and that comparison is shown in Table 1.

Table 1. Comparison of PM and Pb Emissions with the WESP On and Off

Pollutant (mg/dscm at 7% O ₂)	WESP On	WESP Off
PM	1.46	2.70
Pb	0.0018	0.0024

From the limited data, PM is 1.8 times greater on average and Pb is 1.3 times greater on average when the WESP is not running. So while TRC cannot definitively conclude that this is the reason for the two outlier Pb emission results, the concept appears to be valid.

In the earlier "Naugatuck Sewage Sludge Incinerator and APC Equipment Assessment" memo, it was noted that the east WESP is completely inoperable and has been taken out of service. The west WESP is operational, however also in poor condition and nearing the end of its useful service life. Naugatuck should consider the replacement of one of the WESPs with new using the latest technology for improved PM and Pb emissions control. This would also address the more practical consideration that the west WESP needs to be replaced within the next few years anyway despite the maintenance efforts by Veolia to keep the unit online and operating. TRC reached out to three WESP vendors, two of which had merged into one. Table 2 summarizes WESP options from the vendors' budgetary proposals:

Table 2. Comparison of APC Equipment Vendor Options for Lead (and PM) Control

Company	Bionomic Industries		MEGTEC	
Contacts	Dave Meier		Margarita Svidunovich	
Approximate Overall Size	36 ft tall x 8 ft diameter, single tower		31 ft tall x 11 ft diameter, single tower	
Collection Surface Area	91 ft ² / 1,000 acfm		148.1 ft ² / 1,000 acfm	
PM Guarantee	≤ 10 mg/m ³ or 75% reduction, whichever is less stringent, for 12 months		< 10 mg/m ³ or 86.3% reduction (assumed inlet loading), whichever is less stringent, for 12 months from startup or 18 months from shipment, whichever occurs first	
Pb Guarantee	≤ 0.0065 mg/m ³ or 75% reduction, whichever is less stringent, for 12 months		< 0.0065 mg/m ³ or 95.4% reduction (assumed inlet loading), whichever is less stringent, for 12 months from startup or 18 months from shipment, whichever occurs first	
Budgetary Installed Capital Cost ¹	316 SS internals and housing	\$1,469,000	316L SS internals and housing	\$1,786,000
	AL6XN internals and FRP housing	\$1,966,000	AL6XN internals and 316L SS housing	\$2,060,000
	Hastelloy C-276 internals and FRP housing	\$2,482,000	Hastelloy C-276 internals and 316L SS housing	\$2,693,000
Budgetary Annual Operating Cost ^{1,2}	316 SS internals and housing	\$377,000	316L SS internals and housing	\$274,000
	AL6XN internals and FRP housing	\$431,000	AL6XN internals and 316L SS housing	\$304,000
	Hastelloy C-276 internals and FRP housing	\$488,000	Hastelloy C-276 internals and 316L SS housing	\$374,000

¹ These are budgetary estimates only, without having performed detailed engineering

² Differences in operating costs among various materials of construction stems from the investment recovery

Company	Bionomic Industries	MEGTEC
Pros	<ul style="list-style-type: none"> • 20% lower capital cost on base proposal • Can offer an integrated APC system with both the WESP and activated carbon for mercury control Switch mode power supply and transformer/rectifier • Smaller footprint • Meets emission limit guarantee requirements • Offer corrosion resistant FRP housing as an option • 82% lower rinse water demand 	<ul style="list-style-type: none"> • Same manufacturer as existing WESPs at Naugatuck, so the operators may be familiar with the maintenance • 60% greater specific collection surface area • NWL Power-Plus switch mode power supply and transformer/rectifier • Meets emission limit guarantee requirements • 15% more electrodes and longer collection tubes • 50% lower flue gas pressure drop • Flow distribution plate at inlet • 50% lower primary electrical demand • 67% lower purge air blower motor horsepower • 60% lower heating element electrical demand • 316L stainless steel construction (base quote) • Several municipal and industrial SSI projects cited with contact information • Better payment schedule
Cons	<ul style="list-style-type: none"> • Lower specific collection surface area • Fewer electrodes and shorter collection tubes • Higher flue gas pressure drop • Higher primary electrical demand • Higher purge air blower motor horsepower and heating element electrical demand • No prior SSI experience cited 	<ul style="list-style-type: none"> • Higher capital cost • Offered options for upgrade to higher alloy, corrosion resistance materials for high voltage electrodes and support framing only • 2 week longer delivery

Both vendors quoted 316 stainless steel as their base material of construction (MOC), although MEGTEC quoted 316L (lower carbon content), which has slightly better properties for welded fabrications. Both vendors also quoted options for higher grade alloys or other materials of construction that offer superior corrosion resistance to acid gases such as hydrogen chloride, hydrogen fluoride, and sulfur dioxide. As previously noted in other reports by TRC, corrosion has been an ongoing issue for the existing WESPs at Naugatuck. However, that corrosion was the result of prior operation of the upstream wet scrubbers with little to no caustic addition that would help neutralize the acids formed

in the scrubber and so maintain a more neutral pH. In more recent years, the scrubber has been operated with improved caustic addition which has resulted in reduced WESP corrosion and maintenance, although it is still an issue. TRC's experience with WESPs used to control emissions from hazardous waste incinerators that burn highly chlorinated waste streams required the use of very expensive high-nickel content alloys such as Hastelloy C-276. Another slightly less expensive stainless alloy that offers greater chloride corrosion resistance than ordinary 316 stainless is AL6XN, which has increased nickel and molybdenum content. TRC requested that the vendors offer these material of construction upgrades for comparison purposes. Given that the majority of WESPs in service at SSI installations are constructed of 304, 316, or 316L stainless steel and that it is expected the upstream wet scrubbers at the Naugatuck facility will be operated using caustic and/or soda ash for effective acid gas and pH control, TRC is comfortable recommending that the base materials of construction quoted by both vendors is suitable for the application and that the additional cost for the higher grade alloys is not a good value.

As shown in the side-by-side comparison above, both vendors offer distinct advantages and disadvantages. In the case of Bionomic Industries, a significant advantage is base MOC cost, being about 20% lower than MEGTEC. Bionomic also quoted the activated carbon system for mercury control (see below), so having a single vendor responsible for an integrated air pollution control system is a very significant technical and efficiency advantage. MEGTEC offers several technical advantages and it is also the basic TurboSonic Technologies WESP that Naugatuck, and several other municipal and industrial waste water treatment plants, has been operating for several decades to control sludge incinerator emissions. The operators and maintenance people at Naugatuck would have a level of comfort and familiarity with the MEGTEC unit that they would not have with Bionomic unit. Both vendors offer the most significant upgrade in WESP technology which is the newer switch mode power supply and transformer/rectifiers sets, so there is no advantage or disadvantage in that category. The MEGTEC unit offers more collection surface area which should offer better performance, but both vendors guaranteed to meet the same emission limits. Another area where MEGTEC stood out was lower operating costs for electrical power, although Bionomics had a lower daily water consumption rate.

Mercury

Mercury (Hg) stack emission data is available from all stack tests between 2004 and 2013, and averages 0.0899 mg/dscm at 7% O₂. The new regulatory limit under subpart M MMM is 0.037 mg/dscm at 7% O₂, so this will require a 59% reduction from the average. Unlike historic Pb emissions, Hg emissions from the Naugatuck SSI system are consistently above the new regulatory limit, so there is no doubt that additional APC equipment for mercury control is required. TRC explored some chemical oxidant chemistry options in the wet scrubbers for mercury control and put together a trial plan, but several factors caused that pursuit to be abandoned, including the logistical complexity and low expectation for success. Advancing to the commonly used mercury sorbent capture options was instead recommended.

TRC approached seven vendors to solicit budgetary proposals for APC equipment solutions for mercury capture. Only five responded, and two declined to make a proposal. Of the three that did, the common control technology was sorbent capture. Sorbent injection, usually activated carbon, with a fabric filter dust collector (i.e. baghouse) is not an attractive option due to high relative capital cost and huge relative waste of sorbent, unless there is an existing baghouse or if there is separate justification to install one. Fixed beds are more cost effective. Table 3 summarizes the mercury control options from the three APC vendors who made budgetary proposals:

Table 3. Comparison of APC Equipment Vendor Options for Mercury Control

Company	Bionomic Industries	Cameron Great Lakes	EnviroCare Industries / Alpine Technology
Contacts	Dave Meier / Ken Schiffner	Joe Battaglia	Marcel Pomerleau / Peter Brady
Technology	Fixed bed, with sulfurized activated carbon adsorbent	Fixed bed, with sulfurized activated carbon adsorbent	Fixed bed, with W.L. Gore & Associates/ECI novel sorbent
Additional Details	<ul style="list-style-type: none"> Series 3000 dual bed carbon adsorber Loose fill carbon Suggested 3/4" FRP 	<ul style="list-style-type: none"> Model SA3H3W 3 x 3 modules 24" x 24" x 2" deep trays 8 trays per module x 9 = 72 trays per pass x 3 passes = 216 trays total Transition pieces included 	<ul style="list-style-type: none"> 4 or 5 layers with 4 to 6 modules per layer, 16 layers assumed for installed cost Can be retrofitted and included on top of the wet ITS scrubber or as a standalone unit (latter more likely) Capture media is expanded PTFE impregnated with a proprietary Gore sorbent
Approximate Overall Size	30 ft tall x 8 ft diameter, single tower	6.5 ft tall x 6 ft wide x 12.2 ft long, single unit	12 ft tall x 8 ft diameter, single tower
Guarantee	0.025 mg/dscm at 7% O ₂ for 12 months	90% reduction per stage x 3 stages = 99.9% removal which will far exceed the requested guarantee of 0.025 mg/dscm at 7% O ₂ , duration unknown	0.025 mg/dscm at 7% O ₂ for 18 months

Company	Bionomic Industries	Cameron Great Lakes	EnviroCare Industries / Alpine Technology
Budgetary Installed Capital Cost ³	\$1,124,000	\$1,043,000	\$955,000
Estimated Media Life before Replacement	10 years	10 years	3 years
Media Replacement Duration	1 day	1 day	1 day
Media Replacement Cost ⁴	\$47,918 (\$2.47/lb for contractor to remove and dispose of spent carbon and replace with new)	\$16,019 (\$4.12/lb for contractor to remove and dispose of spent carbon and replace with new)	\$172,560 (\$8,500/replacement module; \$128/module for disposal)
Budgetary Annual Operating Cost ¹	\$213,000	\$201,000	\$215,000
Other Maintenance	<ul style="list-style-type: none"> • Periodic draining of any condensed water (no shutdown required) 	<ul style="list-style-type: none"> • Periodic draining any condensed water (no shutdown required) 	<ul style="list-style-type: none"> • Recommended yearly 3-4 days inspection by EnviroCare (~\$4,200 and a 2 day shutdown required) • Additional inspection tasks and frequencies will be provided with individualized operation and maintenance manual
Pros	<ul style="list-style-type: none"> • Simple, proven technology • Small footprint 	<ul style="list-style-type: none"> • Simple, proven technology 	<ul style="list-style-type: none"> • Stream does not have to be dry before passing through the media • Less frequent media change-outs • Some coincidental SO₂ removal

³ These are budgetary estimates only, without having performed detailed engineering

⁴ Media replacement costs are factored into the budgetary annual operating costs

Company	Bionomic Industries	Cameron Great Lakes	EnviroCare Industries / Alpine Technology
			<ul style="list-style-type: none"> • Lower pressure drop (1.3"wg), so should require no fan modification • Vendor claims direct experience designing and troubleshooting for wastewater incinerators
Cons	<ul style="list-style-type: none"> • Stream must be dry before passing through the media, so may require a drying heat exchanger • Higher pressure drop (5"wg), so may require a new or modified fan 	<ul style="list-style-type: none"> • Large footprint • Stream must be dry before passing through the media, so may require a drying heat exchanger • Higher pressure drop, so may require a new or modified fan 	<ul style="list-style-type: none"> • Newer technology with less runtime history available • Naugatuck's reduction target is on the edge of technology's reduction capability

The budgetary costs provided are for the sorbent housing equipment as quoted by the respective vendors, as well as for assumed costs of ancillaries such as ductwork, engineering, new or modified ID fans, and drying heat exchangers. No heat exchanger or ID fan was included in the budgetary estimate for the EnviroCare option installed cost since those ancillaries are expected not to be necessary. TRC used typical equipment installation factors, similar to those used by the EPA Office of Air Quality Planning and Standards (OAQPS), to estimate the total capital and annual operating costs shown in Table 2 and included in each proposal attachment. Redundant sorbent housings were not included in the costs. Since these were only budgetary proposals, additional engineering is needed to further refine these numbers into formal quotes and exactly determine ancillaries necessary. All three vendors offer performance guarantees, so there should be reasonable confidence that any would be suitable for the application.

EnviroCare Industries / Alpine Technology, which proposes a proprietary polymer-based capture media, purports to have specific experience with this technology in the SSI industry and a number of recent APC upgrades at SSI units for compliance with Subpart M that might give their technology an advantage. This claim was not validated by TRC. Alpine Technology even more recently, since the original issuance of this memo report, introduced a technology through CPPE called Kombisorbon Light. This is an evolved version of the Kombisorbon system, which is designed for greater mercury reduction demands (99%+) and is much more expensive. Kombisorbon Light is less expensive than the original Kombisorbon system. Kombisorbon Light is designed for 70-90% reduction, which is more in line with the capture range needed at Naugatuck; however, it is still about three times more expensive than the other three options presented. It is also new to the market so lack of long term operational

experience is a risk. The more common activated carbon media proposed by the other vendors has more installed applications for controlling Hg, as well as dioxin and furan (D/F), from a number of combustion sources including coal fired power plants and hazardous waste incinerators.

Conclusions/Recommendations

Based on averaged data available from stack tests between 2004 and 2013, acid gases, lead, and mercury need to be addressed to meet the new emission regulations.

Acid gases can be addressed by adding more caustic and/or soda ash to keep the pH closer to neutral, if any change is needed at all since the available data is very old and wet scrubber operation has been improved over the years.

Lead is only a potential concern from two outlier data points that very likely coincided with poor or no WESP operation. If any action will be taken, lead removal is tied to WESP performance so the aging and deteriorated WESPs could be replaced with a new unit that has upgraded electrodes and state of the art transformer/rectifiers (T/R) for improved control of PM and Pb emissions. This will reduce any risk of having an outlier emission test as happened in 2006 and 2011. Before making this decision, Naugatuck may wish to conduct additional stack testing for Pb to determine whether operational improvements by Veolia have resulted in lower Pb emissions. However, choosing to leave the existing west WESP in place will only be a temporary deferment of necessary capital expense based on equipment condition. Increased maintenance costs and system downtime will soon require rebuilding or an in-kind replacement regardless as the WESP has reached the end of its useful life. Therefore, TRC recommends that Naugatuck include a new WESP with state-of-the-art transformer/rectifier sets, constructed of 316L stainless steel. Of the two vendors solicited for this report, TRC selected the quote from MEGTEC for developing our opinion of total project cost. Final vendor selection will be based on firm vendor proposals to be solicited during the preliminary engineering phase of the project.

Mercury is the one pollutant emission that clearly and definitively needs to be addressed. Therefore, TRC solicited proposals from vendors for APC equipment to reduce Hg emission. The common control technology among the three vendor options is a fixed bed sorbent. One of the two sulfurized activated carbon fixed beds is likely the better choice over the more novel polymer sorbent (or the newer and more expensive Kombisorbon Light system for that matter), mainly due to a long proven track record for Hg control in a number of applications. Bionomic Industries and Cameron Great Lakes will be practically identical in performance, with the primary difference being the size of the footprint. The former is a tall tower with minimal footprint and the latter requires more footprint but is not nearly as tall. TRC selected the quote from Bionomics for developing our opinion of total project cost. Final vendor selection will be based on firm vendor proposals to be solicited during the preliminary engineering phase of the project.

In TRC's opinion, the total project installed cost, which includes a new WESP for enhanced Pb and particulate control and a new activated carbon adsorption system for Hg control, is estimated to be \$2.9 million with a total annualized cost of \$0.5 million, based on a 20 year amortization. A detailed breakdown of the total project cost estimate is shown in Attachment F. This opinion of installed capital costs and annual operating costs is not based on detailed engineering, and therefore is subject to change, but is suitable for budgetary purposes based on TRC's experience.

Attachment A

Bionomic Industries Mercury Proposal

Total Costs - Bionomic Industries

DIRECT CAPITAL COSTS		
1	Purchased Equipment Costs	
a.	Basic Equipment and Auxiliaries (A)	\$310,000
1)	Carbon Adsorber	\$104,600
2)	New ID Fan	\$75,000
3)	Interconnecting Ductwork	\$30,000
4)	Drying Heat Exchanger	\$100,000
b.	Instrumentation and Controls (0.1 A)	\$31,000
c.	Freight (0.05 A)	\$15,500
d.	Sales Taxes (0.0625 A)	\$19,375
	TOTAL PURCHASED EQUIPMENT COST (B)	\$376,000
2	Direct Installation Costs	
a.	Foundations and Supports (0.12 B)	\$45,120
b.	Erection and Handling (0.4 B)	\$150,400
c.	Electrical (0.01 B)	\$3,760
d.	Piping (0.10 B)	\$37,600
e.	Insulation (0.05 B)	\$18,800
f.	Painting (0.01 B)	\$3,760
g.	Site Preparation and Demolition	\$50,000
h.	Building and Structural Modifications	\$50,000
	TOTAL DIRECT INSTALLATION COSTS (C)	\$359,000
INDIRECT CAPITAL COSTS		
3	Engineering & Supervision (0.12*[B+C])	\$88,200
4	Construction & Field Expenses (0.1*[B+C])	\$73,500
5	Contractor Fees (0.10*[B+C])	\$73,500
6	Start-up (0.05 B)	\$18,800
7	Equipment Acceptance Test	\$25,000
8	Contingency (0.15*[B+C])	\$110,250
	TOTAL INDIRECT CAPITAL COST	\$389,000
TOTAL INSTALLED CAPITAL COST		\$1,124,000
DIRECT ANNUAL COSTS		
1	Operating Labor, (0 hr/yr x \$30/hr)	\$0
2	Supervisory Labor, 0.15 X (1)	\$0
3	Maintenance Labor (548 hr/yr x \$30/hr)	\$16,440
	Materials (100% of labor)	\$16,440
4	Utilities	
a.	Water (\$3.20/1000 gal)	\$0
b.	Electricity (\$0.0966/kwh * 326,622 kwh)	\$31,552
5	Carbon Replacement (19,400 lb x \$2.47/lb/10 years frequency)	\$4,792
	TOTAL DIRECT OPERATING COSTS	\$69,000
INDIRECT OPERATING COSTS:		
6	Overhead - 60% Operating & Maintenance Labor	\$19,728
7	Property Tax - 0% Total Capital Cost	\$0
8	Insurance - 1% Total Capital Cost	\$11,240
9	Administration - 2% Total Capital Cost	\$22,480
10	Capital Recovery (5% Interest, 20 Years)	\$90,190
	TOTAL INDIRECT OPERATING COSTS	\$144,000
TOTAL ANNUALIZED OPERATING COST		\$213,000



BIONOMIC INDUSTRIES

"Superior Engineered Pollution Control Systems With Unequaled Performance"

Bionomic Industries Inc. Proposal Number 120313-01DM/KS

Proposal Issued to: **TRC SOLUTIONS**
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Suite 116
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Attention: Michael R. Macheski
Project Engineer

Phone: 610-834-0490 ext. 5931

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Proposal Issued By: David Meier
Bionomic Industries Inc.

Proposal for: **SLUDGE INCINERATOR**
Mercury Gas Control System

Date: December 03, 2013

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SECTION 1 DESCRIPTION

GENERAL DESCRIPTION:

The main purpose of the proposed Air Pollution Control Systems is to control mercury vapor emissions from a sewage sludge incinerator exhaust after a wet electrostatic precipitator system. The package includes a specially designed, fixed bed activated carbon filter adsorber with instrumentation.

Adsorption is a process whereby molecules stick to the surface area only.

Activated carbon is produced to have a large surface area due to being a porous material.

Sulfide impregnated activated carbon is best used on mercury vapor

The volatile mercury vapors stick to surface area in the carbon particles.

Activated carbon is typically used in a column contactor called adsorbers.

The design is engineered for anticipated loading (amount of gas per cross sectional area); contact time (a minimum contact time is required to assure removal efficiency); and pressure drop through the adsorber (needed to size the vessel pressure rating and fan design).

The standard Bionomic Industries carbon adsorbers are pre-engineered to meet all of the requirements for good adsorber design.

The molecular weight, polarity, temperature of the gas stream and concentration are all factors that affect the capacity of the carbon for the material to be removed.

Activated carbon does not have a great capacity for removal of these vapors but is very cost effective for treating large volumes of air to remove dilute concentrations of contamination, typically found in incineration exhausts.

To meet the specified requirements, we recommend one (1) scrubber package, each consisting of a Bionomic Series 3000 Dual Bed Carbon Absorber.

The recommended components are part of a proven economic, effective and maintenance free operating system. The equipment is designed for a 24hr. /day, 365day/year operation with no more than 1 hour /week preventive maintenance required.

There are numerous successful industrial applications using the Bionomic carbon adsorbers.

EQUIPMENT RECOMMENDATION:

Series 3000 DUAL BED CARBON ADSORBER

The contaminated exhaust enters a vertical, dual bed adsorber.

One half the gas flow proceeds upward through the higher activated carbon bed to a side outlet and the other half proceeds downward through the lower bed to the lower side outlet.

Mercury vapors are adsorbed onto the impregnated activated carbon sites where the mercury will react with the impregnated sulfide to form a reacted, non-volatile mercury compound.

The adsorber bed is designed for uniform distribution of the exhaust flow and extended bed life before mercury break through.

A condensate drain is supplied to remove any water accumulation that may occur.

The Series 3000 Dual Bed Carbon Adsorber has no moving parts and requires essentially no maintenance.

The expected bed life of each adsorber (based on the design information) is over 10 years. Spent carbon is easily removed and replacement carbon added via the large access doors.

DESIGN DATA & SCOPE OF SUPPLY

PERFORMANCE CONDITIONS

Per supplied data:

Inlet Exhaust Gas

Gas Volume (design basis)	14115	dscfm
Gas Temperature (+20F above scrubber exhaust)	105	degree, F
Mercury Concentration, typical	0.103	mg/dscm

Performance Criteria (at adsorber outlet):

Mercury Concentration,	≤0.025	mg/dscm
Adsorber pressure drop, design	5	inch w.c.

DESIGN DATA AND SCOPE OF SUPPLY

Equipment Data:

Model	300	
Units	1	
Vessel:		
Material of construction	FRP	
Thickness	3/8	inch
Diameter	8	ft
Height	28	ft
Overall Height	30	ft
Weight, empty	10000	lb
Weight, operating	29400	lb

INSTRUMENTATION & CONTROLS

Description	Quantity
Manual Drain Valves	1
Pressure differential transmitter	1
Manual carbon bed sample probe	1

ENGINEERING SERVICES FURNISHED BY BIONOMIC INDUSTRIES INC.

Bionomic will furnish the following engineering and drawings for the proposed system as follows:

- One (1) set of prints as ACAD-2008 submittal for approval consisting of:
 - Plan, elevation and dimensional drawings along with weights of the APC system
 - Instrumentation, P & I diagram
 - Dimensional drawings of structural supports
- One (1) set of final drawings as ACAD-2008 submittal
- One (1) set of operating & maintenance manual (hard copy) and one (1) CD, instructions in English

TRC-mercury

EQUIPMENT AND SERVICES TO BE PROVIDED BY OTHERS

The following material, equipment, and services are not included as part of the Bionomic Industries supply unless otherwise specified:

- Foundations, anchor bolts and grouting
- Erection and installation of all equipment
- Support Structures
- Fan
- Stack
- Duct and Duct Supports
- Buildings and enclosures
- Concrete and foundation design drawings
- Applicable sales and use taxes
- Receive and store all material at site prior to erection
- Building, construction and operating permits and all certifications
- Temporary erection facilities, including parking, water, toilet facilities, and access to site
- All emissions monitoring equipment (including CEMs)
- All emissions testing

SECTION 3 PERFORMANCE GUARANTEE

Bionomic Industries Inc. guarantees that the equipment system supplied, when operated in accordance with the Operating Conditions specified in this document and Bionomic's Operating & Maintenance Manual, will meet the following performance:

System's outlet mercury emissions will not exceed 0.025 mg/dscm

The above performance is based on the Performance inlet conditions in the data section included in this proposal. This guarantee is based on the Terms and Conditions attached. The guarantee is for the specific items listed above and does not extend to any other items.

SECTION 4 BUDGETARY PRICE AND TERMS

SERIES 3000 DUAL BED CARBON ADSORBER

Design, Engineer, and Supply **one (1)** mercury vapor adsorber, as described in this proposal:

ONE HUNDRED FOUR THOUSAND SIX HUNDRED DOLLARS..... \$104,600 (US)

All prices are subject to revision and are F.O.B. points of manufacture

Terms:

- The price is exclusive of all taxes or duties.

Delivery & Installation Schedule:

- System Drawings for approval ARO: 7-8 weeks
- Shipment of Equipment after **receipt of approval** drawings: 14-16 weeks

Field Service:

Field Services are available but not included in the proposal. Field Services can be used for any services required at the site, such as, site inspection, erection check out, start-up / commissioning, training and witness of compliance testing. Rates are included in the attached terms and conditions

Typical Terms of Payment:

- 30 % of contract price upon receipt of order
- 30 % of the contract price upon receipt of material for fabrication –net 30.
- 35 % of the contract price upon shipment of equipment (prorated) or 30 days after notice by Bionomic Industries of readiness for shipment, if shipment is delayed for reasons not attributed to Bionomic Industries-net 30.
- 5 % of the contract price upon completion of satisfactory performance test or sixty (60) days after shipping if performance testing is not conducted due to reasons not attributed by Bionomic Industries.

Terms and Conditions:

Attached

Macheski, Michael

From: David Meier <DMeier@bionomicind.com>
Sent: Friday, February 07, 2014 11:17 AM
To: Macheski, Michael
Subject: RE: Mercury control

Follow Up Flag: Follow up
Flag Status: Flagged

Mike,
See responses below in **red**.
If you require additional information, please contact me.
Regards,
Dave Meier

From: Macheski, Michael [mailto:MMacheski@trcsolutions.com]
Sent: Thursday, February 06, 2014 3:39 PM
To: David Meier
Subject: RE: Mercury control

Dave,

As you can tell, this process is quite long as the borough is still reviewing the budgetary options we presented to them. They're looking for some additional information related to maintenance and disposal to help weight the options.

Based on the 19,400 lb of activated carbon and \$2/lb, we're talking \$38,800 per media change-out on an expected 10 year frequency. Do you have any idea how long these change-outs normally take to do in terms of number of shutdown days?

Response: I would allow two days for the change-out although it should be done in one day. Typically, the spent carbon is vacuumed out of the vessel into a van-type truck. Replacement carbon(either in 55# bags or 350# supersacks) is added through the manways.

Does Bionomic Industries ever contract to do these carbon change-outs? *If* so, about how much would that be and could carbon disposal be included? Any idea who else could contract for the disposal and ballpark how much that could be per lb if not?

Response: We do have a company that we work with that supplies such as service. Typically the cost for disposal is \$0.15 per lb. The replacement service is currently \$0.32 per lb.

Since the mercury is reacted with sulfur, there should not be any potential leaching problems if the spent carbon is land filled. However, there are a few companies that will take the spent carbon and regenerate it, recovering metallic mercury in the process. I do not know the costs of this operation

Besides that carbon replacement maintenance, is there any other anticipated maintenance specifically for this APC equipment that needs to be planned for, especially that which would require a shutdown? *If* so, what would be the scope of that maintenance and how long would it typically take and do you offer contracting for any of it?

Response: There is no anticipated maintenance other that periodically opening a drain valve to remove any condensed water.

Mike

Michael R. Macheski
Project Engineer



521 Plymouth Road, Suite 116, Plymouth Meeting, PA 19462
P: 610.834.0490 x5931 | F: 610.834.1469 | C: 610.772.1473
e-mail: MMacheski@trcsolutions.com
[LinkedIn](#) | [Twitter](#) | [Blog](#) | [Flickr](#) | www.trcsolutions.com

*The Plymouth Meeting Office has Moved.
Note our new address. Phone and fax #s remain the same.*

From: David Meier [<mailto:DMeier@bionomicind.com>]
Sent: Tuesday, December 24, 2013 7:39 AM
To: Macheski, Michael
Subject: Re: RE: Mercury control

The initial charge is included in the price. Additional carbon is about 2 dollar
per #

Sent from my Verizon Wireless 4G LTE Smartphone.

----- Original Message -----

From : Macheski, Michael
Subject : RE: Mercury control

You mentioned how the carbon filter media should last as many as 10 years based on the low mercury loading. When it does need to be replaced, how much would that new carbon cost? Based on the proposal, the full operating weight is 29,400 lb and the empty weight is 10,000 lb, so I assume 19,400 lb is the amount of carbon initially charged. What, then, is the price per pound of sulfurized activated carbon when purchased in bulk at that quantity? Does the cost of the initial charge need to be added to the equipment budgetary cost of \$104,00 or was that already included?

From: David Meier [<mailto:DMeier@bionomicind.com>]
Sent: Wednesday, December 18, 2013 1:03 PM
To: Macheski, Michael
Subject: RE: Mercury control

Loose carbon in a single tower and lasts for 10 years because of the light loading

From: Macheski, Michael [<mailto:MMacheski@trcsolutions.com>]
Sent: Wednesday, December 18, 2013 11:57 AM
To: David Meier
Subject: RE: Mercury control

A couple follow up questions - I assume the carbon is loose filled within the single tower and not packed into modules, correct? Also, is this adsorber tower going through a periodic regeneration cycle whereby a hot gas is run through to desorb the capture mercury and that's why it can last 10 years or is strictly because this is such a dilute stream?

From: David Meier [<mailto:DMeier@bionomicind.com>]
Sent: Tuesday, December 03, 2013 2:25 PM
To: Macheski, Michael

Cc: Ken Schiffner; Will.Cheyney@JenningsAlberts.com

Subject: Mercury control

Mike,

Attached for your review and comment is a budgetary proposal for a mercury control package designed to reduce the mercury content in the exhaust to less than the required levels.

Based on the supplied mercury concentrations, the filter media should last up to ten years before replacement is required.

If there is an interest in upgrading the existing WESPs for improved particulate control, please let me or Ken know.

We have had documented success in improving the particulate and heavy metal collection efficiency in these units by replacing the ionizing electrodes with a more effective design.

Should you have any questions or require additional information, please feel free to contact me.

Regards,

Dave Meier

Account Manager

Bionomic Industries Inc.

777 Corporate Drive, Suite 3

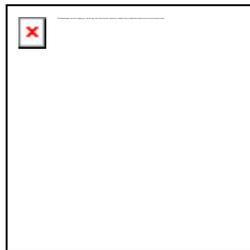
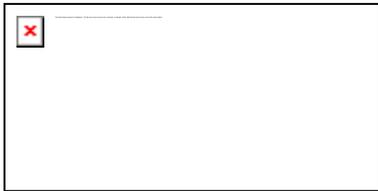
Mahwah N.J. 07430

Phone: 201-529-1094

Ext.124

Fax: 201-529-0252

www.bionomicind.com



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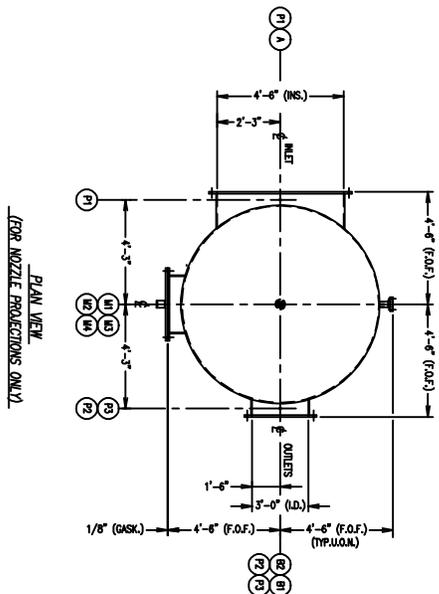
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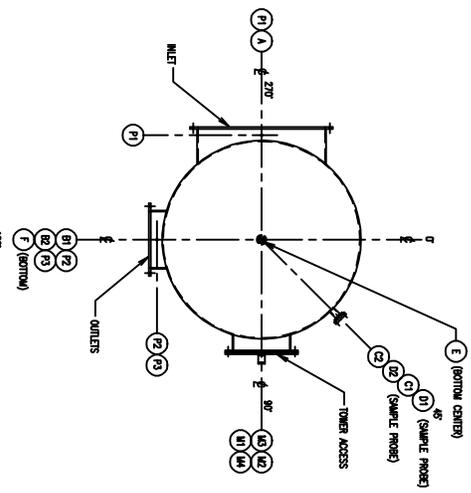
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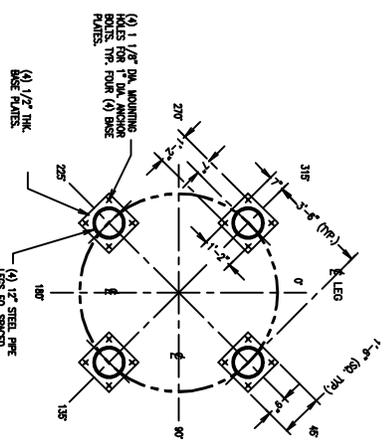
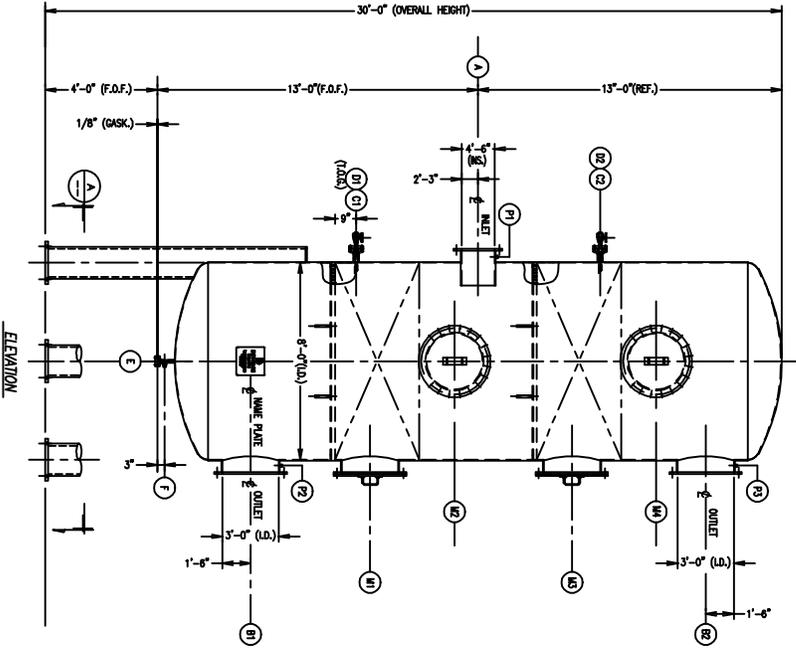
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FOR NOZZLE PROJECTIONS ONLY



NOZZLE TRUE ORIENTATION



SECTION A-A TOWER MOUNTING PLAN
 NOTE: CUSTOMER TO SET ANCHOR BOLTS AFTER RECEIPT OF UNIT.

GENERAL NOTES:
 1- MATERIALS OF CONSTRUCTION: SHELL AND CANNERS: SSP SHEATH: LESS: FRP

CARBON BEDS: IMPREGNATED ACTIVATED CARBON
 LIFTING LOSS: FABRICATOR'S STANDARD
 GASKETS TO BE 1/8" THK. FULL FACE EPDM
 BOLTS, NUTS AND FLAT WASHERS (EXTERNAL)
 STAINLESS STEEL, NUTS AND BOLTS TO BE HEX
 EACH VESSEL DESIGN:
 DESIGN PRESSURE: ±15 IN. W.C. ● 120°F

VESSEL IS NOT DESIGNED FOR EXTERNAL LOADING.
 3- DESIGN OPERATING CONDITIONS:
 GAS FLOW: DESIGN 14115
 GAS TEMP.: F-REFERENCE 105
 PRESSURE DROP: 5" (F/F)

ITEM	SIZE	CONNECTION	SERVICE
A	5/8" ID	FABRICATED FLG.	GAS INLET
B	3/8" I.D.	FABRICATED FLG.	GAS OUTLETS
C	2"	FLAT FACE	RECEPTACLES FOR 1" AND 1 1/2"
D	1"	BALL VALVE (TURNED)	CARBON BED SAMPLE PROBE
E	1"	150# F.F. FLG.	CARBON BED SAMPLE PROBE
F	3/4"	HALF THROUGH	CONDENSATE SENSOR CONNECTION
G	1"	150# F.F. FLG.	CONDENSATE SENSOR CONNECTION
H	1"	150# F.F. FLG.	CONDENSATE SENSOR CONNECTION
I	1"	150# F.F. FLG.	CONDENSATE SENSOR CONNECTION
J	1"	150# F.F. FLG.	CONDENSATE SENSOR CONNECTION
K	1"	150# F.F. FLG.	CONDENSATE SENSOR CONNECTION
L	1"	150# F.F. FLG.	CONDENSATE SENSOR CONNECTION
M	2 1/2" I.D.	FABRICATED FLG.	TOWER ACCESS WITH COVER (CARBON BED CLEANOUT)
N	2 1/2" I.D.	FABRICATED FLG.	TOWER ACCESS WITH COVER (CARBON BED FLG.)
O	2 1/2" I.D.	FABRICATED FLG.	TOWER ACCESS WITH COVER (CARBON BED FLG.)
P	1 1/2"	HALF THROUGH	PRESSURE TPA CONNECTION (WITH FLG.)
Q	1 1/2"	HALF THROUGH	PRESSURE TPA CONNECTION (WITH FLG.)

NOZZLE SCHEDULE

BIONOMIC Industries
 777 CORPORATE DRIVE, MAHWAH, NJ 07430

SERIES 3000 MODEL 300
 DUAL BED CARBON ADSORBER
 TYPICAL GENERAL ARRANGEMENT
 MERCURY CONTROL P

REV.	DESCRIPTION	BY	DATE	QTY	DATE
1	CUSTOMER TPO FOR DESIGN AND CONTROL				

THE DESIGN IS THE PROPERTY OF BIONOMIC INDUSTRIES AND IS TO BE USED ONLY FOR THE PROJECT AND VESSEL SPECIFICALLY IDENTIFIED HEREIN. ANY REUSE OR MODIFICATION OF THIS DESIGN WITHOUT THE WRITTEN PERMISSION OF BIONOMIC INDUSTRIES IS STRICTLY PROHIBITED.

Standard Warrantee

Bionomic Industries, Inc., herein referred to as the Company warrants to the original purchaser that (i) all Products manufactured and sold by the Company will be free from defects in material and workmanship, and (ii) such Products will reasonably perform the intended use thereof in accordance with the condition and specifications submitted by this Company as are described in this Company's written Proposal (the "Proposal") to such Purchaser. The foregoing warranties shall be applicable only when the Product is used in normal use and service and while the Product is in a clean condition, under such conditions and specifications as are described in the Company's Proposal to the Purchaser, and only when the following additional conditions are complied with by the Purchaser:

The Product must be properly installed by a qualified installer in accordance with the Company's recommended installation instructions and procedures;

- (a) The Product must be properly installed by a qualified installer in accordance with the Company's recommended installation instructions and procedures;
- (b) The Product must be operated, maintained and serviced in accordance with the Company's recommended operating instructions and procedures; and
- (c) The installation and operation of the Product must be in conformity with all applicable laws, statutes, rules and regulations of federal, state and local governmental bodies, agencies or departments thereof.

IN THE EVENT OF ANY CLAIM UNDER THIS WARRANTY, THE PURCHASER SHALL GIVE WRITTEN NOTICE THEREOF TO THE COMPANY WITHIN THIRTY DAYS AFTER PURCHASER HAS KNOWLEDGE OF ANY CLAIMED DEFECT, OTHERWISE THE FOREGOING WARRANTY SHALL BECOME NULL AND VOID. The foregoing warranty shall be for a period of one year from the start of operation, but in no event shall such warranty extend beyond **12** months from date of shipment by the Company. Any requested performance test procedures must be as mutually agreed upon. Such testing will be solely at Purchaser's expense. The company's sole obligation under this Warranty shall be limited to the replacement or repair of the Product or any parts thereof which may be proven to the Company's satisfaction to be defective. F.O.B. the Company's shipping point. In the event any claim is made against the Company in connection with such Product, the Company shall not be liable for any cost of removal, dismantling, reinstalling or reconstruction of the Product from, onto or into any building or other structure in which or upon which the Product may be installed, constructed or enclosed. All such costs shall be borne by the Purchaser who shall make the Product reasonably available on Purchaser's premises for necessary inspection and repairs required under the foregoing warranty. If, in the sole judgment of the Company, such necessary repairs can best be made at the Company's plant, the Purchaser shall pay all costs of shipping and transporting the Product to and from the Company's plant. THE COMPANY SHALL NOT BE LIABLE FOR LOSS OF ANTICIPATED PROFITS, LOSS BY REASON OF PLANT SHUTDOWN, NON-OPERATION OF THE PRODUCT OR INCREASED COSTS OF OBTAINING OR OPERATING OTHER OR SUBSTITUTE EQUIPMENT OR PROCESSES OR OTHER CONSEQUENTIAL LOSS OR DAMAGE OF ANY NATURE.

THE COMPANY MAKES NO WARRANTY WITH RESPECT TO COMPONENTS AND ACCESSORIES MANUFACTURED BY ANY OTHER PARTY EXCEPT FOR THE SCRUBBER AND EXPRESSLY WARRANTED BY SUCH OTHER PARTY, NOR FOR DETERIORATION OR FAILURE OF THE PRODUCT DUE TO THE EFFECTS OF EROSION OR CORROSION, OR WHICH MAY IN ANY WAY BE ATTRIBUTED TO FAULTY OPERATION. THE COMPANY MAKES NO WARRANTIES, EITHER EXPRESSED OR IMPLIED, THAT EXTEND BEYOND THOSE EXPRESSLY STATED HEREIN. THE COMPANY DOES NOT WARRANT PERFORMANCE OF THE PRODUCT PURSUANT TO ANY DESIGNS, DRAWINGS OR SPECIFICATIONS FURNISHED BY THE PURCHASER UNLESS SUCH DESIGN, DRAWINGS OR SPECIFICATIONS HAVE BEEN EXPRESSLY INCORPORATED INTO AND INCLUDED AS A PART OF THE COMPANY'S PROPOSAL. IN NO EVENT SHALL THE COMPANY BE LIABLE FOR ANY AMOUNT IN EXCESS OF THE PURCHASE PRICE OF THE PRODUCT TO THE PURCHASER. THIS DISCLAIMER AND WARRANTY AGREEMENT IS EXPRESSLY IN LIEU OF ANY AND ALL OTHER WARRANTIES AND REPRESENTATIONS, EXPRESSED OR IMPLIED, EXCEPT AS STATED IN OUR PROPOSAL, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WHETHER ARISING FROM STATUTE, COMMON LAW, CUSTOM OR OTHERWISE. THE REMEDY SET FORTH IN THIS DISCLAIMER AND WARRANTY AGREEMENT SHALL BE THE EXCLUSIVE REMEDIES AVAILABLE TO PURCHASER. NO PERSON HAS ANY AUTHORITY TO BIND THE COMPANY TO ANY REPRESENTATION OR WARRANTY OTHER THAN AS SET FORTH IN THIS DISCLAIMER, WARRANTY AGREEMENT AND OUR PROPOSAL. THE COMPANY SHALL NOT BE LIABLE FOR ANY CONSEQUENTIAL DAMAGES RESULTING FROM THE USE OF THE PRODUCT OR CAUSED BY ANY DEFECT, FAILURE OR MALFUNCTION OF THE PRODUCT, WHETHER A CLAIM FOR SUCH DAMAGE IS BASED UPON WARRANTY, CONTRACT, NEGLIGENCE OR OTHERWISE. THIS WARRANTY SHALL NOT APPLY TO ANY PRODUCT OR EQUIPMENT WHICH HAS BEEN REPAIRED OR ALTERED IN ANY WAY, WITHOUT THE PRIOR EXPRESSED WRITTEN APPROVAL OF THE COMPANY, BY ANYONE OTHER THAN THE COMPANY'S EMPLOYEES OR AGENTS SO AS, IN THE JUDGMENT OF THE COMPANY, TO AFFECT ITS OPERATION OR

PERFORMANCE. THE TERM "ORIGINAL PURCHASER" SHALL BE DEEMED TO MEAN ONLY THAT PERSON, FIRM OR CORPORATION FOR WHOM THE PRODUCT IS ORIGINALLY INSTALLED. THE TERMS, PROVISIONS AND CONDITIONS OF THIS DISCLAIMER AND WARRANTY AGREEMENT SHALL NOT BE AMENDED, EXTENDED OR MODIFIED BY THE TERMS OF ANY PURCHASE ORDER OR OTHER DOCUMENT OF THE PURCHASER, HIS CONTRACTOR OR OTHER AGENT UNLESS UPON THE EXPRESSED WRITTEN APPROVAL OF AN AUTHORIZED OFFICER OF THE COMPANY.

BIONOMIC INDUSTRIES INC.
DOMESTIC TECHNICAL SERVICE CHARGES

EFFECTIVE DATE February 26, 2013

THE CORPORATION referenced above, and hereinafter referred to as the SELLER, maintains a staff of technical personnel to provide assistance for the installation, overhaul, repair, maintenance, or operation of various industrial machinery, equipment, processes, or systems (hereinafter "Services").

The Buyer upon receipt of monthly invoices, shall pay the charges for: (1) the expenses for each service person, and (2) his time at SELLER'S prevailing rates in effect at the time the services are performed in U.S. dollars.

The sale and provision of any Services are expressly conditioned upon the Terms and Conditions of Technical Service of which this Appendix I is a part. Any additional or different terms and conditions by the Buyer are objected to and will not be binding on Seller unless specifically assented to in writing by Seller's authorized representative prior to provision of Services. The rules for application of charges and the terms and conditions under which said Services shall be provided are set forth in the "Terms and Conditions of Technical Services" below.

CHARGES FOR SERVICES

SITE SERVICES' ACTIVITIES	STANDARD DAY	LONG TERM PER/DAY	OVERTIME PER HR
Process & Equipment Evaluation/Consulting	\$ 1,160.00	\$ 1,110.00	\$ 210.00
Start-up Service	\$ 1,160.00	\$ 1,050.00	\$ 210.00
Erection/Repair Assistance	\$ 1,050.00	\$ 1,000.00	\$ 155.00
Site Training	Contact Seller for Pricing		

- A) The minimum charge for Site Services Activities, in accordance with the type of Service performed as listed above shall be not less than the standard day. The fees are based on a maximum of 8 hours/day and 40-hours/calendar week. Overtime will be charged when 8 hours/day or when 40 hours/week are exceeded and for holidays and weekends.
- B) "Standard" fees are applicable where no less than two weeks notice was given in advance.
- C) "Long Term": fees are applicable for services on more than three months continuous duration.
- D) "Emergency" fees are applicable where a client requests assistance with less than two weeks previous notice, and where rescheduling of services once begun, becomes necessary.
- E) Traveling days and standby time will be charged as an 8 hr/day at a rate of \$630.00 per diem. Traveling and living expenses are not included in the fees.
- F) Any reporting work prepared by the Seller's personnel after performed services are not included in the fees. Hourly charges are \$115.00 hr for engineering and \$ 75.00 hr for drafting services.

CHARGES FOR EXPENSES

Buyer will pay for all travel, living, and other expenses incidental to the work. All charges will be invoiced at actual cost plus 10%. Charges for lodging, air and ground transportation will be substantiated by copies of receipts.

BIONOMIC INDUSTRIES INC.

TERMS AND CONDITIONS OF TECHNICAL SERVICE

THE CORPORATION referenced above, and hereinafter referred to as the SELLER, maintains a staff of service personnel to provide technical assistance for the installation, overhaul, repair, maintenance, or operation of various industrial machinery, equipment, processes, or systems (hereinafter "Services").

Services may be arranged by consulting the corporate headquarters located in Mahwah, New Jersey, U.S. A. ("CHQ"). The Buyer agrees to pay Seller for Services at current rates and per diem for the classification of Services to be furnished, and expenses, as provided in Appendix I, "Technical Service CHARGES (attached and incorporated herein)"> The sale of any Services is expressly conditioned upon these Terms and Conditions of Technical Service. Any additional or different Terms and Conditions by the Buyer are objected to and will not be binding on Seller unless specifically assented to in writing by Seller's authorized representative prior to provision of Services. The rules for application of rate charges and the terms and conditions under which said Services shall be provided are set for the in these "Terms and Condition of Technical Services" including Appendix I hereto.

1. BUYER RESPONSIBILITY

It is understood Buyer will assure SELLER personnel a safe place to work in accordance with all applicable safety laws or codes, and will also furnish and assume responsibility for all labor, materials, equipment, utility services, and tools necessary to perform the work. Buyer shall provide at no cost to Seller's personnel appropriately equipped, secured, and air-conditioned office facilities at the site. Buyer shall provide at no cost to Seller personnel necessary communication services including, but not limited to, phone, fax and mail from Buyer's site to CHQ.

2. WORKER'S COMPENSATION AND TAXES

SELLER will maintain Worker's Compensation Insurance and unemployment compensation benefits and shall make U.S. Income Tax withholding, as may be required by U.S. law, for Seller personnel.

The prices and charges as listed on Appendix I do not include any federal (country), state (province), or local property, license, privilege, sales, use excise, gross receipts, income (except U.S.A. corporate income tax and U.S.A. personal income tax withholding imposed on U.S. base salary and overtime compensation, value added, or other taxes which may now or hereafter be applicable to, measured by, or imposed upon this transaction, services performed in connection therewith. Such taxes are for the account of the Buyer, and the Buyer agrees to pay or reimburse any taxes which SELLER, its contractor, suppliers or expatriate personnel are required to pay

3. DELAYS IN WORK

If the work of Seller personnel is postponed or Suspended by Buyer, it's contractors or agents, or for

reasons for force majeure, or is delayed or does not proceed with reasonable dispatch not due to fault of SELLER, SELLER may withdraw SELLER personnel and return to the job when needed and available or may agree to standby for a reasonable time, and any additional costs (including travel time and expenses), and charges for standby time, caused by this delay will be an additional charge to the Buyer.

4. TIME SHEETS

SELLER'S personnel will present Buyer at the end of each week, or at the completion of the job if less than one week, with their time sheets on which will be indicated the number of hours spent on this work. Buyer shall sign time sheets in the place indicated, thus signifying approval of the time spent on this work.

5. LIMITED WARRANTY AND REMEDY

SELLER shall perform the Services in an advisory capacity only and shall inform Buyer of any obvious defects in the installation, overhaul, repair, maintenance or operation of its equipment for which Services are requested and which are reasonably observable at the time the work is performed. Should the Services provided by SELLER hereunder be defective, SELLER will, at its sole option, refund the amount paid by the Buyer or furnish the Services which SELLER deems necessary and adequate to correct such defect at its expense. However, such correction and any modification, to equipment shall be made or caused to be made by Buyer at its sole cost and expense. This is the sole and exclusive remedy available to buyer, and no other guarantee or warranty, express, implied, or statutory is made with respect to the Service to be provided, hereunder and SELLER assumes no other responsibility or liability whatsoever.

6. BUYER RESPONSIBILITY

It is understood Buyer will assure SELLER personnel a safe place to work in accordance with all applicable safety laws or codes, and will also furnish and assume responsibility for all labor, materials, equipment, utility services, and tools necessary to perform the work. Buyer shall provide at no cost to Seller's personnel appropriately equipped, secured, and air-conditioned office facilities at the site. Buyer shall provide at no cost to Seller personnel necessary communication services including, but not limited to, phone, fax and mail from Buyer's site to CHQ.

7. WORKER'S COMPESATION AND TAXES

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The prices and charges as listed on Appendix I do not include any federal (country), state (province), or local property, license, privilege, sales, use excise, gross receipts, income (except U.S.A. corporate income tax and U.S.A. personal income tax withholding imposed on U.S. base salary and overtime compensation, value added, or other taxes which may now or hereafter be applicable to, measured by, or imposed upon this transaction, services performed in connection therewith. Such taxes are for the account of the Buyer, and the Buyer agrees to pay or reimburse any taxes which SELLER, its contractor, suppliers or expatriate personnel are required to pay

8. DELAYS IN WORK

If the work of Seller personnel is postponed or Suspended by Buyer, it's contractors or agents, or for

reasons for force majeure, or is delayed or does not proceed with reasonable dispatch, not due to fault of SELLER, SELLER may withdraw SELLER personnel and return to the job when needed and available or may agree to standby for a reasonable time, and any additional costs (including travel time and expenses), and charges for standby time, caused by this delay will be an additional charge to the Buyer.

TIME SHEETS

SELLER'S personnel will present Buyer at the end of each week, or at the completion of the jot if less than one week, with their time sheets on which will be indicated the number of hours spent on this work. Buyer shall sign time sheets in the place indicated, thus signifying approval of the time spent on this work.

LIMITED WARRANTY AND REMEDY

SELLER shall perform the Services in ad advisory capacity only and shall inform Buyer of any obvious defects in the installation, overhaul, repair, maintenance or operation of its equipment for which Services are requested and which are reasonably observable at the time the work is performed. Should the Services provided by SELLER hereunder be defective, SELLER will, at its sole option, refund the amount paid by the Buyer or furnish the Services which SELLER deems necessary and adequate to correct such defect at its expense. However, such correction and any modification, to equipment shall be made or caused to be made by Buyer at its sole cost and expense. This is the sole and exclusive remedy available to buyer, and no other guarantee or warranty, express, implied, or statuary is made with respect to the Service to be provided, hereunder and SELLER assumes no other responsibility or liability whatsoever.

Attachment B

Cameron Great Lakes Mercury Proposal

Total Costs - Cameron Great Lakes

DIRECT CAPITAL COSTS		
1	Purchased Equipment Costs	
a.	Basic Equipment and Auxiliaries (A)	\$284,000
	1) Carbon Adsorber	\$78,900
	2) New ID Fan	\$75,000
	3) Interconnecting Ductwork	\$30,000
	4) Drying Heat Exchanger	\$100,000
b.	Instrumentation and Controls (0.1 A)	\$28,400
c.	Freight (0.05 A)	\$14,200
d.	Sales Taxes (0.0625 A)	\$17,750
	TOTAL PURCHASED EQUIPMENT COST (B)	\$344,000
2	Direct Installation Costs	
a.	Foundations and Supports (0.12 B)	\$41,280
b.	Erection and Handling (0.4 B)	\$137,600
c.	Electrical (0.01 B)	\$3,440
d.	Piping (0.10 B)	\$34,400
e.	Insulation (0.05 B)	\$17,200
f.	Painting (0.01 B)	\$3,440
g.	Site Preparation and Demolition	\$50,000
h.	Building and Structural Modifications	\$50,000
	TOTAL DIRECT INSTALLATION COSTS (C)	\$337,000
INDIRECT CAPITAL COSTS		
3	Engineering & Supervision (0.12*[B+C])	\$81,720
4	Construction & Field Expenses (0.1*[B+C])	\$68,100
5	Contractor Fees (0.10*[B+C])	\$68,100
6	Start-up (0.05 B)	\$17,200
7	Equipment Acceptance Test	\$25,000
8	Contingency (0.15*[B+C])	\$102,150
	TOTAL INDIRECT CAPITAL COST	\$362,000
TOTAL INSTALLED CAPITAL COST		\$1,043,000
DIRECT ANNUAL COSTS		
1	Operating Labor, (0 hr/yr x \$30/hr)	\$0
2	Supervisory Labor, 0.15 X (1)	\$0
3	Maintenance Labor (548 hr/yr x \$30/hr)	\$16,440
	Materials (100% of labor)	\$16,440
4	Utilities	
a.	Water (\$3.20/1000 gal)	\$0
b.	Electricity (\$0.0966/kwh * 326,622 kwh)	\$31,552
5	Carbon Replacement (3,888 lb x \$4.12/lb /10 year frequency)	\$1,602
	TOTAL DIRECT OPERATING COSTS	\$66,000
INDIRECT OPERATING COSTS:		
6	Overhead - 60% Operating & Maintenance Labor	\$19,728
7	Property Tax - 0% Total Capital Cost	\$0
8	Insurance - 1% Total Capital Cost	\$10,430
9	Administration - 2% Total Capital Cost	\$20,860
10	Capital Recovery (5% Interest, 20 Years)	\$83,690
	TOTAL INDIRECT OPERATING COSTS	\$135,000
TOTAL ANNUALIZED OPERATING COST		\$201,000

Macheski, Michael

From: Jmbattag@aol.com
Sent: Monday, December 23, 2013 3:08 PM
To: Macheski, Michael
Cc: bob@cglcarbon.com; cci@cglcarbon.com
Subject: Re: Emissions Control Help for a Sewage Sludge Incinerator

Mike:

The SU carbon currently sells for **\$3.65/lb.** packed in 1200 lb. bulk sacks.

My quote below **includes** the initial charge of SU carbon in the 2" depth filter trays.

The 2" depth filter trays are designed to be opened, the spent media dumped out, and re-filled with fresh SU carbon media. The spent media would then be properly characterized & disposed of by the generator as either a **hazardous** or **non-hazardous** material based on the Hg concentration.

Regards,

Joe Battaglia / CGL East

In a message dated 12/23/2013 1:56:41 P.M. EST, MMacheski@trcsolutions.com writes:

You proposed 215 trays and 3,888 lb of sulfurized activated carbon for my application. How much would it cost for that carbon, or even simply price per lb in bulk? Is the initial charge included in the budgetary proposal cost or is it so relatively small that it wasn't worth including?

From: Jmbattag@aol.com [mailto:Jmbattag@aol.com]
Sent: Tuesday, December 10, 2013 3:59 PM
To: Macheski, Michael
Cc: bob@cglcarbon.com; paula@cglcarbon.com
Subject: Re: Emissions Control Help for a Sewage Sludge Incinerator

Mike:

CGL will guarantee that our filter hsg will remove at least 90% of the Hg per stage of filtration.

So for the three (3) stage unit quoted, our filter hsg will remove:

90% (first pass) + 90% of 10% (second pass) + 90% of 1% (third pass) = 99.9% removal.

So if the inlet Hg concentration is 1 ppmv = 1000 ppbv, the outlet will be 1 ppbv or less.

Regards, Joe Battaglia / CGL East

=====

In a message dated 12/10/2013 3:49:45 P.M. EST, MMacheski@trcsolutions.com writes:

Thanks Joe. This is the level of detail I'm looking for at this point. Are you able to offer a mercury reduction or emission guarantee for the carbon?

From: Jmbattag@aol.com [mailto:Jmbattag@aol.com]
Sent: Monday, December 09, 2013 3:46 PM
To: Jmbattag@aol.com; Macheski, Michael
Cc: bob@cglcarbon.com; paula@cglcarbon.com
Subject: Re: Emissions Control Help for a Sewage Sludge Incinerator

Mike:

Per your request below and our recent telecon, we are pleased to provide this budgetary quote as follows:

CGL Model No. **SA3H3W-4P-TP2T-T36-WH-S-GT-SB**

Details:

SA3H3W - Side access hsg, 3 modules high x 3 modules wide, rated for up to **18846 acfm** flow per your RFQ specs

4P - Track for 24x24x4" prefilters

TP2T - Triple Pass through nom. size 24x24x2" depth filter trays. 8 trays/module x 9 = 72 trays per pass X 3 passes = 216 trays total. Each tray hold **18 lbs.** of **CGL Type SU carbon for Hg removal**. Total 72 trays x 18 lb. each = 1296 lbs. media/pass x 3 passes = 3,888 lb. total SU media

T36 - Inlet & outlet transitions from nominal 9' x 9' flange to 36" dia. duct collar

WH - Weather hood over unit for outdoor installation

S - 3/4" NPT air sample taps between stages

GT - 1/4" FPT taps for delta p gauges for the 4P filter section (Delta P gauges provided by others)

SB - 3" high subbase under hsg

Base hsg size: Approx. 78" H x 72" W x 92.5" depth in direction of airflow + **ADD** transitions in & out at 27" depth each = 58" to depth = total depth in direction of airflow = 92.5" + 58" = **146.5" overall depth**

Please refer to attached **typical** drawings to get an idea of the physical size & scope of this housing. Material is carbon steel, stitch welded & caulked construction, with epoxy based paint finish inside & out.

Pricing

1. CGL Model SA3H3W filter hsg per above scope (*empty*): **\$55,500.00**
2. Qty 216 trays filled with SU carbon @ **\$80.00 each** = **\$17,280.00** for ***initial*** filter trays.
3. Qty 9 - 4" prefilters for start-up + qty 9 for spares = 18 prefilters @ \$20.00 each = **\$360.00**

It would be a very good idea for the Owner to have a spare set of qty 72 trays on site. This will enable the Owner to quickly replace the original trays in the spent first stage when they become spent. Qty 72 trays filled with SU carbon @ \$80.00 each = \$5,760.00 for spare trays.

Prices are net to first buyer. Prices are firm for 60 days.

Prices are FOB, Batavia, IL and do not include freight or any taxes.

Payment terms are 1/3rd down payment, 1/3rd progress payment on notice of ready-to-ship, and 1/3rd balance due net 30 days with credit approval.

Typical lead-time is 12-14 weeks ARO, drawing approval & down payment.

We look forward to working with you and your customer as this project develops.

Regards,

Joseph M. Battaglia, VP, Engineering
Cameron Great Lakes, Inc. - **Eastern Office**
104 W Fairview Avenue, Langhorne, PA 19047
Tel. [215-752-2246](tel:215-752-2246) Fax [215-752-2247](tel:215-752-2247) Cell [215-859-2150](tel:215-859-2150)

Corporate Office:

2335 NW 29th Avenue, Portland, OR 97210
Tel. [800-777-4044](tel:800-777-4044) or [503-241-8037](tel:503-241-8037) Fax [503-225-0137](tel:503-225-0137)

=====
===

In a message dated 12/9/2013 11:03:13 A.M. EST, MMacheski@trcsolutions.com writes:

Joe, please send a budgetary proposal for the fixed carbon bed for mercury capture as discussed over the phone by the end of the day Tuesday 12/10 if at all possible. The customer is looking for a summary memo of options by Wednesday.

Thanks, Mike

From: Jmbattag@aol.com [mailto:Jmbattag@aol.com]
Sent: Wednesday, November 27, 2013 2:00 PM
To: Macheski, Michael
Cc: bob@cglcarbon.com
Subject: Re: Emissions Control Help for a Sewage Sludge Incinerator

Mike:

Thanks for sending the process specs.

Please call me to discuss how CGL can help you with your current budgetary quote needs.

Regards, Joe Battaglia / CGL East

=====

In a message dated 11/27/2013 9:29:33 A.M. EST,
MMacheski@trcsolutions.com writes:

Joe, thanks for following up. I was out yesterday afternoon so I apologize for the delay, but here attached is the process specification I mentioned.

Michael R. Macheski
Project Engineer



521 Plymouth Road, Suite 116, Plymouth Meeting, PA 19462

P: 610.834.0490 x5931 | F: 610.834.1469 | C: 610.772.1473

From: Jmbattag@aol.com [<mailto:Jmbattag@aol.com>]
Sent: Tuesday, November 26, 2013 4:02 PM
To: Macheski, Michael
Cc: bob@cglcarbon.com; cci@cglcarbon.com
Subject: Re: Emissions Control Help for a Sewage Sludge Incinerator

Mike:

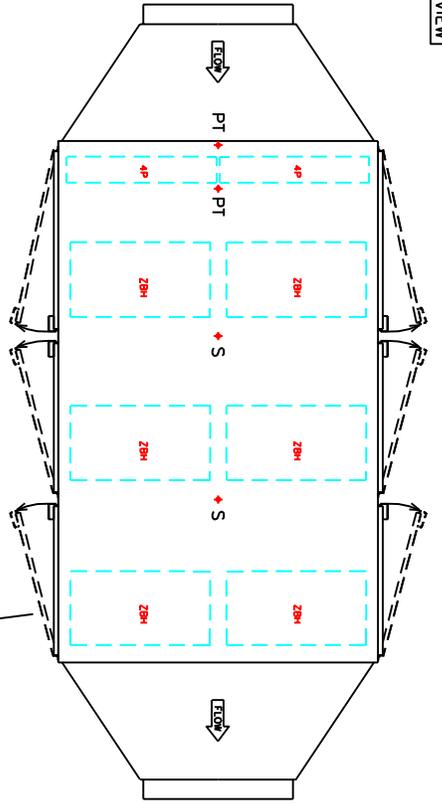
Per my voice mail message today, please re-send your email to me with the attachment so I can review the process specifications.

Regards,

Joseph M. Battaglia, VP, Engineering
Cameron Great Lakes, Inc. - **Eastern Office**
104 W Fairview Avenue, Langhorne, PA 19047
Tel. 215-752-2246 Fax 215-752-2247 Cell 215-859-2150

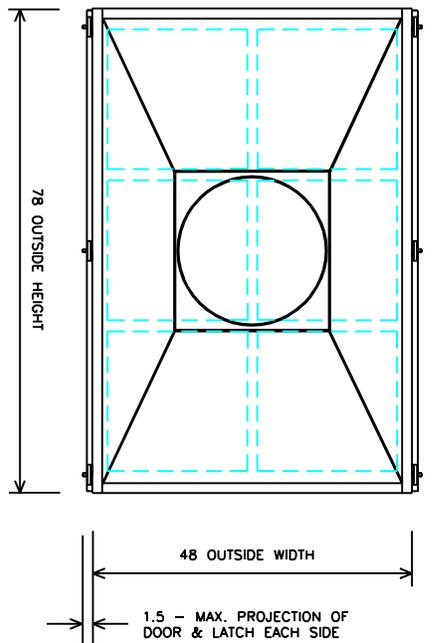
This email has been scanned by the Symantec Email Security.cloud service.
For more information please visit <http://www.symanteccloud.com>

PLAN VIEW

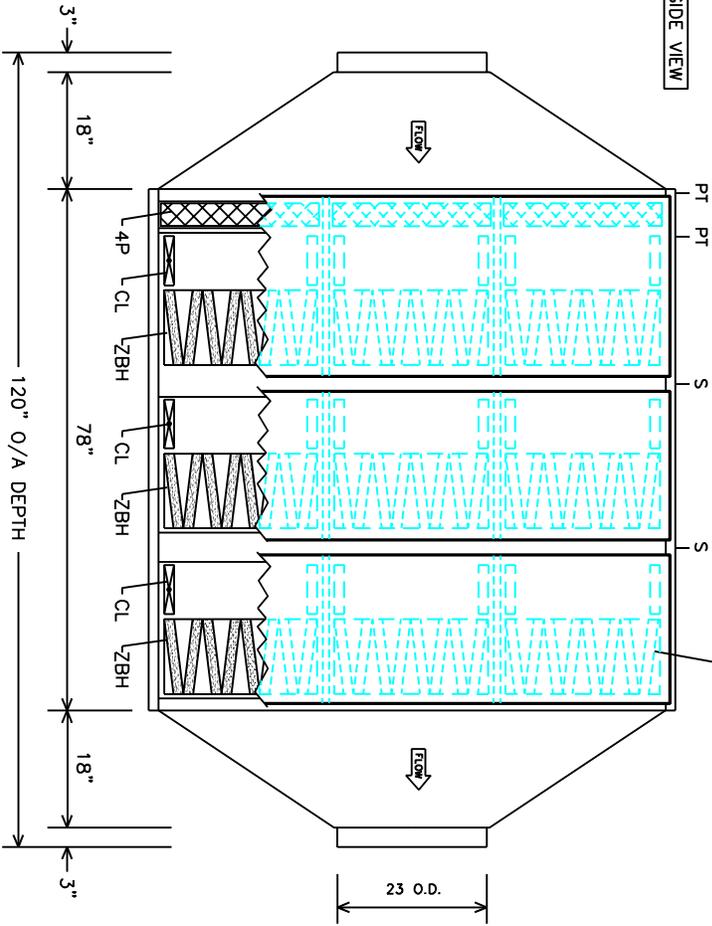


THREE (3)
ACCESS DOORS
EACH SIDE

END VIEW FACING OUTLET



SIDE VIEW



CL = CLAMP LOCK MECHANISM TO HOLD ZBH FILTERS TIGHT AGAINST GASKET ON OUTLET FACE OF FILTER CELL
PT = 1/4" NPT PRESSURE TAP FOR DPG BY OTHERS
S = 1/4" AIR SAMPLE TAP
NOTE - TAPS TO BE LOCATED AS DESIRED BY OWNER

MODEL NO. SA3H2W-4P-TP-ZBH-T
SA - SIDE ACCESS HOUSING
3H - 3 MODULE HIGH
2W - 2 MODULES WIDE
4P - 4 INCH PREFILTER TRACK
TP - TRIPLE PASS DESIGN
ZBH - ZERO BYPASS GAC FILTER CELLS
T - INLET & OUTLET TRANSITIONS
MATERIALS OF CONSTRUCTION
HOUSING: 16 GA. C.S., ALUMINIZED FINISH INSIDE & OUT.
ZBH FILTERS: CARBON STEEL, BLACK POWER COATED FINISH
18 ZBHs @ 132 LBS TOTAL EA. 2376
(18 X 64 = 1152 LB. GAC WGT)
+ 6 PREFILTERS @ 2.0 LB. EA. 12
+ APPROX. EMPTY HOUSING WEIGHT 1042
TOTAL APPROX. OPERATING WEIGHT 3430

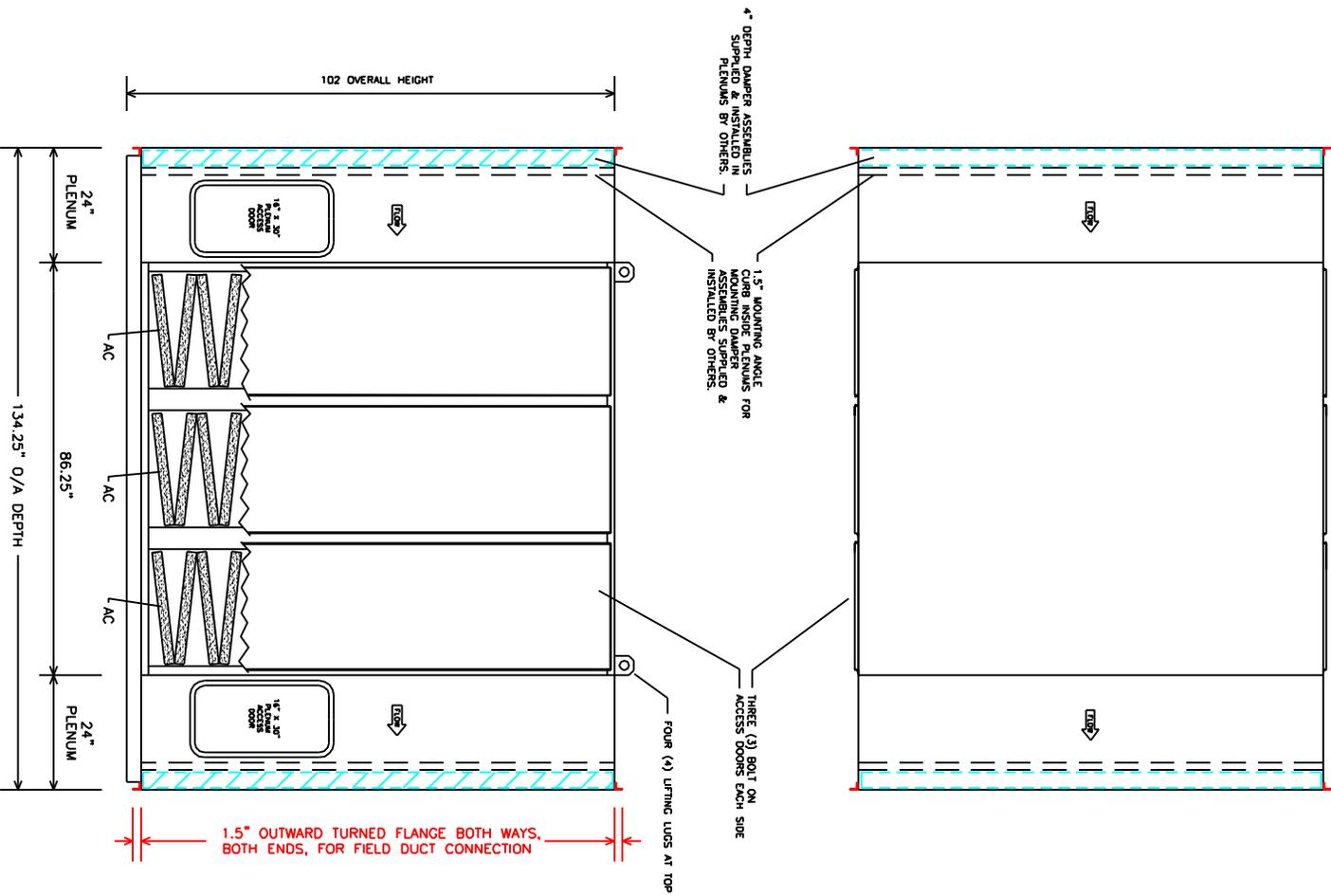
PROPRIETARY DRAWING			
DRAWING MAY NOT BE USED OR REPRODUCED WITHOUT WRITTEN AUTHORIZATION OF CGL, INC.			
DIMENSIONS ARE FOR REFERENCE ONLY. DO NOT USE FOR CONSTRUCTION UNLESS MARKED "CERTIFIED" BY CGL.			
REV.	DATE	BY	REMARKS
--	09/18/07	JMB	ORIGINAL ISSUE



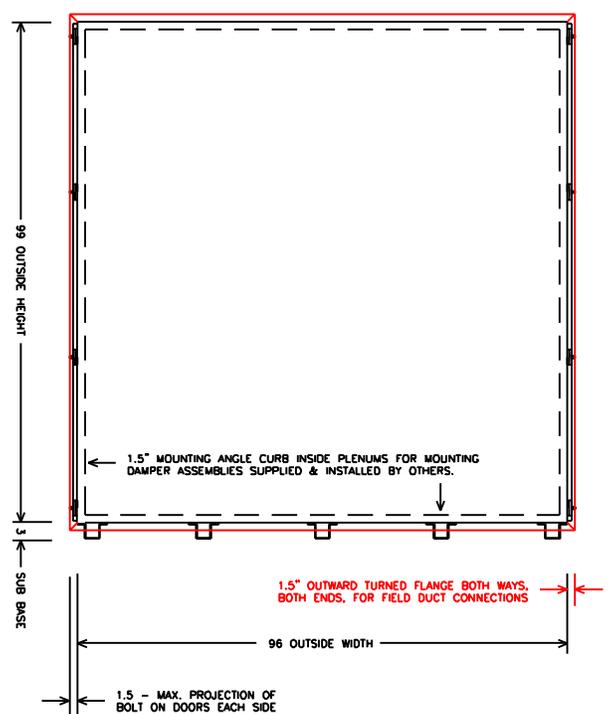
CAMERON GREAT LAKES, INC.
2336 NW 29th AVE. TEL. 800-777-4044
PORTLAND, OR 97210 FAX 503-225-0137

DRAWN: JMB	TITLE: GENERAL ARRANGEMENT
CHECKED: PJJ	MODEL: SA3H2W-4P-TP-ZBH-T
APPROVED: JMB	SIDE ACCESS FILTER HOUSING
SCALE: N.T.S.	DMG. NO.: SA3H2W-4P-TP-ZBH-T

PLAN VIEW



END VIEW FACING OUTLET



<p>MODEL NO. SA4H4W-TP-2in.-IP-OP-SB-SS</p> <p>SA - SIDE ACCESS HOUSING 4H - 4 MODULE HIGH 4W - 4 MODULES WIDE TP - TRIPLE PASS DESIGN 2in. - TRACKS FOR 24X24X2" FILTER TRAYS IP - INLET PLENUM WITH ACCESS DOOR OP - OUTLET PLENUM WITH ACCESS DOOR SB - 3" HIGH SUB BASE SS - 304 STAINLESS STEEL HSG MATERIAL</p>	
<p>MATERIALS OF CONSTRUCTION</p> <p>HOUSING: 14 GA. 304 STAINLESS STEEL, MILL FINISH INSIDE & OUT. STITCH WELDED & CAULKED CONSTRUCTION.</p>	
<p>DESIGN FLOW = 32,000 CFM @ 6" W.G. PRESSURE. GASKETS RATED FOR 300°F FOR PERIODIC MEDIA REGENERATION USING STEAM.</p>	
<p>SEE SEPARATE QUOTE & DWG FOR NOM. SIZE 24X24X2" DEPTH FILTER TRAYS. OTY EIGHT (8) TRAYS PER MODULE X 16 MODULES = 128 TRAYS PER STAGE X 3 STAGES = 384 TOTAL TRAYS IN HSG.</p>	
<p>AC = SIZE 4X8 MESH ACTIVATED CARBON @ 30 LB./FT³ DENSITY (18 LB. AC PER TRAY)</p>	
<p>384 TRAYS @ 18 LB. AC EA. = AC WEIGHT:</p>	6912
<p>+ EMPTY TRAY WEIGHT: 384 X 10 LB./TRAY:</p>	3840
<p>TOTAL APPROX. OPERATING WEIGHT (LBS.):</p>	3000
	13752

PROPRIETARY DRAWING
 DIMENSIONS ARE FOR REFERENCE ONLY.
 THIS DRAWING IS NOT TO BE USED FOR REPRODUCTION WITHOUT WRITTEN AUTHORIZATION OF COL, INC.
 DO NOT SCALE DRAWING
 MARKED "CONTROL" BY COL.

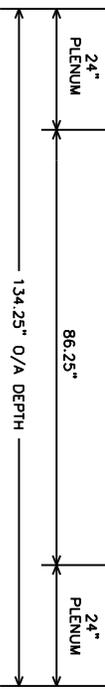
REV	DATE	BY	REMARKS
A	10/24/11	JMB	Rev. to show all AC filter trays
--	09/29/11	JMB	ORIGINAL ISSUE

Drawn: JMB
 Title: GENERAL ARRANGEMENT
 Checked: PJJ
 Approved: JMB

SCALE: N.T.S. DWG NO: SA4H4W-TP-2in.-IP-OP-SB-SS

CAMBRON GREAT LAKES, INC.
 2338 NW 28th AVE. TEL. 800-777-4044
 PORTLAND, OR 97210 FAX 503-525-0137

SIDE VIEW



Attachment C

EnviroCare and Alpine Technology Mercury Proposal

Total Costs - EnviroCare

DIRECT CAPITAL COSTS		
1	Purchased Equipment Costs	
a.	Basic Equipment and Auxiliaries (A)	\$255,000
1)	Mercury Removal Unit - based on 16 modules	\$225,000
2)	New ID Fan - n/a	\$0
3)	Interconnecting Ductwork	\$30,000
4)	Drying Heat Exchanger - n/a	\$0
b.	Instrumentation and Controls (0.1 A)	\$25,500
c.	Freight (0.05 A)	\$12,750
d.	Sales Taxes (0.0625 A)	\$15,938
	TOTAL PURCHASED EQUIPMENT COST (B)	\$309,000
2	Direct Installation Costs	
a.	Foundations and Supports (0.12 B)	\$37,080
b.	Erection and Handling (0.4 B)	\$123,600
c.	Electrical (0.01 B)	\$3,090
d.	Piping (0.10 B)	\$30,900
e.	Insulation (0.05 B)	\$15,450
f.	Painting (0.01 B)	\$3,090
g.	Site Preparation and Demolition	\$50,000
h.	Building and Structural Modifications	\$50,000
	TOTAL DIRECT INSTALLATION COSTS	\$313,000
INDIRECT CAPITAL COSTS		
3	Engineering & Supervision (0.12*[B+C])	\$74,640
4	Construction & Field Expenses (0.1*[B+C])	\$62,200
5	Contractor Fees (0.10*[B+C])	\$62,200
6	Start-up (0.05 B)	\$15,450
7	Equipment Acceptance Test	\$25,000
8	Contingency (0.15*[B+C])	\$93,300
	TOTAL INDIRECT CAPITAL COST	\$333,000
TOTAL INSTALLED CAPITAL COST		\$955,000
DIRECT ANNUAL COSTS		
1	Operating Labor, (0 hr/yr x \$30/hr)	\$0
2	Supervisory Labor, 0.15 X (1)	\$0
3	Maintenance Labor (548 hr/yr x \$30/hr)	\$16,440
	Materials (100% of labor)	\$16,440
4	Utilities	
a.	Water (\$3.20/1000 gal)	\$0
b.	Electricity (\$0.0966/kwh)	\$0
5	Media Replacement (20 modules x \$8,628/module / 3 year frequency)	\$57,520
	TOTAL DIRECT OPERATING COSTS	\$90,000
INDIRECT OPERATING COSTS:		
6	Overhead - 60% Operating & Maintenance Labor	\$19,728
7	Property Tax - 0% Total Capital Cost	\$0
8	Insurance - 1% Total Capital Cost	\$9,550
9	Administration - 2% Total Capital Cost	\$19,100
10	Capital Recovery (5% Interest, 20 Years)	\$76,629
	TOTAL INDIRECT OPERATING COSTS	\$125,000
TOTAL ANNUALIZED OPERATING COST		\$215,000

Macheski, Michael

From: Marcel Pomerleau <marcel_pomerleau@envirocare.com>
Sent: Thursday, February 06, 2014 4:51 PM
To: Macheski, Michael
Subject: re: Emissions Control Help for a Sewage Sludge Incinerator

Follow Up Flag: Follow up
Flag Status: Flagged

Hi Mike,

EnviroCare nor Alpine offer disposal services for the modules. There are companies that specialize in removing hazardous waste. The lowest cost option appears to be landfill as hazardous waste - the modules can be categorized in the "Debris" category which allows for encapsulation and disposal in a lined landfill. Our analysis shows that the disposal cost is only 1-2% of the cost of a new module. We believe a complete exchange of modules can occur in less than a day.

I'll touch base with some of my contacts there in the Northeast to see if I can get you in touch with a company that could do this.

Maintenance

To keep the VenturiPak™ scrubber system at peak operating efficiency, inspections of the scrubber equipment should be performed as outlined below. Individual manufacturer's operation and maintenance manuals are typically provided in our O&M. There are no special tools required for the maintenance of the VenturiPak™ scrubber system. This system is very maintenance friendly, often going years without requiring any need to climb inside. If this system is under draft, the lances can be removed online if needed. However, If flow and pressure indicators are per design, there is really no need to remove any of the spray lances. The list below is a recommended preventative maintenance program to start, and its usually adjusted based on the specifics of the installation after startup.

Preventative maintenance programs are typically done by plant operators/maintenance staff. EnviroCare does recommend annual training/inspection trips by one of our service engineers to maintain optimal performance. That service is provided at our normal field service rates (about \$1,200/day plus expenses). Typical annual training/inspection trips are 3 - 4 days (which includes travel to and from site).

Please let me know if you have any other questions. Thank you.

Device	Maintenance Description	Frequency
Quench & Tray Irrigator Spray Lances	Remove lances and check nozzles	Quarterly
Impingement trays	Check trays for excessive build-up	Annually
Venturi Inlet Lances	Remove lances and check nozzles	Quarterly
Venturi tube assembly	Check flange and Morris	Annually

	coupling hardware	
Venturi tube assembly	Check throat nozzles	Quarterly
Venturi water pumps	See manufacturers recommendations	As required
Separator tray	Check trays for excessive build-up	Annually
Mesh pad mist eliminator	Inspect mesh pad for build up	Quarterly
Mesh Pad Spray Lances	Remove lances and check nozzles	Quarterly
Pressure gauges	Check for proper operating pressures	Daily
Y-strainers	Check and blow down	Weekly or as required
Basket strainers	Isolate, remove and clean	Weekly or as required

Regards,

[Marcel Pomerleau, Vice President - Sales](#)
[EnviroCare International](#)
507 Green Island Road
American Canyon, CA 94503 USA

707-638-6834 Direct
707-638-6800 Office
707-638-6898 Fax
www.envirocare.com

Begin forwarded message:

From: "Macheski, Michael" <MMacheski@trcsolutions.com>
Subject: RE: Emissions Control Help for a Sewage Sludge Incinerator
Date: February 6, 2014 12:22:28 PM PST
To: Marcel Pomerleau <marcel_pomerleau@envirocare.com>

Marcel,

As you can tell, this process is quite long as the borough is still reviewing the budgetary options we presented to them.

They're looking for some additional information related to maintenance and disposal. You mentioned in earlier communications a replacement set of modules on the upper end for this application would be \$170k. I also gleaned

from your expected and guaranteed lifespans that we can count on about 3 years between module change-outs. Do you have any idea how long a media change-out typically takes? Does EnviroCare or Alpine offer disposal of the old media as part of the purchase cost for the new modules? If not, do you have any idea who would and/or how much disposal might cost? Do you offer contracting for that maintenance?

Besides that media replacement maintenance, is there any other anticipated maintenance specifically for this APC equipment that needs to be planned for, especially that which would require a shutdown? *If* so, what would be the scope of that maintenance and how long would it typically take and do you offer contracting for any of it?

Thanks,

Mike

Michael R. Macheski
Project Engineer



521 Plymouth Road, Suite 116, Plymouth Meeting, PA 19462
P: 610.834.0490 x5931 | F: 610.834.1469 | C: 610.772.1473
e-mail: MMacheski@trcsolutions.com
[LinkedIn](#) | [Twitter](#) | [Blog](#) | [Flickr](#) | www.trcsolutions.com

*The Plymouth Meeting Office has Moved.
Note our new address. Phone and fax #s remain the same.*

From: Marcel Pomerleau [mailto:marcel_pomerleau@envirocare.com]
Sent: Monday, December 23, 2013 2:30 PM
To: Macheski, Michael
Cc: pbrady@alpinetechnology.com Brady
Subject: Re: Emissions Control Help for a Sewage Sludge Incinerator

Hi Mike,

Depending on the final size of each module, replacement modules are in the \$6,500 - \$8,500 range. Total set of replacement modules on the upper end (20 modules) would cost about \$170,000.00. For our installations, we don't need to reheat the gas stream and total pressure drop is about 0.625" WC - 1.5" WC (based on four to five layers) which can usually be absorbed by the existing system.

Reviewing the numbers from this application, the facility will need 59% reduction just to meet 0.037 mg/dscm. To reach your request of 0.025 mg/dscm we are talking about ~72% reduction. To be transparent and clear, we believe this can be achieved with our approach but we would consider that outside of our "target" facility. We are negotiating several pilot projects that will demonstrate in excess of 75% reduction, but there is no guarantee those pilot projects move forward.

We'd be happy to discuss the options for piloting this approach at your customers WWTP.

Please let us know if you have any other questions.

Best Regards,

Marcel Pomerleau, Vice President - Sales
EnviroCare International
507 Green Island Road
American Canyon, CA 94503 USA

On Dec 23, 2013, at 10:46 AM, Macheski, Michael wrote:

Can you expand on why the operational costs and replacement costs over the lifetime may be smaller? Your email on 12/11 referenced 18 to 24 months for a guarantee and expected lifespans double that. So maybe 3 years. Then we'd have to replace all the layers, say 5, at 4-6 modules per layer, say 4. So what is the cost to replace the 20 modules every 3 years, or simply the cost per module?

From: Marcel Pomerleau [mailto:marcel_pomerleau@envirocare.com]
Sent: Wednesday, December 18, 2013 1:00 PM
To: Macheski, Michael
Cc: pbrady@alpinetechnology.com
Subject: Re: Emissions Control Help for a Sewage Sludge Incinerator

Hi Mike,

I'm not sure that we would categorize this technology as superior to other forms, but there are benefits for this technology in the market. It certainly will not make sense for everyone. The target facilities would have limited space for additional equipment, would need low to moderate improvement on mercury emissions, and we believe cost is significantly lower. **We believe cost is significantly lower when considering operational costs and replacement costs over the lifetime of the equipment.** The major difference between this technology and others being offered, is the ability to retrofit existing wet scrubbers, or supply it with a new VenturiPak Scrubber in a saturated environment. Of course, a separate vessel after the scrubber or WESP can be considered as well without the need for reheating the gas stream. This technology prefers a moist, saturated, and cool environment so reheating is not necessary or required.

SO₂ reduction occurs because of the chemistry converting SO₂ to H₂SO₄ in the sorbent. SO₂ reduction is really secondary in this application because compliance for MACT 129 rules should be happening in the scrubber, and if its not, simple improvements can be made.

Pressure drop is minimal at about 1/3" WC per layer of module.

Guarantees on mercury removal are typically in the 18 month range (+/-) with expectations that it will meet the requirements for much longer (2x +) with module rotations after 8 - 12 months. All guarantees are based on the assumption that the MHF/FBI are running 24/7, 365 days a year at the specified inlet loading (average).

For sizing, we would need complete process flow information. The modules are all custom in this market for the exact needs of each customer. For 19,000 ACFM, we'd be talking about a 8'0" ID vessel, that would require at minimum 12" of head space for each layer of mercury modules (typically 4 - 6 modules per layer). For a 4 or 5 layer system, the vessel would be engineered for easy access to the modules for rotation or replacement. Please see the attached conceptual GA. This can be modified any number of ways to meet the needs of the customer.

Please let me know if you have any other questions. Thank you Mike.

Regards,

Marcel Pomerleau, Vice President - Sales
EnviroCare International
507 Green Island Road
American Canyon, CA 94503 USA

707-638-6834 Direct
707-638-6800 Office
707-638-6898 Fax
www.envirocare.com

On Dec 18, 2013, at 8:08 AM, Macheski, Michael wrote:

Maybe also some quick bullet points on why this polymer sorbent technology would be superior to other more traditional forms of activated carbon capture. The cost is certainly higher, but is it longer service life because it can hold on to more Hg before it needs to be regenerated or replaced? Is it lower pressure drop than most carbon media? The additional SO₂ reduction that accompanies it?

From: Macheski, Michael
Sent: Wednesday, December 18, 2013 10:47 AM
To: 'pbrady@alpinetechnology.com'
Cc: Marcel Pomerleau (marcel_pomerleau@envirocare.com) (marcel_pomerleau@envirocare.com)
Subject: RE: Emissions Control Help for a Sewage Sludge Incinerator

Also, Marcel said the modules could be guaranteed for somewhere between 18 and 24 months. Is that guarantee that mercury can be reduced to the requested guarantee limit of 0.025 mg/dscm at 7% O₂? Again for reference, the current emission average is 0.0899 mg/dscm at 7% O₂, so that would require a 59% reduction to achieve.

From: Macheski, Michael
Sent: Wednesday, December 18, 2013 10:44 AM
To: 'pbrady@alpinetechnology.com'
Subject: RE: Emissions Control Help for a Sewage Sludge Incinerator

One piece of information I didn't get from Marcel was the size of the whole thing, with the 4 layers and 16 modules total. Or just what is the size per module?

From: pbrady@alpinetechnology.com [<mailto:pbrady@alpinetechnology.com>]
Sent: Tuesday, December 17, 2013 6:46 PM
To: Macheski, Michael
Subject: RE: Emissions Control Help for a Sewage Sludge Incinerator

Hi Mike,

Marcel brought me up to speed with your recent exchanges.

Anything I can do for you before the holidays?

Thanks

Peter

From: pbrady@alpinetechnology.com
Sent: Tuesday, December 03, 2013 2:10 PM
To: 'Macheski, Michael'
Cc: Marcel Pomerleau (marcel_pomerleau@envirocare.com)
Subject: RE: Emissions Control Help for a Sewage Sludge Incinerator

Thanks Mike,

The Kombisorbon system is the premier technology for very high mercury capture, and has been customized for wastewater incineration over a period of 30 years. The designers developed it initially to overcome the disadvantages of carbon injection – large footprint, high disposal cost of contaminated material, large consumption of carbon. Then they developed special materials of construction, and adsorbants, for the wastewater environment. For these high performance duties the capital cost is significant, but the operating cost is considerably lower than injection.

For the moderate capture required for existing incinerators, the EnviroCare module is very cost effective.

Marcel from EnviroCare will call you this afternoon to discuss the module, and also some other observations he had regarding the emissions in general.

Peter

From: Macheski, Michael [<mailto:MMacheski@trcsolutions.com>]
Sent: Tuesday, December 03, 2013 1:46 PM
To: pbrady@alpinetechnology.com
Cc: Marcel Pomerleau (marcel_pomerleau@envirocare.com)
Subject: RE: Emissions Control Help for a Sewage Sludge Incinerator

Peter,

I have read up on the VenturiPak scrubber, the mercury control modules, and the polishing WESPs. It seems for mercury reduction all we might need are these add on ECI/W.L. Gore modules. The scrubber or WESP won't do anything additionally novel that the existing ones don't.

For the mercury control modules, the pilot trial attachment showed 65% reduction of mercury across a single module and claimed that putting them in series should reduce it even further. As of that publication, modules in series had not yet been trialed. Is there any data to support that now? It's intriguing that these modules supposedly work on both the ionic and the elemental species. What is the pressure drop per module? Ballpark price per module? Why is it more effective than the Kombisorbon system I see on the Alpine website?

Thanks,

Mike

Michael R. Macheski

Project Engineer

<image001.jpg>

521 Plymouth Road, Suite 116, Plymouth Meeting, PA 19462

P: 610.834.0490 x5931 | F: 610.834.1469 | C: 610.772.1473

e-mail: MMacheski@trcsolutions.com

[LinkedIn](#) | [Twitter](#) | [Blog](#) | [Flickr](#) | www.trcsolutions.com

The Plymouth Meeting Office has Moved.

Note our new address. Phone and fax #s remain the same.

From: pbrady@alpinetechnology.com [<mailto:pbrady@alpinetechnology.com>]

Sent: Wednesday, November 27, 2013 10:03 AM

To: Macheski, Michael

Cc: Marcel Pomerleau (marcel_pomerleau@envirocare.com)

Subject: RE: Emissions Control Help for a Sewage Sludge Incinerator

Hi Mike,

Here is a link to the EnviroCare scrubber and WESP:

<http://www.envirocare.com/newsletter/SSINewsletter/ssiupdate.html>

Where there is limited space, and where a WESP is also needed, one option is to sit a smaller WESP on top of the scrubber. A smaller unit is often possible due to the high performance of the VenturiPak.

The scrubber mercury module was configured to meet the new EPA rules for moderate capture for existing units, and attached is a paper based on actual pilot testing on a wastewater fluid bed incinerator. One municipal client has since placed an order, and several more are in active discussion.

We have learned over 20 years that Murphy's law rules with respect to wastewater projects, and this applies especially to merchant facilities where sludge is imported. One reason for requesting additional data is to investigate what is actually being captured in the WESP. By the way, it was also because of Murphy's law that EnviroCare tested the module at a wastewater facility, despite the fact that there was a history of good industrial performance.

Let me know if you need sample specifications and drawings.

Thanks

Peter

From: Macheski, Michael [<mailto:MMacheski@trcsolutions.com>]

Sent: Wednesday, November 27, 2013 8:36 AM

To: pbrady@alpinetechnology.com

Subject: RE: Emissions Control Help for a Sewage Sludge Incinerator

Yes, they were shut down about 10 years ago and replaced by a single 3.5 dry ton per hour fluidized bed sewage sludge incinerator.

I will gather the additional needed info, but it sounds like that's more for refining the ballpark number further. In the short term, I will look to find out more about the Venturipak scrubber and mercury control module for it on the website. If you have any additional literature on the technology other than what I can find from the website, please forward it.

From: pbrady@alpinetechnology.com [<mailto:pbrady@alpinetechnology.com>]
Sent: Tuesday, November 26, 2013 6:25 PM
To: Macheski, Michael
Cc: Marcel Pomerleau (marcel_pomerleau@envirocare.com)
Subject: FW: Emissions Control Help for a Sewage Sludge Incinerator

Thanks Mike,

Please see response below from Marcel at EnviroCare. The mercury module is an integral part of their scrubber and is designed for the moderate capture requirement for existing fluid bed incinerators.

As an aside, are the two old multiple hearth furnaces shut down at Naugatuck?

Best wishes.

Peter

Peter Brady

Alpine Technology, Inc.
Tel 512 328 5829
Cell 512 619 5916
www.AlpineTechnology.com

From: Marcel Pomerleau [mailto:marcel_pomerleau@envirocare.com]
Sent: Tuesday, November 26, 2013 4:43 PM
To: pbrady@alpinetechnology.com
Subject: Re: Emissions Control Help for a Sewage Sludge Incinerator

Hi Peter,

EnviroCare typically meets the "existing" FBI limits with a Venturipak Scrubber, and in this case we'd add a stage for the mercury control modules. Each application is unique, but we can provide ball park pricing. The following additional information will be needed for the next step:

1. Available Pressure Drop
2. Sludge metals concentrations (Typically tested monthly)
3. Gas composition entering the scrubber (% vol or % wt.)
4. Current Scrubber Emissions (prior to the WESP)
5. Caustic use (if any)
6. maximum SO₂ and HCl in let loads expected.

Ball park pricing with mercury control is about \$750K - \$800K for a 8.5' Ø Scrubber.

Regards,

[Marcel Pomerleau, Vice President - Sales](mailto:marcel_pomerleau@envirocare.com)
EnviroCare International
507 Green Island Road
American Canyon, CA 94503 USA

From: Macheski, Michael [<mailto:MMacheski@trcsolutions.com>]
Sent: Tuesday, November 26, 2013 12:46 PM
To: pbrady@alpinetechnology.com
Subject: Emissions Control Help for a Sewage Sludge Incinerator

Peter,

I got your contact info from Rich Kratz. I'm working with him on a consulting project for a wastewater treatment plant's sewage sludge incinerator. They are facing some new stack emissions limits and will need some modified or additional APC equipment to meet them. The attached process specification outlines the current and target emissions, along with some other basic information. Existing APC is a wet scrubbing system and a WESP. Note that the existing WESP is somewhere between poor and fair condition.

One of the biggest control issues we see is mercury, which really can't be removed with the current equipment. Much of what I've seen points to some sort of carbon capture, whether it be carbon injection then capture at a baghouse or just a fixed carbon bed. I see that the Kombisorbon carbon adsorption system is a solution for mercury capture, but we are open to all options.

I'm looking for a quick proposal on what you would recommend and a budgetary number. I'm not looking for a full quote at this point, just a ballpark number to go with a recommended solution and we might decide to proceed farther from there. I'm looking for something back by the end of next week (1st week in December).

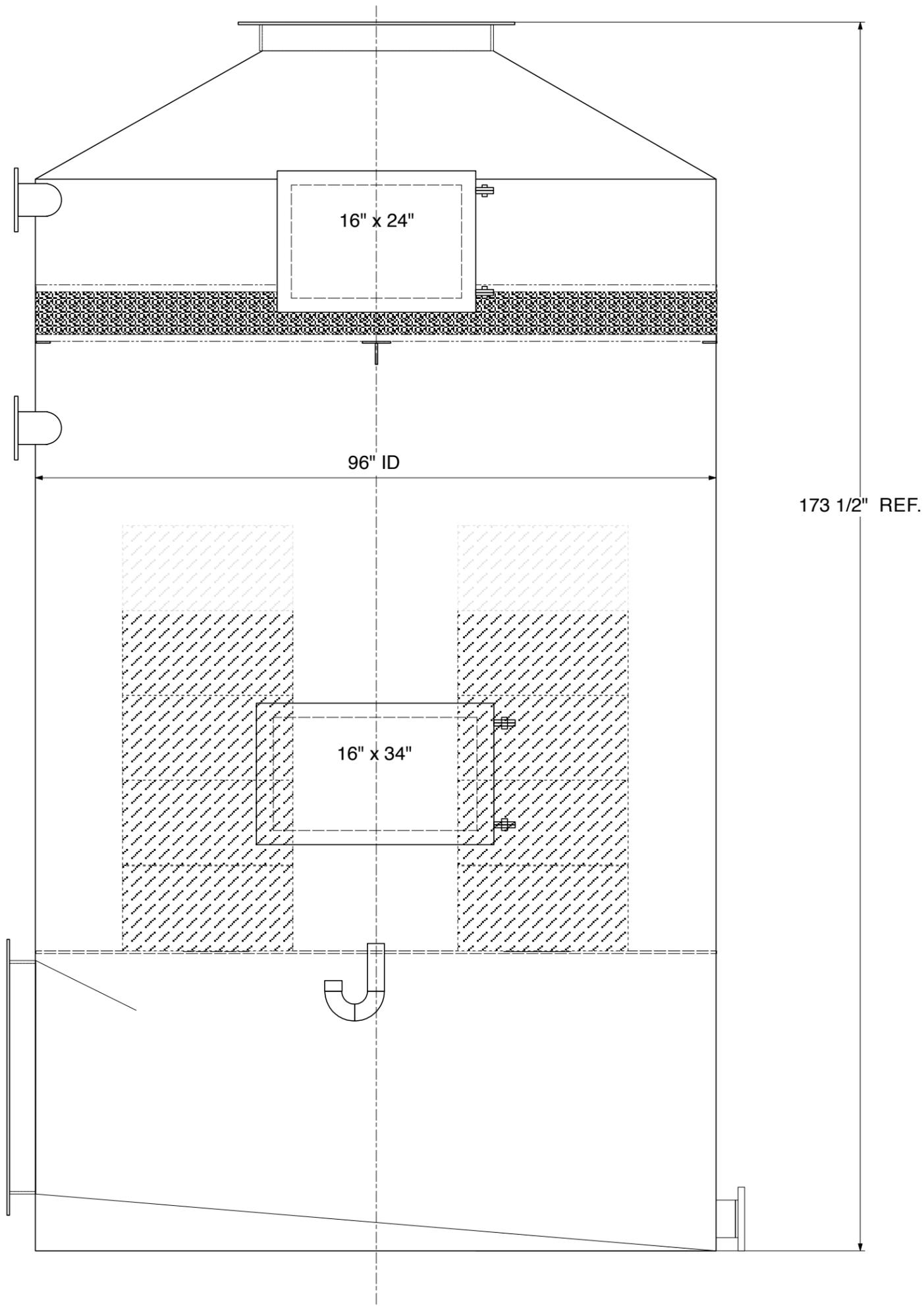
Thanks in advance and let me know what other info is needed to come up with something,

Mike

Michael R. Macheski
Project Engineer

[[cid:image001.jpg@01CE52F9.00341270](#)]

521 Plymouth Road, Suite 116, Plymouth Meeting, PA 19462
P: 610.834.0490 x5931 | F: 610.834.1469 | C: 610.772.1473
e-mail: MMacheski@trcsolutions.com<<mailto:MMacheski@trcsolutions.com>>
LinkedIn<<http://www.linkedin.com/company/trc-companies-inc>> |



ELEVATION VIEW
 PRELIMINARY GENERAL ARRANGEMENT
 NOT FOR CONSTRUCTION

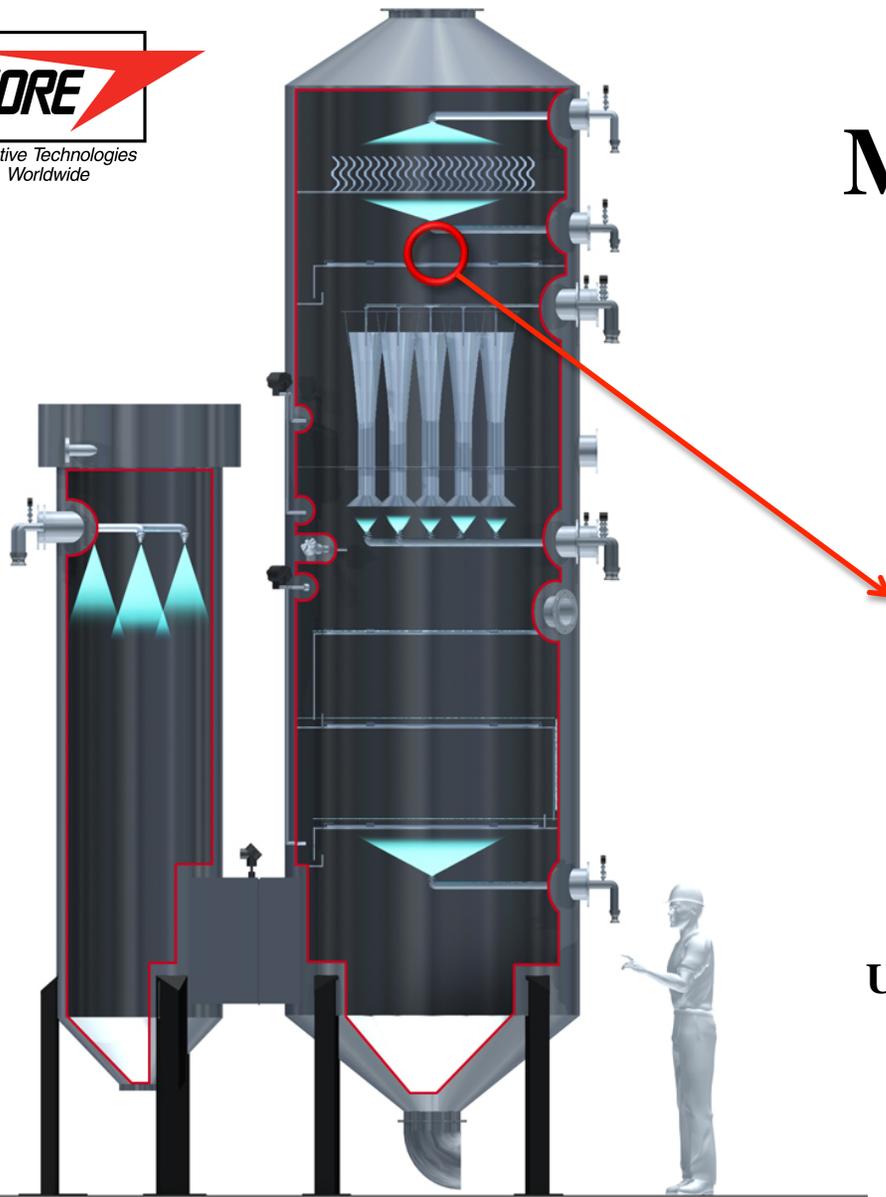
CONCEPTUAL ONLY
 DO NOT USE FOR FABRICATION

<p>NOTES</p> <ol style="list-style-type: none"> ALL PROCESS GAS CONTACT SURFACES TO BE 316L-SS UON. SHELL MATERIAL TO BE 7GA 316L-SS. MODULE DIAPHRAGMS 1/4" 316-SS MERCURY MODULES WILL BE INSTALLED BY CUSTOMER MESH STYLE MIST ELIMINATOR WILL BE FACTORY INSTALLED. ALL MANWAYS SHALL BE QUICK OPENING AND HINGED FROM THE RIGHT SIDE. ALL SPRAY LANCES AND FLEXIBLE HOSE ASSEMBLIES WILL BE FURNISHED LOOSE FOR FIELD INSTALLATION. SUPPORT STRUCTURES TBD 	<p align="center">DOCUMENT RELEASE</p> <input type="checkbox"/> Preliminary Issue <input type="checkbox"/> Certified For Construction <input type="checkbox"/> For Customer Approval <input type="checkbox"/> As Built BY _____ DATE _____				<p align="center">EnviroCare International</p> <p align="center">507 Green Island Road, American Canyon, CA 94503 Tel: 707/638.6800 Fax: 707/638.6898</p>																																						
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VenturiPak™ Scrubber With Integrated Mercury Removal



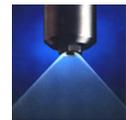
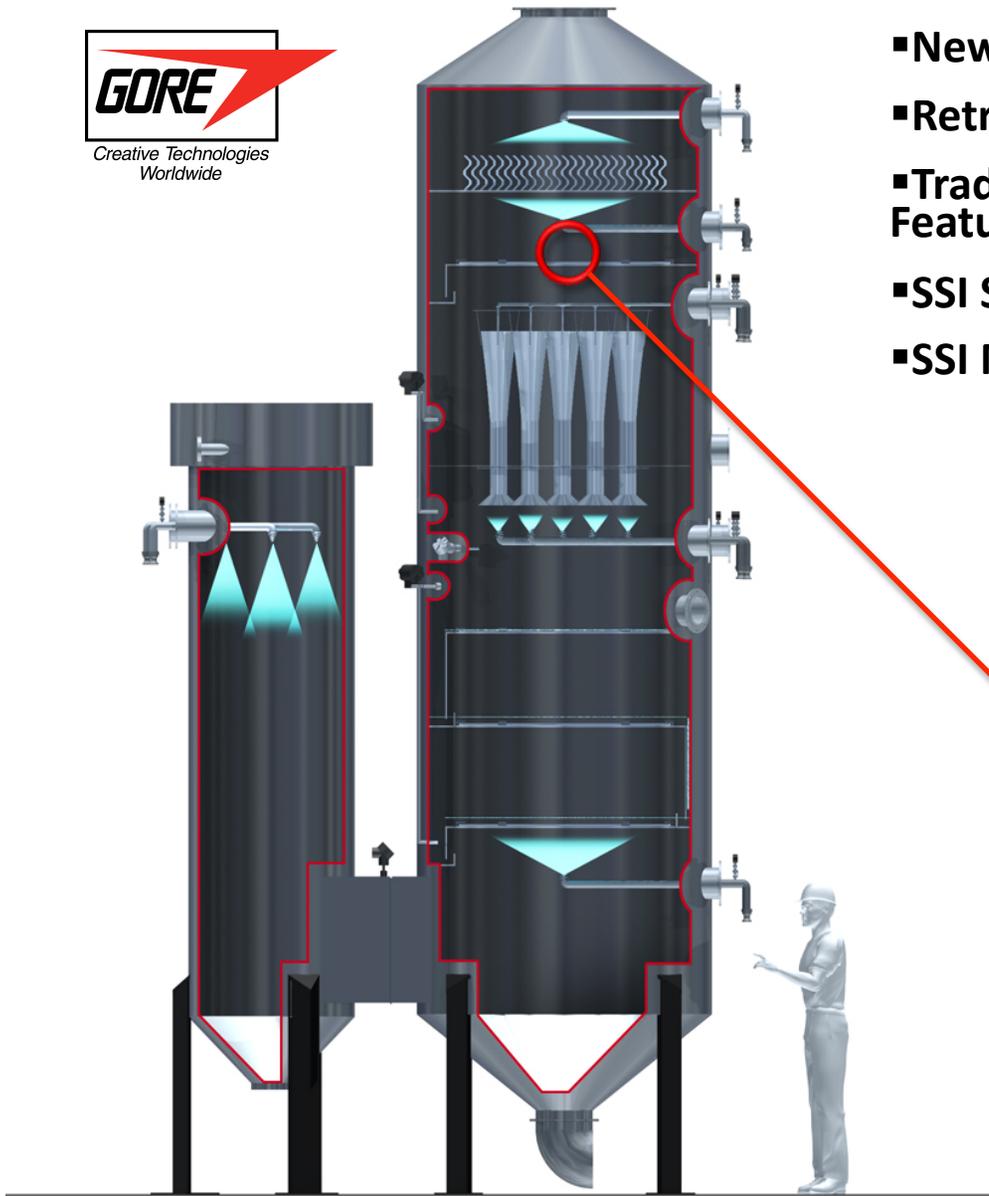
Using W.L. Gore Developed SPC Material

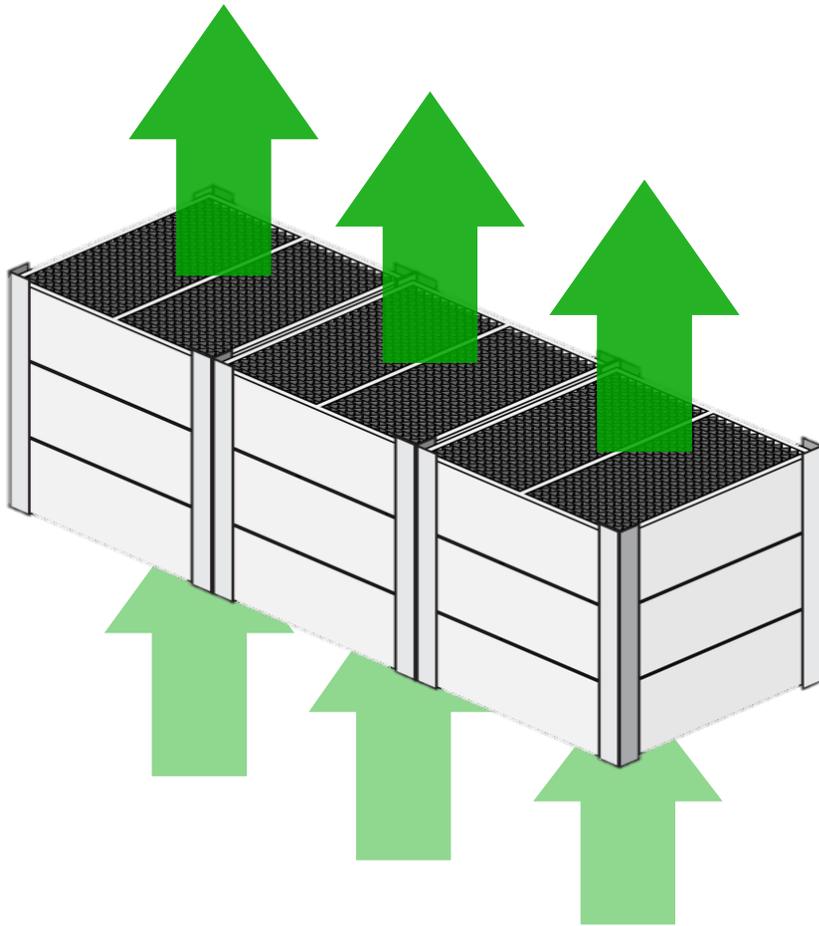




VenturiPak™ Scrubber

- New VenturiPak Scrubbers
- Retrofits of Existing VenturiPak Scrubbers
- Traditional Scrubber Upgrades with this Feature a Consideration
- SSI Specific Testing Completed
- SSI MACT Level Compliance





Material Innovation by Gore

Sorbent Polymer Composite (SPC) Material

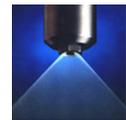
- Efficiently captures gas-phase mercury species
- High capacity for mercury storage
- Acid gases are converted into aqueous solution and expelled to SPC materials outer surface.
- SO₂ reduction is co-benefit of the SPC material

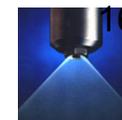
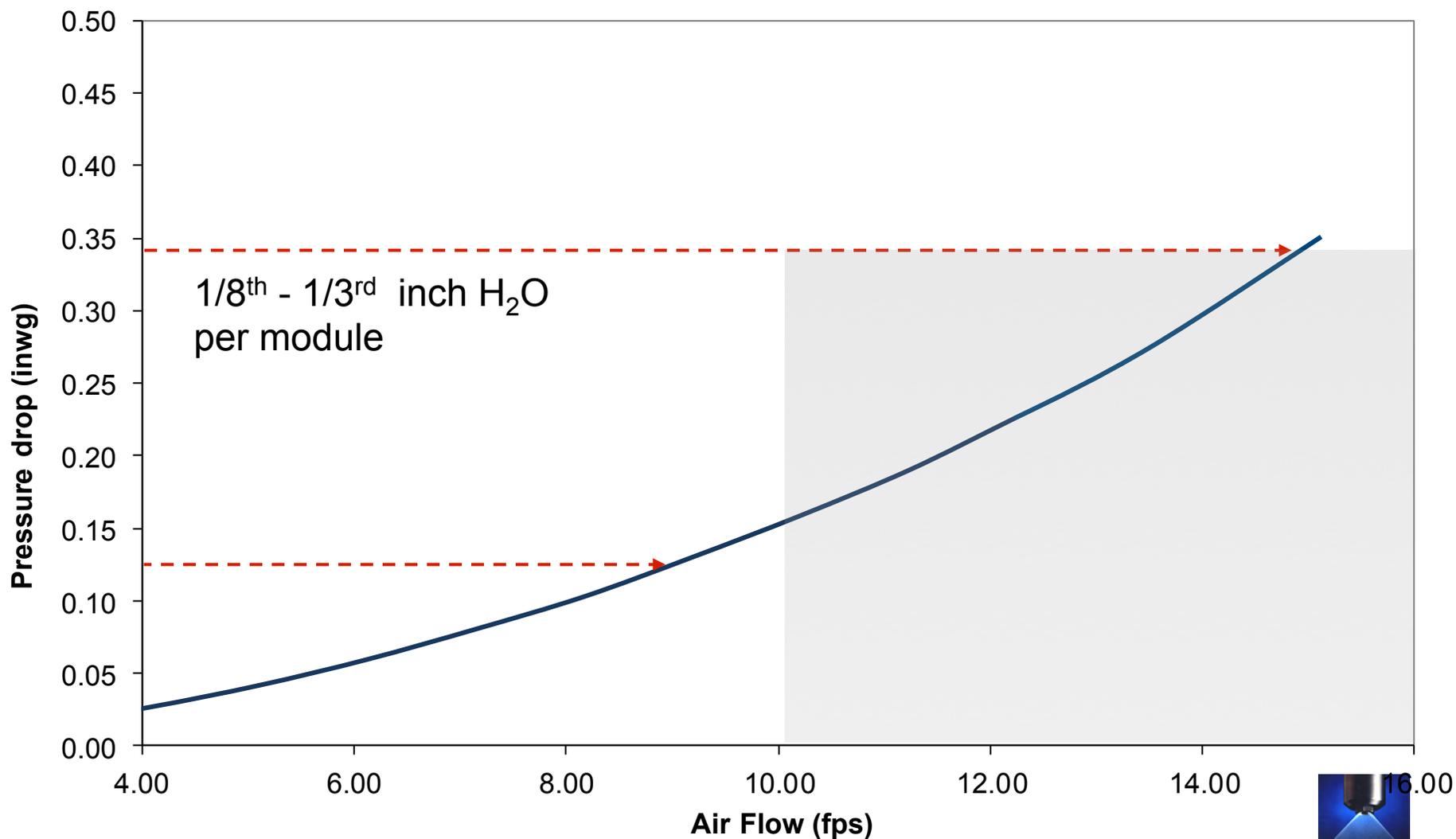
Simple

- No adjustments
- No moving parts
- No regeneration
- VenturiPak provides necessary pre-conditioning

Cost-Effective

- Low operating cost
- Low pressure drop
- Zero-footprint (in-scrubber)
- Some SO₂ reduction





Attachment D

Bionomic Industries WESP Proposal

Total Costs - Bionomic Industries

	316 SS Internals and Housing	AL6XN Internals and FRP Housing	Hastelloy C-276 Internals and FRP Housing
DIRECT CAPITAL COSTS			
1 Purchased Equipment Costs			
a. Basic Equipment and Auxiliaries (A)	\$370,000	\$512,000	\$660,000
1) WESP	\$360,000	\$502,000	\$650,000
3) Interconnecting Ductwork	\$10,000	\$10,000	\$10,000
b. Instrumentation and Controls (0.1 A)	\$37,000	\$51,200	\$66,000
c. Freight (0.05 A)	\$18,500	\$25,600	\$33,000
d. Sales Taxes (0.0625 A)	\$23,125	\$32,000	\$41,250
TOTAL PURCHASED EQUIPMENT COST (B)	\$449,000	\$621,000	\$800,000
2 Direct Installation Costs			
a. Foundations and Supports (0.12 B)	\$53,880	\$74,520	\$96,000
b. Erection and Handling (0.4 B)	\$179,600	\$248,400	\$320,000
c. Electrical (0.25 B)	\$112,250	\$155,250	\$200,000
d. Piping (0.10 B)	\$44,900	\$62,100	\$80,000
e. Insulation (0.05 B)	\$22,450	\$31,050	\$40,000
f. Painting (0.01 B)	\$4,490	\$6,210	\$8,000
g. Site Preparation and Demolition	\$50,000	\$50,000	\$50,000
h. Building and Structural Modifications	\$50,000	\$50,000	\$50,000
TOTAL DIRECT INSTALLATION COSTS (C)	\$518,000	\$678,000	\$844,000
INDIRECT CAPITAL COSTS			
3 Engineering & Supervision (0.12*[B+C])	\$116,040	\$155,880	\$197,280
4 Construction & Field Expenses (0.1*[B+C])	\$96,700	\$129,900	\$164,400
5 Contractor Fees (0.10*[B+C])	\$96,700	\$129,900	\$164,400
6 Start-up (0.05 B)	\$22,450	\$31,050	\$40,000
7 Equipment Acceptance Test	\$25,000	\$25,000	\$25,000
8 Contingency (0.15*[B+C])	\$145,050	\$194,850	\$246,600
TOTAL INDIRECT CAPITAL COST	\$502,000	\$667,000	\$838,000
TOTAL INSTALLED CAPITAL COST	\$1,469,000	\$1,966,000	\$2,482,000
DIRECT ANNUAL COSTS			
1 Operating Labor, (0 hr/yr x \$30/hr)	\$0	\$0	\$0
2 Supervisory Labor, 0.15 X (1)	\$0	\$0	\$0
3 Maintenance Labor (548 hr/yr x \$30/hr)	\$16,440	\$16,440	\$16,440
Materials (100% of labor)	\$16,440	\$16,440	\$16,440
4 Utilities			
a. Water (\$3.20/1000 gal * 60 gal/min * 525,600 min/yr)	\$100,915	\$100,915	\$100,915
b. Electricity (\$0.0966/kwh * 72 kwh * 24 hr/day * 365 day/yr)	\$60,928	\$60,928	\$60,928
TOTAL DIRECT OPERATING COSTS	\$195,000	\$195,000	\$195,000
INDIRECT OPERATING COSTS:			
5 Overhead - 60% Operating & Maintenance Labor	\$19,728	\$19,728	\$19,728
6 Property Tax - 0% Total Capital Cost	\$0	\$0	\$0
7 Insurance - 1% Total Capital Cost	\$14,690	\$19,660	\$24,820
8 Administration - 2% Total Capital Cost	\$29,380	\$39,320	\$49,640
9 Capital Recovery (5% Interest, 20 Years)	\$117,873	\$157,752	\$199,156
TOTAL INDIRECT OPERATING COSTS	\$182,000	\$236,000	\$293,000
TOTAL ANNUALIZED OPERATING COST	\$377,000	\$431,000	\$488,000



BIONOMIC INDUSTRIES

"Superior Engineered Pollution Control Systems With Unequaled Performance"

Bionomic Industries Inc. Proposal Number 040714-02DM

Proposal Issued to: **TRC SOLUTIONS**
521 Plymouth Road
Suite 116
Plymouth Meeting, Pa 19462

Attention: Michael R. Macheski
Project Engineer

Phone: 610-834-0490 ext. 5931

E-mail: MMacheski@trcsolutions.com

Proposal Issued By: David Meier
Bionomic Industries Inc.

Proposal for: **SLUDGE INCINERATOR**
WET Electrostatic Precipitator System

Date: April 7, 2014

PROPOSAL CONTENTS

SECTION 1: DESCRIPTION

General Description

Equipment Recommendations

SECTION 2: DESIGN DATA & SCOPE OF SUPPLY

Equipment Supply

Performance Conditions

Operating Conditions

Engineering Services Furnished by Bionomic Ind.

Equipment and Services to be provided by others

SECTION 3: PERFORMANCE GUARANTEE

Performance Guarantee

SECTION 4: PRICES & TERMS

Prices

Delivery Schedule

Field Services

Terms of Payment

Terms & Conditions

SECTION 1 DESCRIPTION

GENERAL:

Bionomic Industries was established in 1980 and has been engaged in design, supply and installation of air pollution control equipment and systems for industrial applications. Bionomic Industries is known for its technical expertise and high quality of work in the design and supply of wet scrubbers, wet electrostatic precipitators, and integrated air pollution control systems. During the past 30 years Bionomic Industries has supplied thousands of successful gas cleaning systems worldwide for various applications in pulp & paper, incineration, iron & steel, refineries, chemical and pharmaceutical industries, mining, etc.

Bionomic Industries is one of the few pollution control companies that have been under continuous ownership during this period and one of the few companies with experience and expertise in the design and supply of the complete package requested.

Our technical staff consists of engineers and draftsmen with hundreds of years combined experience, with the average experience level in the pollution control industry of thirty (30+) years.

The main purpose of the proposed Air Pollution Control System is to control residual particulate including heavy metals from a sludge incinerator exhaust stream

The package includes a Series HEI wet electrostatic precipitator (WESP) system with accessories, including instrumentation.

The recommended components are part of a proven economic, effective and maintenance free operating system. The equipment is designed for a 24hr. /day, 365day/year operation with no more than 1 hour /week preventive maintenance required.

There are numerous successful industrial applications using the Bionomic WESP.

EQUIPMENT RECOMMENDATION:

Wet Electrostatic Precipitator

The Bionomic Industries WESP is typically the final particulate removal component of an Air Pollution Control train, removing the remaining sub-micron particulate exiting the downstream scrubber.

The WESP is the ultimate sub-micron removal device and operates at a low-pressure drop.

The WESP design anticipates and overcomes the problem of current suppression, expected with collection of sub-micron particles.

This proposed system is a modular design that contains tubular components that typically use the entrained scrubber droplets as an irrigation medium.

The saturated flue gas enters a vertical tube collector in which a generated high intensity corona charges the droplets and incoming particles.

Both the particulate and water droplets absorb electrons produced in the corona field and migrate to the grounded collecting tube walls, forming the irrigation film.

This film gradually washes collected particulate from the entire tube by gravity, before draining into the sump for removal to waste.

The corona-producing discharge electrodes use rectified high voltage, dc current and are a rigid tube type design; thereby eliminating the high maintenance steadying devices.

Each collecting tube has one discharge electrode, which is centered and plumbed during initial commissioning.

DESCRIPTION (Cont'd)

EQUIPMENT RECOMMENDATION: continued

Wet Electrostatic Precipitator-continued

The corona-producing discharge electrodes are a multi-point, rigid tube type design. Each collecting tube has one discharge electrode. Each electrode is supported from an individual centering and plumb adjuster.

- **Design Advantage-** no bottom/top adjustment frame, thereby eliminating these high maintenance steadying devices and removing a source of collected particulate accumulation.
- **Design Advantage-** sharp corona generating areas of the rigid mast (welded) electrodes are produced by laser cutting, resulting in longer electrode life and a more uniform electrical field, especially when compared to an assembled star/spacer design.

The high voltage transformer-rectifier package uses a **Switch Mode Power Supply** which converts AC to high voltage DC with an automatic voltage control system. This unit will produce the highest secondary power levels while maintaining the lowest spark rate. The control logic helps to achieve longer periods of high corona intensity; hence, higher removal efficiencies. The controller will have the capacity to transmit operating data to a plant DCS.

Switch Mode Power Supply Description

The vast majority of Electrostatic Precipitator Power Supplies in use today operate at a fixed frequency of 60 Hz. In recent years Switch Mode Power Supplies have been used for ESP's with the goal of improving ESP field collection efficiencies.

The difference in performance is almost completely due to the low ripple voltage delivered by such power supplies.

The Mid Frequency Integrated Power Supplies (MFPS) abilities provide distinct advantages to precipitator operation and maintenance.

A three phase AC main power source is fed into a rectifier and filter combination to create a relatively smooth DC power source. This DC source is then fed into an integrated gate bipolar transistor (IGBT) full wave bridge circuit where it is converted into a high frequency AC waveform.

The MFPS switch module is assembled on a steel panel that occupies roughly the same space as an existing SCR module. Mounted on a common heat sink are the rectifiers, the filter assembly, IGBT Modules, and IGBT Gate drivers.

The controller outputs a predetermined frequency to fire the IGBT's. Feedback control uses mA and KV feedback for voltage, current and spark/arc control. The higher frequency permits a CLR of much lower mH value to achieve protective current limiting as well as waveform shaping.

The controller uses interrupt driven spark detection and control allowing response to spark and arc disruptions to be processed in micro-second response time. Such rapid response reduces the intensity of such disruptions and the damage arcing can do to ESP internals and insulators.

Transformer Rectifier Description

The MFPS output frequency AC source created by the control circuit is fed into a new, smaller and lighter specially designed, high frequency transformer rectifier. Generally, a Switch Mode Transformer Rectifier is approximately half the size of a 60 Hz transformer. These systems, typically, do not require active ventilation fans be used with the TR.

DESCRIPTION (Cont'd)

EQUIPMENT RECOMMENDATION: continued

Wet Electrostatic Precipitator-continued

Advantages of Switching Power Supplies

- **Higher power levels**

The efficiency of an ESP field is closely related to the level of average power that can be delivered to the charging field. The power level that can be delivered to an ESP field, however, is almost always limited by the spark-over voltage that the field can withstand. Sparking and arcing typically occur at the peak of the KV waveform. The KV ripple, as well the ratio of the peak voltage to the average voltage is reduced through the use of higher switching frequencies. Due to the steep nature of an ESP V-I curve; a relatively small increase in KV could result in a significant increase in current creating a stronger corona (electron field)

- **Faster spark control**

Unlike SCRs that depend upon the natural zero crossing of the 60 Hz feed signal to turn off, IGBT control permits instantaneous (micro-second) turn off. This ability provides the means for drastically reducing the energy delivered to the ESP during sparking and thus should reduce internal component erosion and insulator tracking.

- **Higher Collection Efficiency**

Because the frequency of the DC voltage to the precipitator has been increased the ripple voltage is insignificant when compared to the peak DC voltage level.

Because the ripple voltage is less, the precipitator can be operated at a much higher average voltage before flashover occurs. An increase in voltage should result in an increase in precipitator collection efficiency, and decrease in outlet emissions.

- **Energy Savings**

The response time of a typical SCR controlled transformer rectifier can be no faster than 8.33 milliseconds. However, at the higher frequency operating level of the MIPS controller, the response time can be as quick as 100 microseconds, an order of magnitude quicker.

This quicker response time allows the control to reduce the short circuit inrush current created by arcing in the precipitator. Short circuits created by arcs simply send current to ground and waste power. By reducing these arcs, power is conserved.

- **High Power Factor**

The three phase input permits a better power factor as well as better load balance.

If the collection rate exceeds the irrigation rate, the automated flushing system can be energized to clean the collecting tubes. The flushing cycle is intermittent, on-line and field adjustable and the hydraulic nozzles are internally located above the collecting tubes.

The cleaned gases exit through the outlet plenum.

TRC-WESP

DESIGN DATA & SCOPE OF SUPPLY

PERFORMANCE CONDITIONS

Per supplied data:

INLET CONDITIONS:

Gas Flow (design)	22600	acfm
Gas Temperature	85	°F
Gas Stream Composition:		
Particulate (max.)	2.18	lb/h
Lead	0.05	lb/h

OUTLET CONDITIONS:

Gas Flow (design)	23200	acfm
Gas Temperature	90	°F
Gas Stream Composition:		
Particulate (max.)	10	mg/m ³
Lead	0.0065	mg/m ³
Pressure Differential	≤3 "	w.c

OPERATING DATA:

Water Flows

WESP Wash Rate, as required	60	gpm @ 30psi
Duration, est	3	min/day

DESIGN DATA & SCOPE OF SUPPLY (Continued)**Equipment Data:****WESP:**

Quantity	1	
Specifications:		
Module Housings		
Material of Construction	316	stainless steel
Thickness	3/16	in.
Bottom Type	Cone	
Internals		
Material of Construction	316	stainless steel
Module Dimensions		
Diameter	8	ft.
Height	32	ft.
Vessel Height w/support legs	36	ft.
Inlet/Outlet Duct Diameter	4.25	ft
Access Door	2	units
WESP Ionizing System:		
No. Of Discharge Electrodes	60	
Material of Construction	316	stainless steel
Type	solid mast, multipoint	
Electrode Support	upper frame only	
Electrode Alignment	individual plumb	
Number of Insulators	5	
Insulator Purge Air Volume	600	acfm
Insulator Purge Air Heater	1	
No. Of Safety Key Interlocks	7	
WESP Collection system:		
No. Of Collecting Electrodes	60	
Material of Construction	316	stainless steel
WESP Collector Tube Design:	hexagonal	
Collector Tube Length	12	ft
Collector Tube width	10	in
Collecting Area, total	2060	ft ²
Specific Collection Area,	91	ft² / 1000 acfm

DESIGN DATA AND SCOPE OF SUPPLY- (CONT.)**EQUIPMENT DATA DETAILS****WET ELECTROSTATIC PRECIPITATOR (continued):**

WESP High Frequency Power Supply:	1	unit
Primary Side:		
Electrical Source	480 v, 3 ph, 60 Hz	
Rated Input Current, each	48	amps
Secondary Side:		
Average Voltage	70	kVdc
Design Current, each	1000	ma
Power Factor	0.94	
Operating Power	42	Kw
Purge Air System:		
Blower	1	unit
Blower Motor, each	3	hp @ 460/3/60
Heat source	Electric	@ 460/3/60
Heater	1	unit
Heater Rating	30	Kw
WESP power usage, total (est.)	72	Kwh
Weight	25,000	lbs
Weight with power supply	27,000	lbs

CONTROL PANEL

	Pre-wired	
Quantity	1	unit
Enclosure	Nema	4

INSTRUMENTATION & CONTROLS

Description	Quantity	Location
WESP Automatic Voltage Controller, with remote display	1	control panel
Wash system timer	1	control panel

ENGINEERING SERVICES FURNISHED BY BIONOMIC INDUSTRIES INC.

Bionomic will furnish the following engineering and drawings for the proposed system as follows:

- One (1) set of prints as ACAD-2008 submittal for approval consisting of:
 - Plan, elevation and dimensional drawings along with weights of the APC system
 - Instrumentation, P & I diagram
- One (1) set of final drawings as ACAD-2008 submittal
- One (1) set of operating & maintenance manual (hard copy) and one (1) CD, instructions in English and Spanish

EQUIPMENT AND SERVICES TO BE PROVIDED BY OTHERS

The following material, equipment, and services are not included as part of the Bionomic Industries supply unless otherwise specified:

- Foundations, anchor bolts and grouting
- Erection and installation of all equipment
- Exhaust fan, if required
- External Wiring
- Wash water supply
- Platforms and ladders
- External piping
- Local PLC
- Supply Duct and Duct Supports
- Buildings and enclosures
- Concrete and foundation design drawings
- Plant water supply
- Electric power
- Applicable sales and use taxes
- Receive and store all material at site prior to erection
- Building, construction and operating permits and all certifications
- Temporary erection facilities, including parking, water, toilet facilities, and access to site
- Wastewater disposal
- All emissions monitoring equipment (including CEMs)
- All emissions testing

TYPICAL PERFORMANCE GUARANTEE

Bionomic Industries Inc. guarantees that the equipment system supplied, when operated in accordance with the Operating Conditions specified in this document and Bionomic's Operating & Maintenance Manual, will meet the following performance:

System's particulate inlet emissions shall be reduced by 75% or have outlet emissions $\leq 10 \text{ mg/Nm}^3$ whichever is less stringent.

System's lead inlet emissions shall be reduced by 75% or have outlet emissions $\leq 0.0065 \text{ mg/Nm}^3$ whichever is less stringent

The above performance is based on the Performance inlet conditions in the data section included in this proposal. This guarantee is based on the Terms and Conditions attached. The guarantee is for the specific items listed above and does not extend to any other items.

SECTION 4 BUDGETARY PRICE AND TERMS

Wet Electrostatic Precipitator System & Auxiliaries:

Design, Engineer, and Supply as described in this proposal.

THREE HUNDRED SIXTY THOUSAND DOLLARS..... . \$360,000 (US)
Option: FRP housing/AL6XN internals \$502,000 (US)
FRP housing/Hastelloy C-276 internals.....\$650,000 (US)

All prices are F.O.B. points of fabrication

- The price is exclusive of all taxes or duties.

Delivery & Installation Schedule:

- System Drawings for approval ARO: 9-10 weeks
- Shipment of Equipment after **receipt of approval** drawings: 18-20 weeks

Field Service:

Field Services are available but not included in the proposal. Field Services are billed separately at the per diem rate shown in the attached terms and conditions. These can be used for any services required at the site, such as, site inspection, erection check out, start-up / commissioning, training and witness of compliance testing.

Typical Terms of Payment:

- 30 % of contract price upon receipt of order
- 30 % of the contract price upon receipt of material for fabrication –net 30.
- 35 % of the contract price upon shipment of equipment (prorated) or 30 days after notice by Bionomic Industries of readiness for shipment, if shipment is delayed for reasons not attributed to Bionomic Industries-net 30.
- 5 % of the contract price upon completion of satisfactory performance test or sixty (60) days after shipping if performance testing is not conducted due to reasons not attributed by Bionomic Industries.

Terms and Conditions:

Attached

BIONOMIC INDUSTRIES INC.
DOMESTIC TECHNICAL SERVICE CHARGES

EFFECTIVE DATE February 26, 2013

THE CORPORATION referenced above, and hereinafter referred to as the SELLER, maintains a staff of technical personnel to provide assistance for the installation, overhaul, repair, maintenance, or operation of various industrial machinery, equipment, processes, or systems (hereinafter "Services").

The Buyer upon receipt of monthly invoices, shall pay the charges for: (1) the expenses for each service person, and (2) his time at SELLER'S prevailing rates in effect at the time the services are performed in U.S. dollars.

The sale and provision of any Services are expressly conditioned upon the Terms and Conditions of Technical Service of which this Appendix I is a part. Any additional or different terms and conditions by the Buyer are objected to and will not be binding on Seller unless specifically assented to in writing by Seller's authorized representative prior to provision of Services. The rules for application of charges and the terms and conditions under which said Services shall be provided are set forth in the "Terms and Conditions of Technical Services" below.

CHARGES FOR SERVICES

SITE SERVICES' ACTIVITIES	STANDARD DAY	LONG TERM PER/DAY	OVERTIME PER HR
Process & Equipment Evaluation/Consulting	\$ 1,160.00	\$ 1,110.00	\$ 210.00
Start-up Service	\$ 1,160.00	\$ 1,050.00	\$ 210.00
Erection/Repair Assistance	\$ 1,050.00	\$ 1,000.00	\$ 155.00
Site Training	Contact Seller for Pricing		

- A) The minimum charge for Site Services Activities, in accordance with the type of Service performed as listed above shall be not less than the standard day. The fees are based on a maximum of 8 hours/day and 40-hours/calendar week. Overtime will be charged when 8 hours/day or when 40 hours/week are exceeded and for holidays and weekends.
- B) "Standard" fees are applicable where no less than two weeks notice was given in advance.
- C) "Long Term": fees are applicable for services on more than three months continuous duration.
- D) "Emergency" fees are applicable where a client requests assistance with less than two weeks previous notice, and where rescheduling of services once begun, becomes necessary.
- E) Traveling days and standby time will be charged as an 8 hr/day at a rate of \$630.00 per diem. Traveling and living expenses are not included in the fees.
- F) Any reporting work prepared by the Seller's personnel after performed services are not included in the fees. Hourly charges are \$115.00 hr for engineering and \$ 75.00 hr for drafting services.

CHARGES FOR EXPENSES

Buyer will pay for all travel, living, and other expenses incidental to the work. All charges will be invoiced at actual cost plus 10%. Charges for lodging, air and ground transportation will be substantiated by copies of receipts.

BIONOMIC INDUSTRIES INC.

TERMS AND CONDITIONS OF TECHNICAL SERVICE

THE CORPORATION referenced above, and hereinafter referred to as the SELLER, maintains a staff of service personnel to provide technical assistance for the installation, overhaul, repair, maintenance, or operation of various industrial machinery, equipment, processes, or systems (hereinafter "Services").

Services may be arranged by consulting the corporate headquarters located in Mahwah, New Jersey, U.S. A. ("CHQ"). The Buyer agrees to pay Seller for Services at current rates and per diem for the classification of Services to be furnished, and expenses, as provided in Appendix I, "Technical Service CHARGES (attached and incorporated herein)> The sale of any Services is expressly conditioned upon these Terms and Conditions of Technical Service. Any additional or different Terms and Conditions by the Buyer are objected to and will not be binding on Seller unless specifically assented to in writing by Seller's authorized representative prior to provision of Services. The rules for application of rate charges and the terms and conditions under which said Services shall be provided are set for the in these "Terms and Condition of Technical Services" including Appendix I hereto.

1. BUYER RESPONSIBILITY

It is understood Buyer will assure SELLER personnel a safe place to work in accordance with all applicable safety laws or codes, and will also furnish and assume responsibility for all labor, materials, equipment, utility services, and tools necessary to perform the work. Buyer shall provide at no cost to Seller's personnel appropriately equipped, secured, and air-conditioned office facilities at the site. Buyer shall provide at no cost to Seller personnel necessary communication services including, but not limited to, phone, fax and mail from Buyer's site to CHQ.

2. WORKER'S COMPENSATION AND TAXES

SELLER will maintain Worker's Compensation Insurance and unemployment compensation benefits and shall make U.S. Income Tax withholding, as may be required by U.S. law, for Seller personnel.

The prices and charges as listed on Appendix I do not include any federal (country), state (province), or local property, license, privilege, sales, use excise, gross receipts, income (except U.S.A. corporate income tax and U.S.A. personal income tax withholding imposed on U.S. base salary and overtime compensation, value added, or other taxes which may now or hereafter be applicable to, measured by, or imposed upon this transaction, services performed in connection therewith. Such taxes are for the account of the Buyer, and the Buyer agrees to pay or reimburse any taxes which SELLER, its contractor, suppliers or expatriate personnel are required to pay

3. DELAYS IN WORK

If the work of Seller personnel is postponed or Suspended by Buyer, it's contractors or agents, or for

reasons for force majeure, or is delayed or does not proceed with reasonable dispatch not due to fault of SELLER, SELLER may withdraw SELLER personnel and return to the job when needed and available or may agree to standby for a reasonable time, and any additional costs (including travel time and expenses), and charges for standby time, caused by this delay will be an additional charge to the Buyer.

4. TIME SHEETS

SELLER'S personnel will present Buyer at the end of each week, or at the completion of the job if less than one week, with their time sheets on which will be indicated the number of hours spent on this work. Buyer shall sign time sheets in the place indicated, thus signifying approval of the time spent on this work.

5. LIMITED WARRANTY AND REMEDY

SELLER shall perform the Services in an advisory capacity only and shall inform Buyer of any obvious defects in the installation, overhaul, repair, maintenance or operation of its equipment for which Services are requested and which are reasonably observable at the time the work is performed. Should the Services provided by SELLER hereunder be defective, SELLER will, at its sole option, refund the amount paid by the Buyer or furnish the Services which SELLER deems necessary and adequate to correct such defect at its expense. However, such correction and any modification, to equipment shall be made or caused to be made by Buyer at its sole cost and expense. This is the sole and exclusive remedy available to buyer, and no other guarantee or warranty, express, implied, or statutory is made with respect to the Service to be provided, hereunder and SELLER assumes no other responsibility or liability whatsoever.

6. BUYER RESPONSIBILITY

It is understood Buyer will assure SELLER personnel a safe place to work in accordance with all applicable safety laws or codes, and will also furnish and assume responsibility for all labor, materials, equipment, utility services, and tools necessary to perform the work. Buyer shall provide at no cost to Seller's personnel appropriately equipped, secured, and air-conditioned office facilities at the site. Buyer shall provide at no cost to Seller personnel necessary communication services including, but not limited to, phone, fax and mail from Buyer's site to CHQ.

7. WORKER'S COMPESATION AND TAXES

SELLER will maintain Worker's Compensation Insurance and unemployment compensation benefits and shall make U.S. Income Tax withholding, as may be required by U.S. lay, for Seller personnel.

The prices and charges as listed on Appendix I do not include any federal (country), state (province), or local property, license, privilege, sales, use excise, gross receipts, income (except U.S.A. corporate income tax and U.S.A. personal income tax withholding imposed on U.S. base salary and overtime compensation, value added, or other taxes which may now or hereafter be applicable to, measured by, or imposed upon this transaction, services performed in connection therewith. Such taxes are for the account of the Buyer, and the Buyer agrees to pay or reimburse any taxes which SELLER, its contractor, suppliers or expatriate personnel are required to pay

8. DELAYS IN WORK

If the work of Seller personnel is postponed or Suspended by Buyer, it's contractors or agents, or for

reasons for force majeure, or is delayed or does not proceed with reasonable dispatch, not due to fault of SELLER, SELLER may withdraw SELLER personnel and return to the job when needed and available or may agree to standby for a reasonable time, and any additional costs (including travel time and expenses), and charges for standby time, caused by this delay will be an additional charge to the Buyer.

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SELLER'S personnel will present Buyer at the end of each week, or at the completion of the jot if less than one week, with their time sheets on which will be indicated the number of hours spent on this work. Buyer shall sign time sheets in the place indicated, thus signifying approval of the time spent on this work.

LIMITED WARRANTY AND REMEDY

SELLER shall perform the Services in ad advisory capacity only and shall inform Buyer of any obvious defects in the installation, overhaul, repair, maintenance or operation of its equipment for which Services are requested and which are reasonably observable at the time the work is performed. Should the Services provided by SELLER hereunder be defective, SELLER will, at its sole option, refund the amount paid by the Buyer or furnish the Services which SELLER deems necessary and adequate to correct such defect at its expense. However, such correction and any modification, to equipment shall be made or caused to be made by Buyer at its sole cost and expense. This is the sole and exclusive remedy available to buyer, and no other guarantee or warranty, express, implied, or statuary is made with respect to the Service to be provided, hereunder and SELLER assumes no other responsibility or liability whatsoever.

Standard Warrantee

Bionomic Industries, Inc., herein referred to as the Company warrants to the original purchaser that (i) all Products manufactured and sold by the Company will be free from defects in material and workmanship, and (ii) such Products will reasonably perform the intended use thereof in accordance with the condition and specifications submitted by this Company as are described in this Company's written Proposal (the "Proposal") to such Purchaser. The foregoing warranties shall be applicable only when the Product is used in normal use and service and while the Product is in a clean condition, under such conditions and specifications as are described in the Company's Proposal to the Purchaser, and only when the following additional conditions are complied with by the Purchaser:

The Product must be properly installed by a qualified installer in accordance with the Company's recommended installation instructions and procedures;

- (a) The Product must be properly installed by a qualified installer in accordance with the Company's recommended installation instructions and procedures;
- (b) The Product must be operated, maintained and serviced in accordance with the Company's recommended operating instructions and procedures; and
- (c) The installation and operation of the Product must be in conformity with all applicable laws, statutes, rules and regulations of federal, state and local governmental bodies, agencies or departments thereof.

IN THE EVENT OF ANY CLAIM UNDER THIS WARRANTY, THE PURCHASER SHALL GIVE WRITTEN NOTICE THEREOF TO THE COMPANY WITHIN THIRTY DAYS AFTER PURCHASER HAS KNOWLEDGE OF ANY CLAIMED DEFECT, OTHERWISE THE FOREGOING WARRANTY SHALL BECOME NULL AND VOID. The foregoing warranty shall be for a period of one year from the start of operation, but in no event shall such warranty extend beyond **12** months from date of shipment by the Company. Any requested performance test procedures must be as mutually agreed upon. Such testing will be solely at Purchaser's expense. The company's sole obligation under this Warranty shall be limited to the replacement or repair of the Product or any parts thereof which may be proven to the Company's satisfaction to be defective. F.O.B. the Company's shipping point. In the event any claim is made against the Company in connection with such Product, the Company shall not be liable for any cost of removal, dismantling, reinstalling or reconstruction of the Product from, onto or into any building or other structure in which or upon which the Product may be installed, constructed or enclosed. All such costs shall be borne by the Purchaser who shall make the Product reasonably available on Purchaser's premises for necessary inspection and repairs required under the foregoing warranty. If, in the sole judgment of the Company, such necessary repairs can best be made at the Company's plant, the Purchaser shall pay all costs of shipping and transporting the Product to and from the Company's plant. THE COMPANY SHALL NOT BE LIABLE FOR LOSS OF ANTICIPATED PROFITS, LOSS BY REASON OF PLANT SHUTDOWN, NON-OPERATION OF THE PRODUCT OR INCREASED COSTS OF OBTAINING OR OPERATING OTHER OR SUBSTITUTE EQUIPMENT OR PROCESSES OR OTHER CONSEQUENTIAL LOSS OR DAMAGE OF ANY NATURE.

THE COMPANY MAKES NO WARRANTY WITH RESPECT TO COMPONENTS AND ACCESSORIES MANUFACTURED BY ANY OTHER PARTY EXCEPT FOR THE SCRUBBER AND EXPRESSLY WARRANTED BY SUCH OTHER PARTY, NOR FOR DETERIORATION OR FAILURE OF THE PRODUCT DUE TO THE EFFECTS OF EROSION OR CORROSION, OR WHICH MAY IN ANY WAY BE ATTRIBUTED TO FAULTY OPERATION. THE COMPANY MAKES NO WARRANTIES, EITHER EXPRESSED OR IMPLIED, THAT EXTEND BEYOND THOSE EXPRESSLY STATED HEREIN. THE COMPANY DOES NOT WARRANT PERFORMANCE OF THE PRODUCT PURSUANT TO ANY DESIGNS, DRAWINGS OR SPECIFICATIONS FURNISHED BY THE PURCHASER UNLESS SUCH DESIGN, DRAWINGS OR SPECIFICATIONS HAVE BEEN EXPRESSLY INCORPORATED INTO AND INCLUDED AS A PART OF THE COMPANY'S PROPOSAL. IN NO EVENT SHALL THE COMPANY BE LIABLE FOR ANY AMOUNT IN EXCESS OF THE PURCHASE PRICE OF THE PRODUCT TO THE PURCHASER. THIS DISCLAIMER AND WARRANTY AGREEMENT IS EXPRESSLY IN LIEU OF ANY AND ALL OTHER WARRANTIES AND REPRESENTATIONS, EXPRESSED OR IMPLIED, EXCEPT AS STATED IN OUR PROPOSAL, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WHETHER ARISING FROM STATUTE, COMMON LAW, CUSTOM OR OTHERWISE. THE REMEDY SET FORTH IN THIS DISCLAIMER AND WARRANTY AGREEMENT SHALL BE THE EXCLUSIVE REMEDIES AVAILABLE TO PURCHASER. NO PERSON HAS ANY AUTHORITY TO BIND THE COMPANY TO ANY REPRESENTATION OR WARRANTY OTHER THAN AS SET FORTH IN THIS DISCLAIMER, WARRANTY AGREEMENT AND OUR PROPOSAL. THE COMPANY SHALL NOT BE LIABLE FOR ANY CONSEQUENTIAL DAMAGES RESULTING FROM THE USE OF THE PRODUCT OR CAUSED BY ANY DEFECT, FAILURE OR MALFUNCTION OF THE PRODUCT, WHETHER A CLAIM FOR SUCH DAMAGE IS BASED UPON WARRANTY, CONTRACT, NEGLIGENCE OR OTHERWISE. THIS WARRANTY SHALL NOT APPLY TO ANY PRODUCT OR EQUIPMENT WHICH HAS BEEN REPAIRED OR ALTERED IN ANY WAY, WITHOUT THE PRIOR EXPRESSED WRITTEN APPROVAL OF THE COMPANY, BY ANYONE OTHER THAN THE COMPANY'S EMPLOYEES OR AGENTS SO AS, IN THE JUDGMENT OF THE COMPANY, TO AFFECT ITS OPERATION OR

PERFORMANCE. THE TERM "ORIGINAL PURCHASER" SHALL BE DEEMED TO MEAN ONLY THAT PERSON, FIRM OR CORPORATION FOR WHOM THE PRODUCT IS ORIGINALLY INSTALLED. THE TERMS, PROVISIONS AND CONDITIONS OF THIS DISCLAIMER AND WARRANTY AGREEMENT SHALL NOT BE AMENDED, EXTENDED OR MODIFIED BY THE TERMS OF ANY PURCHASE ORDER OR OTHER DOCUMENT OF THE PURCHASER, HIS CONTRACTOR OR OTHER AGENT UNLESS UPON THE EXPRESSED WRITTEN APPROVAL OF AN AUTHORIZED OFFICER OF THE COMPANY.

Attachment E

MEGTEC WESP Proposal

Total Costs - MEGTEC

	316 SS Internals and Housing	AL6XN Internals and 316L SS Housing	Hastelloy C-276 Internals and 316L SS Housing
DIRECT CAPITAL COSTS			
1 Purchased Equipment Costs			
a. Basic Equipment and Auxiliaries (A)	\$461,000	\$539,000	\$720,000
1) WESP	\$461,000	\$538,800	\$719,700
b. Instrumentation and Controls (0.1 A)	\$46,100	\$53,900	\$72,000
c. Freight (0.05 A)	\$23,050	\$26,950	\$36,000
d. Sales Taxes (0.0625 A)	\$28,813	\$33,688	\$45,000
TOTAL PURCHASED EQUIPMENT COST (B)	\$559,000	\$654,000	\$873,000
2 Direct Installation Costs			
a. Foundations and Supports (0.12 B)	\$67,080	\$78,480	\$104,760
b. Erection and Handling (0.4 B)	\$223,600	\$261,600	\$349,200
c. Electrical (0.25 B)	\$139,750	\$163,500	\$218,250
d. Piping (0.10 B)	\$55,900	\$65,400	\$87,300
e. Insulation (0.05 B)	\$27,950	\$32,700	\$43,650
f. Painting (0.01 B)	\$5,590	\$6,540	\$8,730
g. Site Preparation and Demolition	\$50,000	\$50,000	\$50,000
h. Building and Structural Modifications	\$50,000	\$50,000	\$50,000
TOTAL DIRECT INSTALLATION COSTS (C)	\$620,000	\$708,000	\$912,000
INDIRECT CAPITAL COSTS			
3 Engineering & Supervision (0.12*[B+C])	\$141,480	\$163,440	\$214,200
4 Construction & Field Expenses (0.1*[B+C])	\$117,900	\$136,200	\$178,500
5 Contractor Fees (0.10*[B+C])	\$117,900	\$136,200	\$178,500
6 Start-up (0.05 B)	\$27,950	\$32,700	\$43,650
7 Equipment Acceptance Test	\$25,000	\$25,000	\$25,000
8 Contingency (0.15*[B+C])	\$176,850	\$204,300	\$267,750
TOTAL INDIRECT CAPITAL COST	\$607,000	\$698,000	\$908,000
TOTAL INSTALLED CAPITAL COST	\$1,786,000	\$2,060,000	\$2,693,000
DIRECT ANNUAL COSTS			
1 Operating Labor, (0 hr/yr x \$30/hr)	\$0	\$0	\$0
2 Supervisory Labor, 0.15 X (1)	\$0	\$0	\$0
3 Maintenance Labor (548 hr/yr x \$30/hr)	\$16,440	\$16,440	\$16,440
Materials (100% of labor)	\$16,440	\$16,440	\$16,440
4 Utilities			
a. Water (\$3.20/1000 gal * 0.75 gal/min * 525,600 min/yr)	\$1,261	\$1,261	\$1,261
b. Electricity (\$0.0966/kwh * 26.81 kw * 24 hr/day * 365 day/yr)	\$22,687	\$22,687	\$22,687
TOTAL DIRECT OPERATING COSTS	\$57,000	\$57,000	\$57,000
INDIRECT OPERATING COSTS:			
5 Overhead - 60% Operating & Maintenance Labor	\$19,728	\$19,728	\$19,728
6 Property Tax - 0% Total Capital Cost	\$0	\$0	\$0
7 Insurance - 1% Total Capital Cost	\$17,860	\$20,600	\$26,930
8 Administration - 2% Total Capital Cost	\$35,720	\$41,200	\$53,860
9 Capital Recovery (5% Interest, 20 Years)	\$143,309	\$165,294	\$216,086
TOTAL INDIRECT OPERATING COSTS	\$217,000	\$247,000	\$317,000
TOTAL ANNUALIZED OPERATING COST	\$274,000	\$304,000	\$374,000

Macheski, Michael

From: Svidunovich, Margarita <MSvidunovich@megtec.com>
Sent: Monday, April 07, 2014 6:10 PM
To: Macheski, Michael
Subject: WESP proposal
Attachments: Q14-1186 rev 0 SonicKleen WESP Proposal.pdf; Q14-1186-600-001 NEW.PDF; Q14-1186-300r0 (MEGTEC standard).pdf; USA2013perdiemrates.pdf; Commercial Terms and Conditions_New Equipment Sales April 2013.pdf

Michael,

We have completed the design and budgetary pricing for one WESP regarding the Naugatuck plant. Our scope include flange to flange WESP unit with new TR set and 2 pricing options for the material of construction.

The following documents are attached:

1. Proposal Q14-1186
2. Dimensional Sketch
3. P&I
4. Per diem rate schedule
5. T&C of Sales

Please review our offer and let me know if you have any questions or comments.

Thank you.

Best Regards,

Margarita Svidunovich, Ph.D.

Senior Application Engineer

MEGTEC TurboSonic Technologies, Inc.

Andover, NJ, USA

msvidunovich@megtec.com

Cell: (973) 668-8413

Office: (919) 844-0411 ext. 404

Fax: (908) 979-3115

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BUSINESS CONFIDENTIAL

PROPOSAL TO: **TRC Solutions**
ADDRESS: 521 Plymouth Road, Suite 116
Plymouth Meeting, PA 19462
USA

ATTENTION: **Michael R. Macheski**
MMACHESKI@TRCSOLUTIONS.COM

PROPOSAL FOR: **SonicKleen™ WESP for**
NAUGATUCK, CT



PROPOSAL NO.: **Q14-1186-revision 0**

DATE SUBMITTED: April 4, 2014

Proposal By: **MEGTEC TurboSonic Technologies, Inc.**
Andover, NJ

CONTACT NAME: **Margarita Svidunovich, Ph.D.**

E-MAIL: ms@turbosonic.com

TELEPHONE: (973) 668-8413

FACSIMILE: (908) 979-3115



BUSINESS CONFIDENTIAL

Proposal No.: Q14-1186- rev 0

Date: April 4, 2014

Client: TRC Solutions

Location: Plymouth Meeting, PA

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CONDITIONS OF PERFORMANCE GUARANTEE

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MEGTEC TURBOSONIC TERMS & CONDITIONS OF SALES

PROPOSAL DRAWINGS



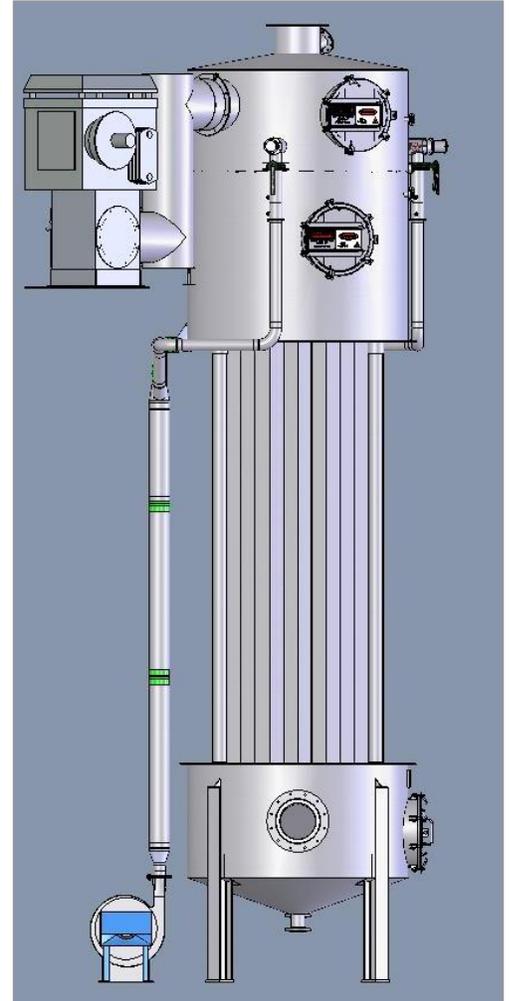
1.0 GENERAL DESCRIPTION

The purpose of the proposed Sonickleen WESP system is to reduce particulate matter (PM) emissions from a sewage sludge incinerator. The WESP would be installed downstream of the existing wet scrubbers.

The WESP is a high efficiency removal device for particulate matter.

The following features and considerations are included in the design of the proposed Sonickleen WESP system:

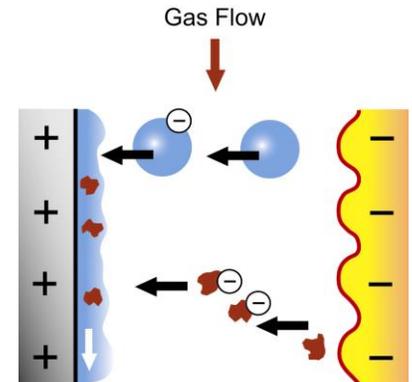
- ◆ Simple construction
- ◆ Energy efficient design with low system pressure loss & advanced WESP power supply
- ◆ High Efficiency removal of particulate
- ◆ Falling film, downflow design
- ◆ High quality – equipment, materials and components
- ◆ Low maintenance requirements
- ◆ Maintenance free mist eliminator
- ◆ Easy access for maintenance and inspections



1.1. SONICKLEEN™ WET ELECTROSTATIC PRECIPITATOR

DOWNFLOW TUBULAR DESIGN

The top inlet design allows the flue gas to flow downward through the collection tubes. The collected liquid and particulate droplets create a self-forming falling film of liquid that flows by gravity, irrigating the inside surfaces of the tube walls, (collecting surface) to provide continuous cleaning. Since the liquid flows co-current to the gas flow, there are no interruptions in the falling film of liquid preventing dry spots from forming on the collection tubes. Dry spots cause particle deposition and premature arcing.



HEXAGONAL COLLECTION TUBE BUNDLE



A common wall hexagonal tube design provides high structural strength and smaller footprint. This design provides a higher collection area per pound of material providing a more economical design especially on units constructed of stainless steel or higher alloys.

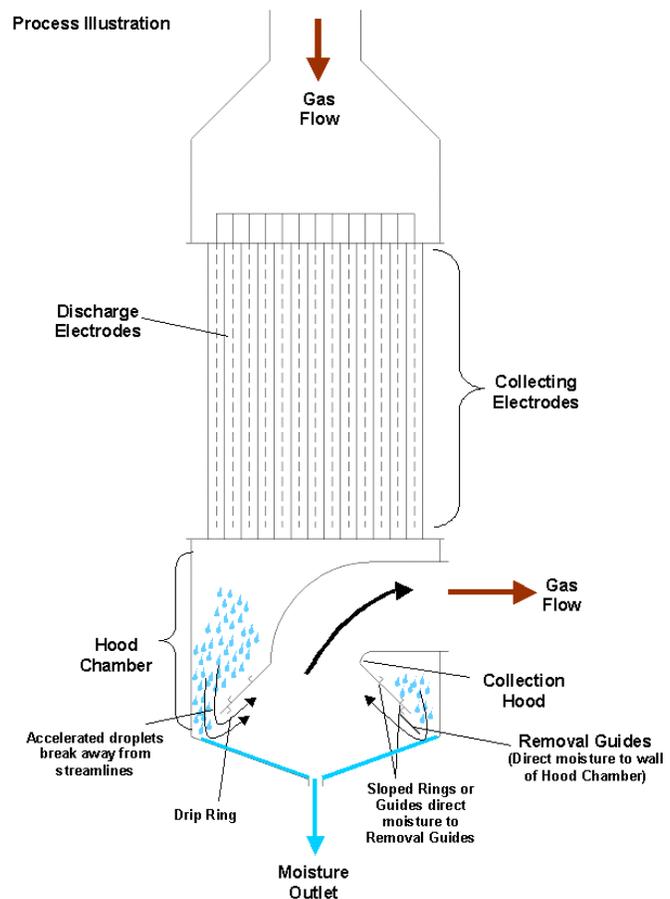
The hexagonal tubes provide an even uniform corona, and do not allow build-up in the corners, which is commonplace with a square tube design.

HIGH VOLTAGE SYSTEM

This system consists of a rigid high voltage frame suspended at three points by rugged and durable ceramic insulators. The insulator location is removed from the flue gas stream thus avoiding contamination due to wetting and particle deposition. The insulator compartment is designed with large inspection/maintenance doors to provide more than adequate space for insulator inspection and/or removal. The compartment is also purged with heated clean air to prevent process gas infiltration.

HOOD MIST ELIMINATOR (HME) PATENT US 7,160,348 B2

The gas outlet has a patented Hood Mist Eliminator (HME) designed to prevent water droplets from entering the discharge ductwork. Specially designed drip ring channels prevent liquid re-entrainment at the trailing edge of the HME. Additional downstream mist elimination is not required. The HME operates with minimal pressure loss, and does not contain any consumable media. The HME is kept clean with the cascading water from the collection tube flushing, which eliminates maintenance. In contrast to the HME, Mesh Pads and Chevrons require frequent removal for cleaning, replacement, and also have escalating pressure drop across them, as the media begins to blind with contaminants.



SONICCHARGE™ RIGID ELECTRODES

The discharge electrodes consist of 1.5-inch diameter rigid tube electrodes, providing long life and requiring virtually no maintenance. Specially designed flights are located on each electrode providing high intensity charging fields that the particulate in the gas stream must pass through. The spacing of the charging flights on the electrodes provides multiple stages of charging and collecting to provide maximum collection efficiency for the WESP. Other designs often incorporate spike or star shaped discs, which leads to lower flashover levels and reduces the attainable Voltage in the WESP. Lower attainable voltages equate to reduced field intensities. The SonicCharge electrode has been developed to incorporate the proper diameter and finish on the charging flights -- yielding higher voltages and greater collection efficiencies than other designs. The SonicCharge electrode design also locates the charging flights in a manner that allows greater misalignment deviation than other designs.



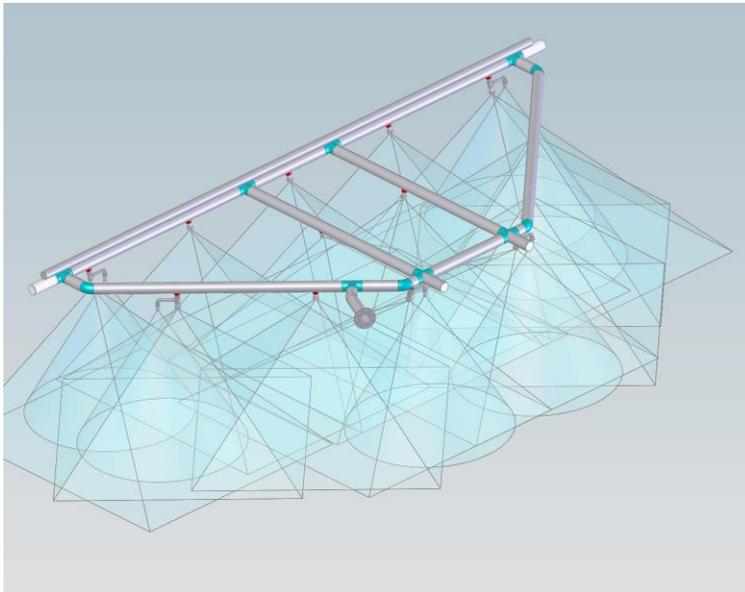
ELECTRODE ALIGNMENT SYSTEM

The electrodes are suspended from the high voltage frame with a three-point adjustable suspension system that allows for easy alignment of the electrodes in the collector tubes. The three-point adjustment system offers maximum holding power and the ability to properly adjust all emitting electrodes into alignment tolerance.

GAS FLOW DISTRIBUTION SYSTEM

Multiple perforated plates are located at the gas inlet to the precipitator to equally distribute the flue gas to the collection tubes. The perforated plates are fabricated from stainless steel plate with perforations of no less than 2-inch diameter in a pattern that allows for equalized gas distribution. Large diameter holes are used to prevent any buildup of particulate from causing pluggage. The result is a highly effective gas flow distribution system that will not require any maintenance.

FLUSHING SYSTEM



The high voltage plenum is equipped with a flushing header that provides an intermittent flushing spray to prevent buildup of particulate on the high voltage frame or collection tubes. The duration and frequency of the spray depends on the severity of the application but is typically set for 2 - 4 minutes every 3 - 6 hours.



INSULATOR COMPARTMENT AIR PURGE SYSTEM

The insulator compartment is purged with filtered, heated air to keep the insulators clean and dry. The purge air is heated with a heater that is mounted inside the purge air supply duct.

The insulator compartment access is protected with the Key Interlock system. The quick release inspection doors provide easy access for maintenance inspections and routine cleaning.

LIQUID SEALING

The system includes a support structure of sufficient height to allow installation of liquid seal drain legs and ensure proper system drainage.

WESP POWER SUPPLY: NWL POWERPLUS™ SMPS T/R SET



The NWL PowerPlus™ switch mode power supply is used as the WESP power supply. The PowerPlus™ utilizes high efficiency power conversion technology. This system offers more efficient use of power (higher form factor) and is smaller and lighter than tradition T/R sets. It is supplied by 3-phase power and is inherently less “noisy” than traditional single-phase T/R sets. The cleaner input power provides greater average voltages than typical conventional power supplies.

Complete instrumentation and diagnostics for voltage and current control, power monitoring and alarms are supplied by a digital interface (GVC module).



2.0 DESIGN DATA

2.1. PLANT DATA:

Plant Elevation	Feet ASL	184
Design Wind Load	MPH	TBA
Seismic Zone		TBA
Application		SS incineration – Fluidized Bed Reactor

2.2. DESIGN INLET GAS CONDITIONS INTO WESP:

Gas Flow- Saturated after the Scrubber	ACFM	22,600
	DSCFM	20,962
Gas Temperature	°F	85
Gas Pressure	in WG	+2.0
Gas Moisture	%, by vol.	4.10
Particulate Matter	mg/Nm ³ dry	73
(assumed max loading)	gr/dscf	0.0297
	lbs/hr	5.34
Lead Concentration (assumed max loading)	mg/Nm ³ dry	0.143

2.3. EXPECTED OUTLET GAS CONDITIONS AFTER WESP:

Gas Flow	ACFM	22,600
Gas Temperature	°F	85
Gas Pressure	in WG	+0.77
Gas Moisture	%, by vol.	4.10
Particulate Matter – total	mg/Nm ³ dry	10
	gr/dscf	0.004
	lbs/hr	0.73
Particulate Removal Efficiency	%	86.3
Lead Concentration	mg/Nm ³ dry	0.0065
Lead Removal Efficiency	%	95.4



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3.0 OPERATING DATA

3.1. SONICKLEEN™ WET ELECTROSTATIC PRECIPITATOR

Design Parameters		
Pressure Drop across WESP	in WG	1.2
Gas Throughput Velocity	ft/sec	6.3
Gas Retention time	Sec	2.2
Effective Specific Collecting Area	SCA ft ² /1000acfm	148.1
Flushing - Fresh Water		
Flushing - average	GPM	0.75
Flushing Electrostatic (max. instantaneous)	GPM	103.5 (2 min/6 hr)
Flushing Distribution plates (max. instantaneous)	GPM	46.8 (2 min/12 hr)
Electrical		
Precipitator – Transformer/Rectifiers		
Primary Power (V/PH/HZ)		480/3/60
KVA Connected		19.24
KVA Demand		15.15
kW Consumed		13.39
Insulator Purge Heater (V/PH/HZ)		
KVA Connected		18
KW Consumed		12.6



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3.2. ESTIMATED ELECTRICAL USAGE FOR THE WESP

Motor/Device	Qty	Motor HP/kW Rating	Operational time	Consumed kW
Purge Air Fan	1	2 HP	100%	0.82
Purge Air Heater	1	18 kW	100%	12.6
TR Set	1	19.2 kVA [17 kW]	100%	13.39
Total				26.81



4.0 EQUIPMENT SUPPLY

MEGTEC TurboSonic scope of supply is limited to items specifically listed in this section of this proposal. All equipment to be manufactured to MEGTEC TurboSonic standard specifications unless otherwise noted. Drawings included are for information purposes only and do not necessarily represent the scope of the project defined in this proposal.

4.1. SONICKLEEN™ WET ELECTROSTATIC PRECIPITATOR

Equipment	
Model	SonicKleen™ WESP-316L-69-12H14
General Information	
Orientation/Flow Direction	Top inlet, vertical downflow
Inlet Gas Flow Distribution Type	Multiple perforated plate distribution
Emitting Electrode Design	SonicCharge rigid mast
Collecting Electrode Style	12" hexagonal tube
Particulate Removal Design	Self forming film, gravity drain
Inlet / Outlet Plenum	
Temperature Design Max.	300°F
Pressure Design Max.	+/- 20 in w.g.
Plenum Material (Gas wetted components)	316L SS
Discharge Electrodes	
Quantity	69
Material	316L SS/ Price adders for AL6XN and C276
Tube Bundle (collecting electrodes)	
Tube Quantity	69
Tube Length (ft.)	14
Shell Material/Tube Material	316L SS / 316L SS
High Voltage System	
Electrode Suspension Frame	One (1) 316L SS frame c/w heavy duty support beams/ Price adders for AL6XN and hastelloy C-276
Insulator Type/Material/Qty	Heavy Duty / Fluted Porcelain / 3
Electrode Support	Top support only – no lower alignment frame
Electrode Alignment Mechanism	3 point triangular, Individually adjustable
HV Connections	Pipe with Guard & Flexible Connector
HV Power Supply	One (1) NWL Power Plus Series resonant switch mode
Rectifier	3 ph full wave/ DC Bus/ high frequency AC/DC
Insulation	Mineral oil
HV Controls	Microprocessor GVC (graphic voltage control) display or equivalent mounted in the operator interface control panel.
Insulator Compartments	Integral plenum mounted, bolted access hatch



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Insulator Compartment Ventilation System	
Purge Fan	540 acfm, 2 HP
Air Heater	One (1) common 18 kW heater
Air Filtration	Metal Mesh/ Pleated paper cartridge
Air Flow Control	Manual damper
Air Temperature Control	Contactora
Purge Air Piping	304 SS Spiral ducting
Flushing System	
Flushing Controls	Controlled by local control panel
Flushing Design	Overlapping sprays with hydraulic nozzles
Indication	Flow Transmitter
Accessories	
Key Interlocks	Key lock Kirk or equal - doors, T/R, HV controller
Access Doors	Inlet/outlet plenum access, quick opening doors
HV Warning Labels	Included
Maintenance Grounding Rod	Included
Dimensions	10'–11" D x 30'–8.5" H
Weight	23,720 lbs estimated
Options	
Support Steel	Support Legs Included
Access Platforms & Ladders	Not Included
Field Instrumentation	Included as per P&I attached

4.2. WESP HIGH VOLTAGE CONTROLS

The following components and instrumentation are integral to the WESP TR High Voltage Power Supply located at the WESP access platforms. The WESP contains one (1) high voltage power supply.

- ◆ NWL Power Plus™ control electronics assemblies
- ◆ Circuit breaker (3 phase)
- ◆ Three Phase DC rectifier
- ◆ Insulated Gate Bipolar Transistors (IGBT)
- ◆ Resonant Tank circuit
- ◆ High Voltage Oil Tank - Step up High Voltage Transformer Rectifier Assembly
- ◆ GVC (Graphic Voltage Controller) is mounted in the system control cabinet
- ◆ Local Control Panel



5.0 SERVICES

5.1. TECHNICAL SERVICES

MEGTEC TurboSonic will provide the following services with drawings and flow sheets in PDF or SolidWorks format:

1. Design and engineering of the equipment specified under 'Equipment Supply'
2. General Arrangement drawing of 'Equipment Supply'
3. Two (2) Operating and Maintenance manuals
4. Instrumentation & Controls documentation:
 - ◆ Functional Description of Process
 - ◆ Instrument List
 - ◆ Motor List
 - ◆ Device List
 - ◆ Configuration drawing
 - ◆ Instrumentation Loops

5.2. SERVICES TO BE PROVIDED BY OTHERS

The following services have not been included as part of MEGTEC TurboSonic services and shall be supplied by others:

- ◆ Any item required for the project not specifically included in Section 4 of this proposal
- ◆ Servicing Platforms and Ladders
- ◆ PLC/DCS Hardware and programming
- ◆ Motor control center
- ◆ Cranes for unloading, storage, and installation
- ◆ Mechanical and electrical installation and installation materials
- ◆ Ductwork
- ◆ Piping and valves
- ◆ Flushing Pumps (if required)
- ◆ Treatment and disposal of liquid effluent
- ◆ Performance guarantee testing
- ◆ All permits
- ◆ All civil work, concrete foundations, slabs on grade, embedded steel and anchor bolts
- ◆ All building enclosures, lighting and sprinklers if required
- ◆ Piping racks and piping support systems
- ◆ Grounding grid.



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6.0 PERFORMANCE GUARANTEE

MEGTEC TurboSonic guarantees that the equipment supplied, when operated in accordance with the Design Data (section 2) and Operating Data (section 3) specified in this document, and MEGTEC TurboSonic Operating and Maintenance Manual, will meet the following performance:

Particulate Matter:	Less than 10 mg/Nm ³ (dry basis) or 86.3% removal efficiency, whichever is less stringent
Lead:	Less than 0.0065 mg/Nm ³ (dry basis) or 95.4% removal efficiency, whichever is less stringent

The above performance is based on the MEGTEC TurboSonic 'Conditions of Performance Guarantee' attached in the appendix. The guarantee is valid for the specific items listed above and does not extend to other items listed under 'Operating Conditions'.



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7.0 COMMERCIAL

7.1. PRICING

The pricing for the design, engineering and supply of equipment, drawings and flow sheets as specified in this Proposal.

Qty.	Description	Total Price
One (1):	SonicKleen™ WESP System , as described in Section 4	\$ 461,000
One (1):	Price Adder to upgrade Discharge Electrodes and HV Frame to AL6XN	\$ 77,800
One (1):	Price Adder to upgrade Discharge Electrodes and HV Frame to Hastelloy C276	\$ 258,700

Currency:	US Dollars
Point of Delivery:	Ex Works Incoterms 2010
Proposal Validity:	Budgetary
Price Escalation:	See attached 'Terms and Conditions of Sale'
Taxes:	Not Included
Duties:	Not Included
Field Services	See MEGTEC TurboSonic Per Diem rate sheet

7.2. DELIVERY SCHEDULE

General Arrangement Drawings for Approval:	8 - 10 weeks
Supply of Equipment after Approval:	20 - 22 weeks
Certified Drawing after Approval	3 - 4 weeks

The proposed schedule is valid for ninety (90) days from date of Proposal and is subject to availability of materials and receipt of prior orders, and may be revised during final negotiation and confirmed before award. Actual details pertaining to the shipping dates of specific items will be handled during administration of the contract.

7.3. TERMS OF PAYMENT

All payments are due net 30 days unless otherwise indicated.

10%	Down with purchase order
20%	With general arrangement drawings submitted for approval
30%	On receipt of stainless materials at fabrication shop
30%	Upon shipment of major equipment
10%	On successful source testing, to be completed within 60 days of startup. Should testing be delayed by Purchaser beyond 120 days after readiness to ship, this milestone shall be deemed to have been met only for the purpose of payment related to this milestone. Payment of this milestone shall not excuse Supplier from meeting all obligations under the contract.

* If shipment is delayed through no fault of TurboSonic, Purchaser shall pay for storage and treat remaining payment milestones as if shipment had not been delayed.



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7.4. TERMS AND CONDITIONS

This Proposal is based on the MEGTEC TurboSonic 'Conditions for Performance Guarantee' and 'Terms and Conditions of Sale' attached in the Appendix section of this proposal.



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CONDITIONS FOR PERFORMANCE GUARANTEE

The process guarantee is subject to the following conditions:

- 1) **Operation:** The equipment must be installed, adjusted and operated according to instructions provided by the Company or its authorized representative and shall be operated within its rated capacity and within its design range and operating conditions set forth in Design Conditions and Operating Data section of proposal.
- 2) **Testing:** Performance testing shall be determined by a method mutually agreeable to both the Purchaser and the Company and conducted as soon as practicable after completion of the installation. The parties will use their best efforts to conduct the tests within sixty (60) days of successful start-up. The testing shall be performed by an independent test firm, which meets the approval of both the Purchaser and the Company. The Company requires reasonable prior notice of performance testing to facilitate inspection of equipment before tests commence.
- 3) **Averaging:** At least three Performance tests shall be conducted for the equipment in accordance with the applicable Testing Procedures set forth above and the equipment shall be deemed to have met the Guaranteed Performance Specification if the average of these three performance tests show compliance with each of the Guaranteed Performance Specifications.
- 4) **Reliable Test Data:** All test data obtained for the compliance testing of the systems must be reliable and repeatable for the levels of the compounds to be tested as they appear in the system discharge stacks. Emissions levels lower than this reliable and repeatable range shall be considered as satisfying the performance guarantee.
- 5) **Equipment Condition:** If, through no fault of the Company, the equipment has been abused, altered or otherwise impaired, the Purchaser shall be required to recondition the equipment to the original condition and any replacement of parts, materials and labour shall be for the Purchaser's account.
- 6) **Remedy:** In the event that the proposed equipment does not meet the performance guarantee, the Company has the right, at its own expense on a straight time basis, to make such adjustments, changes and additions to the equipment, as it may deem necessary to meet the performance guarantee.
- 7) **Delays:** In the event performance testing is delayed through no fault of the Company beyond twelve (12) months from start-up or eighteen (18) months from shipment (whichever occurs first) the Company shall be relieved from all obligations to the Purchaser.
- 8) **Test Results:** The Purchaser agrees to provide the Company, upon the Company's request, the results of any performance tests or emission data whether performed by the Purchaser or the Company or any third party acting for either Purchaser or Company.



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REFERENCES

Facility	Eastman Kodak Company – Rochester Site
Address	Rochester, NY
Application	Photographic Products Incineration
Equipment Supplied	SonicKleen WESP
Project Completion	2001
Contact Info	Roy W. Wood – Health Safety and Environment Division Ph. 585-588-7538

Facility	Hatfield Township Municipal Authority
Address	Colmar, PA
Application	Industrial Waste Incineration
Equipment Supplied	SonicKleen WESP
Project Completion	1992
Contact Info	Matt Ferenchak Ph. 610-310-3007 mattfoo@comcast.net

Facility	Rocky River Regional Waste Water Treatment Plant
Address	Concord, NC
Application	Sewage Sludge Incineration
Equipment Supplied	SonicKleen WESP
Project Completion	1993
Contact Info	Everett Stotesbury – Maintenance Manager

Facility	Thermal Ceramics - Ceramic Brick-Curing Kiln
Address	Augusta, GA
Application	Ceramic Brick-Curing Kiln
Equipment Supplied	SonicKleen WESP
Project Completion	1999



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SONICKLEEN™ WESP CONTROLS EMISSIONS FROM HAZARDOUS WASTE INCINERATOR

EASTMAN KODAK COMPANY – ROCHESTER, NY

THE CHALLENGE

A rotary kiln hazardous waste incinerator at the Eastman Kodak Company - Rochester facility required a high efficiency air pollution control (APC) solution to control particulate and condensable sub-micron emissions.

THE SOLUTION

A system consisting of four SonicKleen™ Wet Electrostatic Precipitators (WESPs) in a 2x2 arrangement was installed.

The SonicKleen™ WESP provides high efficiency removal of the remaining particulate and sub-micron condensable elements.

The main reasons for selecting a WESP and a scrubber for this application were:

- ◆ High efficiency removal of particulate and acid gases
- ◆ High reliability
- ◆ Low energy and operating cost
- ◆ Low maintenance cost

THE RESULTS

The SonicKleen™ WESP performance met both the interim HWC MACT standards that were effective in 2003 and the final HWC MACT standards that were effective in 2008.

System Data as follows:

	Design
◆ Gas volume (ACFM)	71,133 ACFM
◆ Gas temperature	111°F
◆ Outlet particulate Loading	0.003 gr/DSCF
◆ Design Pressure	-55" WG



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SONICKLEEN™ WESP CONTROLS EMISSIONS FROM AN INDUSTRIAL WASTE INCINERATOR HATFIELD TOWNSHIP MUNICIPAL AUTHORITY (TMA) – COLMAR, PA

THE CHALLENGE

An industrial waste incinerator at Hatfield TMA required a high efficiency air pollution control (APC) system to control particulate and heavy metal emissions.

THE SOLUTION

The SonicKleen™ Wet Electrostatic Precipitator (WESP) was selected for its proven performance and low maintenance operation.

The main reasons for selecting a WESP for this application were:

- High efficiency removal of particulate and dioxins
- High reliability
- Low operating cost
- Low maintenance cost

THE RESULTS

The SonicKleen™ WESP performance meets design specifications and U.S. EPA compliance levels, with a minimum of maintenance, based on annual shutdown inspections.

System data as follows:	Design
Saturated gas volume (ACFM)	5810
Outlet particulate loading (gr/DSCF)	0.01
Removal efficiency (%)	70
WESP pressure drop ("H ₂ O)	1.5
Nominal WESP operating voltage (kVDC)	65



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SONICKLEEN™ WESP CONTROLS EMISSIONS FROM MUNICIPAL SEWAGE SLUDGE INCINERATOR ROCKY RIVER REGIONAL WASTE WATER TREATMENT PLANT – CONCORD, NC

THE CHALLENGE

A municipal sewage sludge incinerator at the Rocky River Waste Water Treatment facility required a high efficiency air pollution control (APC) solution to control particulate and condensable sub-micron emissions.



THE SOLUTION

The SonicKleen™ Wet Electrostatic Precipitator (WESP) was selected for its proven performance and low maintenance operation.

The main reasons for selecting a WESP for this application were:

- High efficiency removal of particulate
- High reliability
- Low operating cost
- Low maintenance cost

The WESP design is a vertical downflow self-irrigating type with common wall hexagonal collection tubes. High intensity charging zones are developed using rigid mast-type SonicCharge™ discharge electrodes. An inlet gas conditioning system consisting of Turbotak air atomizing nozzles ensures complete saturation. The atomized water forms a falling film of liquid on the surface of the collection tubes, creating a self-cleaning collector surface to maintain optimal precipitator performance.

THE RESULTS

The SonicKleen™ WESP performance meets design specifications and U.S. EPA compliance levels, with a minimum of maintenance, based on semi-annual shutdown inspections.

System data as follows:	Design
Saturated gas volume (ACFM)	18,615
Outlet particulate loading (gr/DSCF)	0.005
Particulate removal efficiency (%)	90
Heavy Metals removal efficiency (%)	95
WESP pressure drop ("H ₂ O)	2.0
Nominal WESP operating voltage (kVDC)	65



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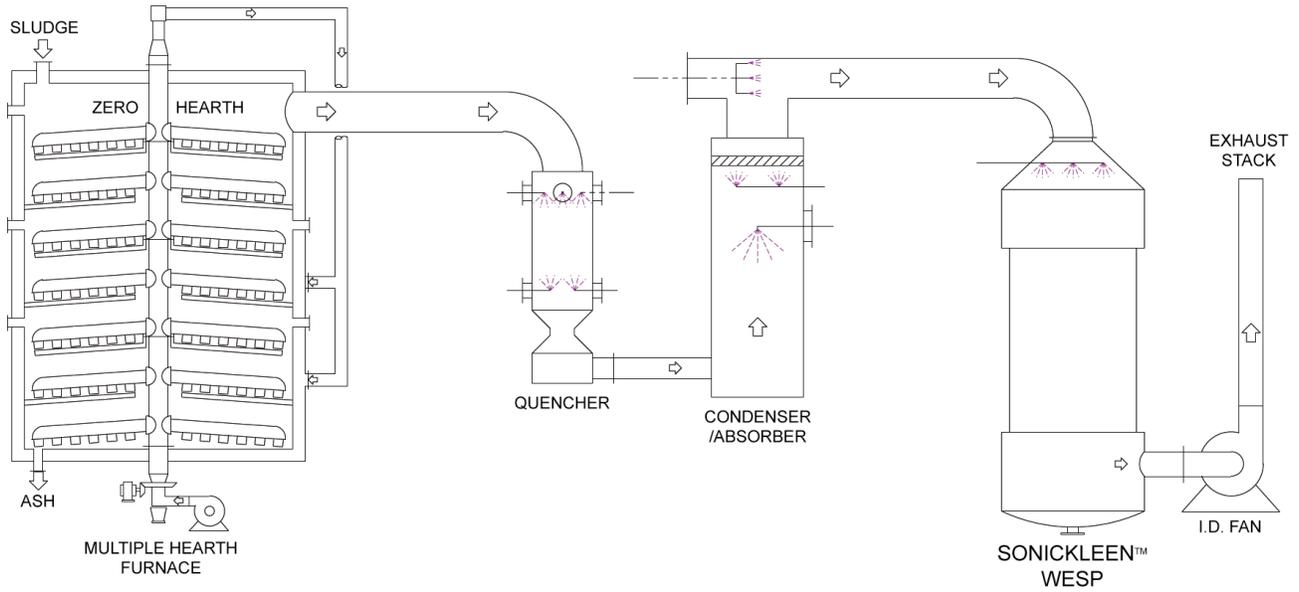
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SONICKLEENTM WESP CONTROLS EMISSIONS FROM CERAMIC KILN

THERMAL CERAMICS – AUGUSTA, GA

THE CHALLENGE

Thermal Ceramics in Georgia required a high efficiency air pollution control (APC) solution to control particulate and acid gas emissions from a ceramic brick-curing kiln.

THE SOLUTION

A system consisting of a Turbotak Wet Scrubber and a SonicKleen™ Wet Electrostatic Precipitator (WESP) was installed.

The scrubber was designed for quenching, removal of coarse particulate and acid gas removal.

The SonicKleen™ WESP provides high efficiency removal of the remaining particulate and sub-micron condensable elements.

The main reasons for selecting a WESP and a scrubber for this application were:

- ◆ High efficiency removal of particulate and acid gases
- ◆ High reliability
- ◆ Low energy and operating cost
- ◆ Low maintenance cost

THE RESULTS

The SonicKleen™ WESP performance meets design specifications and U.S. EPA compliance levels, with a minimum of maintenance, based on annual shutdown inspections.

System Data as follows:

	Design
◆ Gas volume (ACFM)	48,700 ACFM (82,750 Nm ³ /hr)
◆ Gas temperature	917°F (492°C)
◆ Outlet particulate Loading	0.006gr/DSCF (13.7 mg/Nm ³)
◆ WESP Water Consumption	1.5 USgpm (5.7 l/min)
◆ WESP Pressure Drop	1.0 "H ₂ O (25mm)
◆ WESP Operating Voltage	45 kVDC



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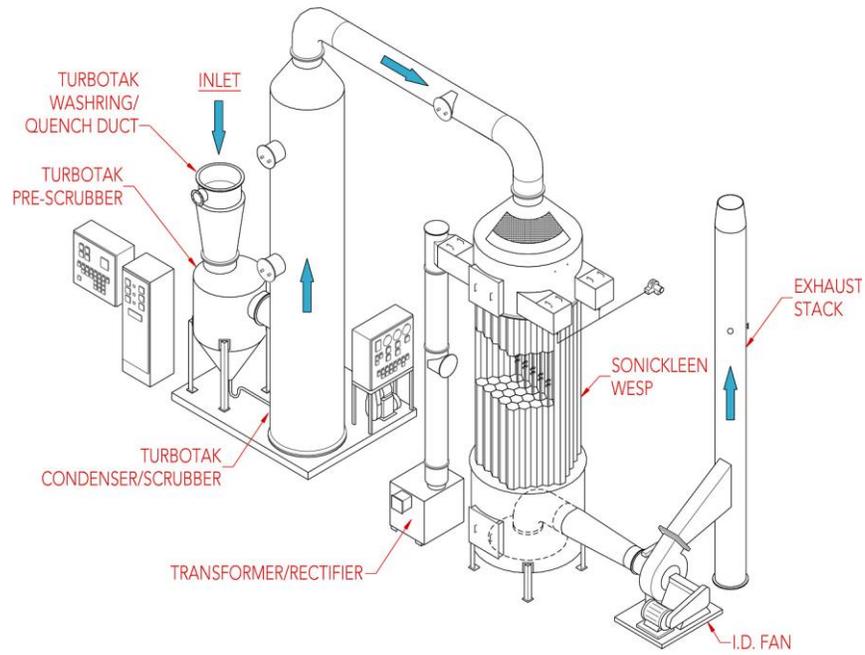
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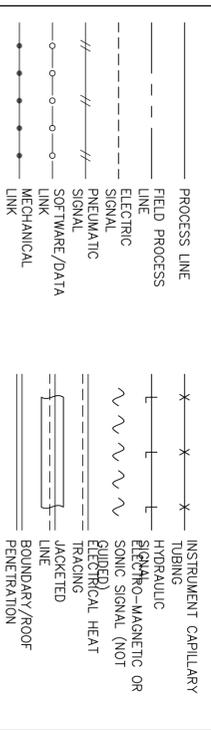
Client: TRC Solutions

Location: Plymouth Meeting, PA

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LINE SYMBOLS



ISA LETTER COMBINATIONS

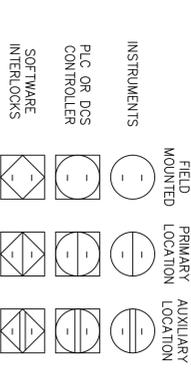
LETTER	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER FUNCTION
A	ANALYSIS		ALARM		
B	BURNER, COMBUSTION			CONTROL	
C	CONDUCTIVITY				
D	DENSITY	DIFFERENTIAL			
E	VOLTAGE		SENSOR (PRIMARY ELEMENT)		
F	FLOW RATE	RATION (FRACTION)	GLASS, VIEWING DEVICE		
G	GLAZING				
H	HAND		INDICATION		HIGH
I	URGENT (ELECTRICAL)		SCAN		
J	POWER		TIME RATE OF CHANGE	CONTROL STATION	
K	TIME, TIME SCHEDULE		TIME RATE OF CHANGE		LOW
L	LEVEL		LIGHT		MIDDLE, INTERMEDIATE
M	MOISTURE / HUMIDITY			MOMENTARY	
N	USER'S CHOICE				
O	OPACITY / TURBIDITY		ORIFICE, RESTRICTION		
P	PRESSURE / VACUUM		POINT (TEST CONNECTION)		
Q	QUANTITY	INTEGRATE, TOTALIZER			
R	RADIATION		RECORD		
S	SPEED, FREQUENCY			SAFETY	
T	TEMPERATURE			SWITCH	
U	MULTIVARIABLE		MULTIFUNCTION	TRANSMIT	
V	VIBRATION			MULTIFUNCTION	MULTIFUNCTION
W	WEIGHT / FORCE			VALVE, DAMPER, LOUVER	
X	USER'S CHOICE	X-Axis			
Y	EVENT, STATE, PRESENCE	Y-Axis		RELY, COMPUTE, CONVERT	
Z	POSITION, DIMENSION	Z-Axis		DRIVER, ACTUATOR	

EXAMPLE

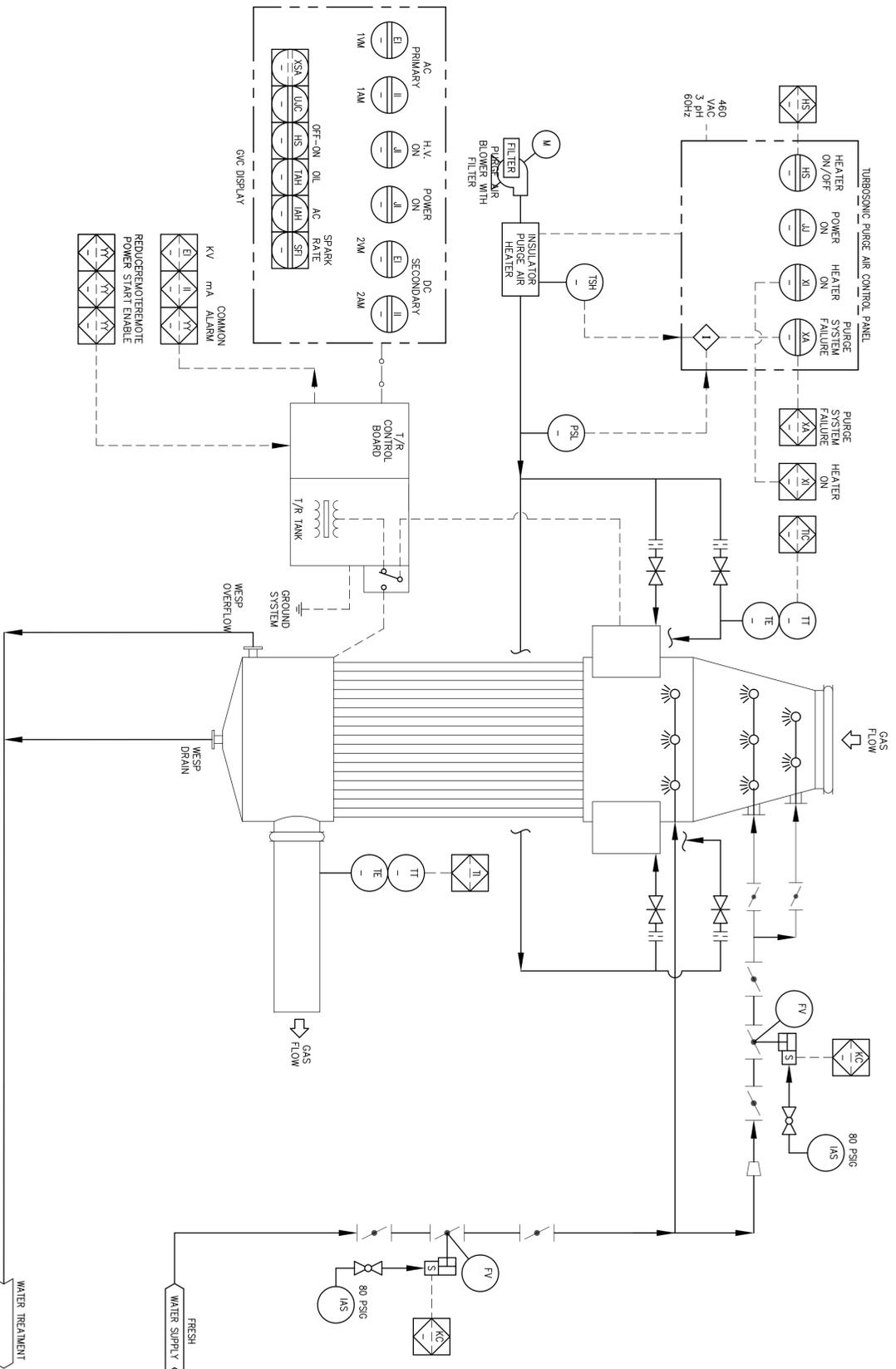
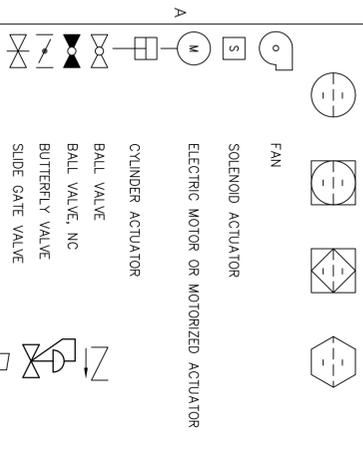
PIT - PRESSURE DIFFERENTIAL INDICATION
 TRANSMITTER CONTROL VALVE
 LO - LOCKED OPEN
 LI - LOCKED CLOSED
 LOM - LIMIT OPEN HIGH
 LOH - LIMIT OPEN LOW
 DOO - TIME TOTALIZING INDICATOR
 LO = LOCKED OPEN
 LC = LOCKED CLOSED
 LOM = LIMIT OPEN HIGH
 LOH = LIMIT OPEN LOW
 CSO = CAR SEAL OPEN
 CSC = CAR SEAL CLOSED
 VP = VIEW PORT
 FO = FAIL OPEN
 FC = FAIL CLOSED
 FI = FAIL INTERMEDIATE
 MOV = MOTOR OPERATED VALVE
 TSO = TIGHT SHUT OFF
 ZSH = LIMIT SWITCH, FULLY OPEN OR HIGH POSITION
 ZSL = LIMIT SWITCH, FULLY CLOSED OR LOW POSITION
 ZSH = LIMIT SWITCH, FULLY OPEN OR HIGH POSITION
 ZSL = LIMIT SWITCH, FULLY CLOSED OR LOW POSITION
 VP = VIEW PORT

ABBREVIATIONS

CONTROL VALVE
 FIELD MOUNTED
 PRIMARY LOCATION
 AUXILIARY LOCATION



NOTE: NORMALLY INACCESSIBLE OR BEHIND THE PANEL DEVICES OR FUNCTIONS MAY BE DEPICTED BY USED THE SAME SYMBOLS BUT WITH DASHED HORIZONTAL LINES, AS SHOWN BELOW.

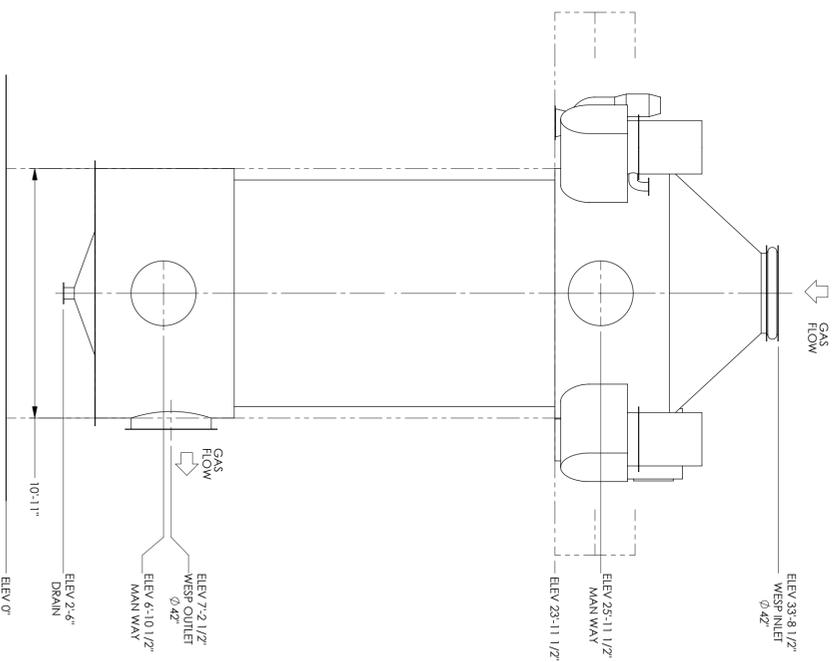
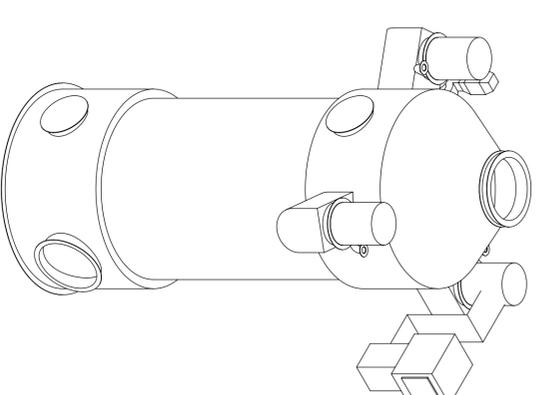
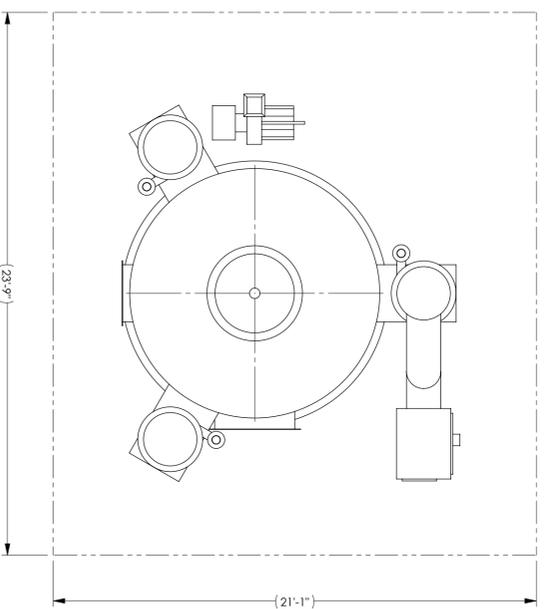


REVISIONS

ZONE	REV	DESCRIPTION	APVD	DATE
01	NEW DRAWING			

MBCTEC SYSTEMS

DATE	BY	TITLE	DRAWING NUMBER	REV
04/03/14	JMS	PROCESS AND INSTRUMENTATION DIAGRAM	Q14-1186-300	0



FOR INFORMATION
ONLY

METTEC TurboSonic Inc. Waterloo, Ontario, Canada

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Customer: TRC SOLUTIONS

Job #: Q14-1186 Project: WESP 69 TUBE

Drawn: SK 04/02/14 Desc.: WET ELECTROSTATIC PRECIPITATOR (WESP)

CHKD:

Scale: 1:48 File: Q14-1186-600-001 Sheet 1 of 1

Dwg #: Q14-1186-600-001 Rev: 0

Effective: January 1, 2013

Start-up services, installation supervision, and service calls are provided at the following rates:

Straight Time	\$130.00/hour	Up to 8 hours per day Monday through Friday
After Hours Straight Time	\$156.00/hour	Up to 8 hours per day After 10pm until 6AM Mon-Fri
Overtime	\$200.00/hour	Over 8 hours up to 12 hours Monday through Friday Up to 8 hours Saturday
Premium Time	\$250.00/hour	Over 12 hours Monday through Friday Over 8 hours on Saturday All day on Sunday
Travel Time	\$ 85.00/hour	All travel based on actual travel hours
Overtime Travel Not including Holidays	\$127.00/hour	All travel based on actual travel hours Over 8 hours Mon-Fri and all weekend travel.
Holiday Time	\$307.00/hour	All work and travel on Holidays and Holiday weekends
Confined Space Attendant Not including Holidays	\$92.00/hour	Plus expenses for attendant.
Weekend Layover Fee	8 Hrs straight time/Day	Plus actual expenses
Trainer / Service Engineer	\$200.00/hour (straight time)	Customer plant training. Process Support, Second level field service support.
24/7 Technical Support	MEGTEC Systems provides 24 hour, 365 day phone technical support. After business hours, a charge of \$500.00 dollars per troubleshooting issue will apply.	
	<ul style="list-style-type: none"> • Prices are subject to change without notice. • All service calls are billed at a rate of 4 hours minimum service plus travel. 	

Expenses

Actual Expenses: will be invoiced as incurred plus a 6% service charge. These charges may include: Airfare, lodging, job supplies and PPEs.

Daily Rate: \$160.00/day (ground transportation & food)
Regional Technician Daily Rate - \$80.00/day
Confined Space Pack - \$170/site visit

MEGTEC SYSTEMS, INC.
STANDARD TERMS AND CONDITIONS OF SALE FOR
NEW EQUIPMENT SALES

1. GENERAL

- a. All sales between MEGTEC Systems, Inc., ("Seller") and Buyer are subject to the following terms and conditions. Provisions additional to or inconsistent with those contained herein, including without limitation penalty or liquidated damages provisions for late delivery, shall not be binding on Seller unless such provisions are specifically identified and accepted in writing by Seller. Orders shall be binding upon Seller only after acceptance by Seller in writing. These Standard Terms and Conditions shall apply to the exclusion of any additional or different terms and conditions stipulated or referred to by the Buyer in its pre-contract negotiations, authorization or purchase order or as otherwise implied by law, trade, custom, practice or course of dealing.
- b. The most recent version of these Standard Terms and Conditions shall apply for all of Seller's performance. The most recent installation rates and service charges as applicable as published or applied from time to time shall apply for all of Seller's performance.

2. WARRANTIES, REMEDIES, AND LIMITATIONS - New Equipment

- a. Standard Equipment ("Equipment") manufactured by Seller and sold hereunder is warranted to be free from defects in workmanship and material for a period of one year from the date of shipment. During the warranty period, the Seller's liability and Buyer's remedy under this warranty are limited to the repair or replacement, at Seller's option, of products found in Seller's reasonable judgment to have been defective in workmanship or material with the Seller's maximum liability being limited to the original price of the Equipment. For components or units purchased by Seller, this warranty shall apply only to the extent of the warranty granted by the suppliers thereof. Seller will not pay for travel and living expenses incurred in connection with the repair or replacement, which expenses will be billed to the Buyer at Seller's prevailing rates. This warranty is conditional upon receipt by Seller of written notice of defects within fifteen days after discovery by Buyer within the warranty period. Unless Buyer provides Seller with written documentation of the maintenance performed on the Equipment, Seller reserves the right not to honor a warranty claim. This warranty does not cover any defects or failures due to (i) negligence, accidents, abuse, improper operation, improper maintenance, improper electrical/mechanical interfacing of Seller products with other products, electrical failure, or abnormal conditions of moisture, temperature, dirt, and corrosive matter, (ii) products tampered with or altered, modified or repaired by anyone not previously approved by Seller, (iii) products damaged in shipment or otherwise without Seller's fault. This warranty does not include the cost of any labor or expenses incurred for the adjustment of products sold hereunder. Transportation charges and risk of loss for allegedly defective products will be assumed by Seller only if returned by Buyer in strict accordance with written instructions from Seller. Replacement parts and charges associated with their replacement will be charged to the customer until defective parts are returned prepaid, accompanied by an Authorized Return of Goods Tag, to Seller's plant in De Pere, Wisconsin. If, in the opinion of Seller, the parts are found to be defective, then credit will be given to the Buyer for the replacement parts. This

warranty does not apply to experimental, developmental or non-standard products which are sold "as is".

- b. This warranty is conditional upon receipt by SELLER of written notice of defects within fifteen (15) days after discovery by Buyer within the warranty period. Unless Buyer provides SELLER with written documentation of the maintenance performed on the allegedly defective work, SELLER reserves the right not to honor a warranty claim. Unless specifically agreed in writing, SELLER shall have no responsibility for the overall performance of Buyer's equipment not worked on by SELLER. This warranty does not cover any defects or failures due to (i) negligence, accidents, abuse, improper installation, improper operation, improper maintenance, improper storage procedures, improper electrical/mechanical interfacing of SELLER products with other products, electrical failure, or abnormal conditions of moisture, temperature, dirt, and corrosive matter, (ii) products tampered with or altered, modified or repaired by anyone not previously approved by SELLER, (iii) products damaged in shipment or otherwise without SELLER's fault. This warranty does not include the cost of any labor or expenses incurred for diagnostic purposes or for the adjustment of products sold hereunder. Transportation charges and risk of loss for allegedly defective products will be assumed by SELLER only if returned by Buyer in strict accordance with written instructions and under a returned goods authorization from SELLER. Replacement parts and charges associated with their replacement will be charged to the Buyer until defective parts are returned prepaid, accompanied by an Authorized Return of Goods Tag, to SELLER's plant in De Pere, Wisconsin.
- c. Seller warrants that the products sold hereunder will not in and of themselves infringe any patent of the United States of America. Seller's liability under this warranty is limited to Seller's defense of any suit or proceeding brought against Buyer based on a claim that any Seller product sold hereunder when employed in the manner intended by Seller constitutes an infringement of any patent of the United States. Seller's liability hereunder is conditioned upon Buyer's giving prompt written notice of any such claim made against Buyer, all such information available to Buyer and such assistance as required by Seller in respect to such claim and Buyer's granting to Seller exclusive control of the settlement and litigation of any such suit, proceeding or claim. If Buyer's use of the product in the manner intended by Seller is finally enjoined, Seller shall at its option: (i) procure for Buyer the right to continue using the product, (ii) replace same with a non-infringing product, (iii) modify the product so it becomes non-infringing but equivalent or (iv) remove the product and refund the purchase price (less allowance for use, damage and obsolescence). In no event will Seller be liable for any patent infringement based on the use of the product for a purpose other than that for which it is sold by Seller. Seller makes no warranty against patent infringement resulting from products made to Buyer's specification or the use of the product in combination with other products or in the practice of any process and if a claim, suit or action is based thereon Buyer shall defend, indemnify and save Seller harmless therefrom. Notwithstanding the foregoing, in no event shall Seller's liability to Buyer under this Section 2b. exceed \$500,000 USD.
- d. Seller warrants to Buyer that it will convey good title to the Equipment sold hereunder. Seller's liability and Buyer's remedy under this warranty are limited to the removal of any title defect or, at the election of Seller, to the replacement of the Equipment or any part thereof which is defective in title; provided, however, that the rights and remedies of the parties with respect to the patent

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infringement shall be limited to the provisions of paragraph (b) above.

- e. Seller is not liable for defects in design arising out of a design stipulated or specified by Buyer.

MEGTEC'S FOREGOING WARRANTIES ARE EXCLUSIVE AND ARE GIVEN AND ACCEPTED IN LIEU OF ANY AND ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS. THE REMEDIES OF BUYER FOR ANY BREACH OF WARRANTY SHALL BE LIMITED TO THOSE PROVIDED HEREIN, AND FOR DELAY OR NONDELIVERY WHICH IS NOT EXCUSABLE SHALL BE LIMITED TO THE PURCHASE PRICE OF THE EQUIPMENT IN RESPECT OF WHICH THE DELAY OR NONDELIVERY IS CLAIMED, TO THE EXCLUSION OF ANY AND ALL OTHER REMEDIES. IN NO EVENT SHALL SELLER BE LIABLE FOR SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, LOSS OF USE OR PROFITS. NO AGREEMENT VARYING OR EXTENDING THE FOREGOING WARRANTIES, REMEDIES OR THIS LIMITATION WILL BE BINDING UPON SELLER UNLESS IN WRITING SIGNED BY A DULY AUTHORIZED OFFICER OF SELLER.

3. NEW EQUIPMENT INSTALLATION AND OTHER SERVICES

For new equipment installation and other services, the following additional provisions shall apply:

- a. Safety. Buyer shall inform Seller personnel at its own expense of existing safety regulations and hazards and shall undertake all action for the protection of persons and property at the worksite.
- b. Support. Buyer shall support Seller personnel in carrying out the work at its own expense and to the required extent and render the support services required under the agreement such as the preparation of the construction site, the provision of tools and cranes and elevators, and the provision of water, steam, and electricity, etc.
- c. Timing. Buyer's support must warrant that Seller's work can begin immediately upon the arrival of Seller's personnel and can be carried out without delay up to acceptance.
- d. Seller Action. If Buyer does not comply with its obligations, Seller shall be entitled, but not obliged, to take the action to which Buyer is obliged in its stead and at its expense.
- e. Delay. If Seller's performance cannot be carried out by Seller on grounds for which Seller is not responsible, Buyer shall compensate Seller for already rendered performance and any incurred time and expense.
- f. Deadlines. Should the performance fail or deteriorate prior to acceptance through no fault on Seller's part, Buyer shall pay Seller the price minus any savings in expenses. Installation deadlines are only binding if confirmed by Seller in writing.

4. DISCONTINUANCE OF SERVICE AND/OR WARRANTY; DEACTIVATION OF SOFTWARE; ELECTRONIC REMEDY

SELLER MAY DISCONTINUE THE FURNISHING OF ANY AND/OR ALL SERVICE(S), OR CANCEL BUYER'S SERVICE(S) OR WARRANTY, OR DEACTIVATE INSTALLED SOFTWARE OR INSTALLED ELECTRONIC CONTROLS BY REMOTE MEANS, WITHOUT INCURRING ANY LIABILITY IMMEDIATELY UPON SEVEN (7) DAYS WRITTEN NOTICE TO BUYER, IF:

- (1) PROVIDING SERVICE(S) WOULD VIOLATE ANY APPLICABLE LAW, REGULATION, COURT ORDER, OR OTHER LEGAL AUTHORITY;
- (2) ANY SUM OWED BY BUYER HAS NOT BEEN PAID WITHIN THE INVOICE DATE AGREED TERMS AND REMAINS UNPAID DURING THE SEVEN (7) DAY PERIOD FOLLOWING

THE DELIVERY OF WRITTEN NOTICE OF NON-PAYMENT TO BUYER;

(3) BUYER FAILS TO COMPLY WITH A REQUEST BY SELLER FOR SECURITY FOR THE PAYMENT OF EQUIPMENT OR SERVICE(S);

(4) BUYER HAS FAILED TO FULFILL AN AGREEMENT OR COMMITMENT TO PAY FOR EQUIPMENT OR SERVICE(S) PREVIOUSLY FURNISHED TO BUYER; OR

(5) BUYER IS NON-COMPLIANT WITH ANY OTHER PROVISION OR REQUIREMENT SET FORTH IN ANY AGREEMENT BETWEEN SELLER AND BUYER.

DISCONTINUANCE OR CANCELLATION OF SERVICE(S), WARRANTY, OR DEACTIVATION OF INSTALLED SOFTWARE OR INSTALLED ELECTRONIC CONTROLS BY SELLER WILL NOT RELIEVE BUYER OF ANY OBLIGATION TO PAY FOR EQUIPMENT OR SERVICE(S) PREVIOUSLY FURNISHED TO BUYER OR FOR ANY TERMINATION OR OTHER CHARGES. UPON SELLER'S DISCONTINUANCE OR CANCELLATION OF WARRANTY, SERVICE(S), OR DEACTIVATION OF INSTALLED SOFTWARE OR INSTALLED ELECTRONIC CONTROLS TO BUYER, ALL APPLICABLE CHARGES, INCLUDING TERMINATION CHARGES, BECOME DUE. THE REMEDIES SET FORTH ABOVE ARE IN ADDITION TO ALL OTHER REMEDIES THAT MAY BE AVAILABLE TO SELLER AT LAW OR IN EQUITY OR UNDER ANY OTHER PROVISION OF THIS AGREEMENT.

5. DELIVERY AND FREIGHT; RISK OF LOSS

Title to and risk of loss of all Equipment parts sold hereunder shall pass to Buyer upon delivery F.O.B. SELLER's plant to an agent of the Buyer including a common carrier. However, the Seller maintains a security interest in the Equipment or parts until full payment is made to the Seller. Seller has the option to select point of origin shipment, method of transportation and routing of shipment. Seller is liable for any delay, loss or damage in transportation however occasioned. All prices listed provide for standard packing for domestic shipment in accordance with SELLER's standard specifications. Special packaging shall be requested and invoiced accordingly.

6. PRICES, CREDIT AND PAYMENT

- a. Buyer shall make payments to Seller for products or services with funds obtained and through financial institutions and accounts in compliance with applicable laws concerning the prevention of money laundering, terrorist financing and other illicit activities, including those enforceable under U.S. Law.
- b. Buyer shall pay for Equipment according to the terms of payment as specified on the face hereof or those terms specifically quoted to Buyer in writing. Pro rata payments shall become due as deliveries are made. Minimum billing by Seller shall be \$25.00 net. If any work is delayed by the Buyer, payments shall be made on the purchase price and the percentage of completion as determined by Seller. Seller shall be entitled to invoice in addition to the price quoted all additional wage costs, including premiums thereon, incurred for overtime requested by Buyer. Price quotes shall remain firm for thirty days from the date of Seller's quote, but prices otherwise are subject to change without notice.
- c. If Buyer shall fail to fulfill the terms of payment or if Seller at any time shall have any doubt as to Buyer's financial responsibility, Seller without liability to Buyer may decline to make further shipments except against cash or satisfactory security at its option.

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d. If Seller is prevented from revising prices or from continuing any price already in effect by an action of government or by compliance with any request of government, Seller may cancel this agreement or any undelivered portion thereof without liability to Buyer upon written notice of such termination to Buyer.

7. TAXES, DUTIES AND EXCISES

In the absence of satisfactory evidence of exemption supplied to Seller by Buyer, Buyer shall pay in addition to the price of the Equipment or parts all taxes, duties, excises or other charges for which Seller may be responsible for collection or payment to any government (national, state or local) upon, measured by or relating to the importation, exportation, production, or any phase or part of the production, storage, sale, transportation and/or use of the Equipment or parts identified on the face hereof.

8. CANCELLATION

Requests for cancellation of any order by Buyer must be in writing and will be subject to payment by Buyer on the following basis:

Any items which, upon receipt of a written notice of cancellation are within thirty calendar days of completion, are to be completed and paid for by the Buyer in full under the regular terms and conditions of billing. On all items for which materials have been purchased but on which no actual production has been started, payment will be made on the basis of actual cost of materials purchased, plus 15% on the total of such cost and expenses. On all items already entered for production and which are not within thirty calendar days of completion, payment will be made on the basis of actual cost of labor (including without limitation engineering services), materials and supplies applied to the production of such items, **any other cost or liability which in the circumstances was reasonably incurred by the Seller in the expectation of completing the Equipment or in the winding down of the work**, plus overhead expenses allocated in accordance with generally accepted accounting practice as applied by Seller, plus 15% on the total of such cost and expenses; provided the total shall not exceed 90% of the agreement price. In the event of cancellation of incomplete Equipment, Seller's figures, which shall be reasonably calculated based upon standard accounting practices, shall be accepted as final and conclusive and Buyer's request for disposition of the material canceled shall be given to Seller within thirty calendar days from date of notice to Buyer of the cost of cancellation. Buyer's failure to request final disposition of canceled material within said thirty days shall be conclusive evidence of Buyer's agreement that Seller may dispose of the canceled material as it sees fit without obligation of any nature by Seller to Buyer.

9. RETURNED MATERIAL

Seller may, at its discretion, accept return of standard products, parts or components for restocking credit. No product, part or component is to be returned without Seller's prior written approval. Standard products, parts or components authorized by Seller for return are subject to a 10% service charge plus Seller's original transportation costs and must be returned to Seller at Buyer's expense and risk of loss and in their original condition.

10. DELAY

a. Buyer acknowledges that delivery dated for Equipment sold hereunder is based on the assumption that there will

be no delay due to causes beyond the reasonable control of Seller.

b. Seller shall not be charged with any liability for delay or non-delivery when due to delays of suppliers, production problems, acts of God or the public enemy, compliance with any applicable foreign or domestic court order or governmental regulation, order or request whether or not it proves to be invalid, fires, riots, labor disputes, unusually severe weather, or any other cause beyond the reasonable control of Seller. In the event of any such delay, the date of delivery shall be extended for a period of time equal to the time lost be reason of the delay, but this agreement shall remain otherwise in effect and Buyer shall not be relieved of his obligations to accept delivery as so delayed.

c. Seller is entitled to seek an adjustment of the agreement price and/or agreement time(s) if its cost or time to provide the Equipment or perform the service(s) has been adversely impacted by any suspension of stoppage of work by Buyer.

11. ENGINEERING DRAWINGS

General layout drawings will be submitted to the Buyer for approval and the Buyer will be asked to approve or comment on these drawings in regard to the scope of the work and overall dimensions. Approval by Buyer does not relieve Seller of obligation to perform to all the other specifications of this agreement. In the event of interference, the Buyer will be responsible for supplying Seller with information that will eliminate interferences of Seller's Equipment with other equipment, piping and wiring. Layout drawings will be used for the preparation of fabrication drawings after they are returned with the Buyer's approval or comments.

All additional engineering and/or drafting costs required to revise layout drawings and manufacturing drawings as a result of changes requested by Buyer after initial approval will be invoiced to the Buyer at Seller's prevailing per hour rates. Increases in manufacturing costs that result from such changes will be presented to the Buyer for approval of Seller's increased price before work commences.

12. INTELLECTUAL PROPERTY RIGHTS; CONFIDENTIAL INFORMATION

Seller Technology is the sole property of Seller. Except as provided in this Section 12 and Section 13, Buyer acquires no right, title or interest in or to the use of Seller Technology. Software created by Seller qualifies as original works and constitutes copyrightable material. Buyer agrees to restrict the use of Seller Technology, and any other Seller confidential technical information, to the installation, testing, calibration, operation or maintenance of the Equipment purchased by Buyer.

"Seller Technology" means the knowledge, information, discoveries, patents, patent applications, copyrights, mask works, concepts, ideas and other intellectual property owned by Seller and/or its subsidiaries or affiliates, whether patentable, copyrightable or not, including without limitation, know-how, processes, methods, formulae, software algorithms and techniques, and all manifestations or embodiments thereof and improvements made thereto and derivatives therefrom. It may be in electronic form or any other form.

Except as required by law, Buyer shall not use (except for purposes connected with the performance of its obligations hereunder), divulge or communicate to any third party any

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STANDARD TERMS AND CONDITIONS OF SALE FOR
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information of Seller it reasonably knows to be confidential or proprietary.

13. USE OF SELLER'S DRAWINGS, REPORTS, AND OTHER SUBMITTALS

Buyer shall have the right to reproduce any and all drawings, reports or other submittals received from Seller if such reproduction does not include any confidential, proprietary or work product information belonging to the Seller; if such reproduction includes such information, Buyer may reproduce such information only if it relates to the installation, testing, calibration, operation or maintenance of the Equipment.

14. SPECIFICATIONS

With the exception of this project, the Seller reserves the right to make product changes and modify product specifications without notice. Seller shall be under no obligation to incorporate any such changes or modifications in products manufactured prior to implementation of such changes and modifications. In cases of ambiguity in the specifications, drawings, designs, or other requirements of an order, Seller's reasonable interpretation of any such requirements shall be final.

15. STORAGE OF EQUIPMENT

If a delay in the shipping date is requested by the Buyer within 60 days before the scheduled shipping date, Seller at its option may place the Equipment in storage facilities and the Buyer will pay the cost of special handling, storage and insurance. Equipment held for the Buyer shall be at the risk of Buyer.

16. SOFTWARE

The general terms and conditions of software providers for their software products contained in Seller's Equipment shall have priority over these General Terms and Conditions. Should such terms and conditions not be available, Seller can provide to the Buyer upon request. Seller's Terms and Conditions shall be in supplement to the software providers. In the event the terms and conditions of the other providers are invalid, Seller's Terms and Conditions shall control. Buyer shall receive a perpetual, simple, non-exclusive right of use to Seller's software products. The grant of sublicense is not permitted. Seller is not obliged to provide the source code on which the software is based. Buyer may only process software products to the extent permissible under law. Buyer may neither remove nor change the manufacturer's product information, including, but not limited to, notices of copyright, without Seller's prior written consent.

17. LIMITATION OF LIABILITY

Seller's and Buyer's liability on any claim of any kind for (a) any commercial loss resulting from this agreement or from the performance or breach thereof shall in no case exceed 100% of the total amount payable under the agreement for the Equipment or services; and (b) any loss or damage arising out of or in connection with or resulting from death, bodily injury or property damage shall in no case exceed ONE MILLION US DOLLARS (\$1,000,000) PER OCCURRENCE OR TWO MILLION US DOLLARS (\$2,000,000) CUMULATIVE, FOR ALL SUCH OCCURRENCES.

18. CONSEQUENTIAL DAMAGES

NOTWITHSTANDING ANYTHING HEREIN TO THE CONTRARY, NEITHER SELLER NOR BUYER SHALL BE LIABLE TO THE OTHER FOR ANY CONSEQUENTIAL LOSSES OR DAMAGES, WHETHER ARISING IN AGREEMENT, WARRANTY, TORT (INCLUDING NEGLIGENCE), STRICT LIABILITY OR OTHERWISE, INCLUDING BUT NOT LIMITED TO LOSSES OF USE, PROFITS, BUSINESS OR REPUTATION.

19. INDEMNITY

Each party during the term of this agreement to the extent of its negligence and to the extent provided for in this agreement will indemnify and save the other party harmless at all times against any liability on account of any and all claims, damages, lawsuits, litigation, expenses, counsel fees and compensation arising out of property damages or injuries, claims, damages, law suits, litigation, expenses, counsel fees and compensation arising out of property damages or injuries, (including death), arising out of its performance under this Agreement. In no event shall Seller's liability hereunder exceed the limits of its insurance coverages as stated in Section 16, which certificates of insurance have been provided to or can be made available to Buyer.

20. SECURITY INTEREST

Seller may, at its discretion, require a Security Agreement from Buyer pursuant to which Buyer will grant Seller a purchase money security interest in the Equipment identified in the agreement purchased by Buyer from Seller and any proceeds therefrom. If so required by Seller, Buyer will execute all appropriate documents, including a form UCC-1, to perfect and evidence such security interest.

21. ASSIGNMENT AND NON-WAIVER

- a. This agreement is not assignable or transferable by Buyer whether voluntary or by operation of law, in whole or in part, without the prior written consent of Seller.
- b. Seller's failure to insist upon strict performance of any provision hereof shall not be deemed to be a waiver of Seller's rights or remedies or a waiver by Seller of any subsequent default by Buyer in the performance of or compliance with any of the terms hereof.

22. SEPARATE AGREEMENT

Each delivery shall stand and may be recovered for as a separate and independent agreement. If Buyer fails to fulfill the terms of order, purchase, or payment under this or any other agreement with Seller, Seller without prejudice to other lawful remedies may at its option defer further shipments hereunder until such default is made good, treat such default as a breach of this entire agreement or terminate this agreement.

23. ROYALTIES; MISCELLANEOUS

The purchase of Equipment from Seller confers no license, express or implied, under any patents. When Equipment identified on the face hereof include Equipment suitable for use according to Seller's patents, a royalty (amount obtainable upon request) is included in the purchase price. Equipment identified on the face hereof may vary according to Seller's established limits, sizes and tolerances in effect at the time of delivery in respect of such Equipment. ANY ADVICE FURNISHED BUYER CONCERNING THE USE OF THE

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EQUIPMENT SHALL REPRESENT SELLER'S BEST JUDGMENT IN THE CIRCUMSTANCES BUT IS ACTED UPON AT BUYER'S SOLE RISK.

24. EXPORT RESTRICTIONS

Sales to Buyer are expressly made subject to any applicable laws, regulations, orders, or other restrictions on the export of the technology or information about the Equipment or the Equipment which may be imposed from time to time. Buyer shall not export the information about the Equipment or the Equipment without complying with such laws, regulations, orders, or other restrictions. Buyer agrees to indemnify and hold harmless Seller against all claims, losses, damages, liabilities, costs and expenses, including reasonable attorneys' fees, to the extent such claims arise out of any breach of this Section.

arguments supporting that position; and (b) the name and title of the executive who will represent that party and of any other person who will accompany the executive. Within 30 days after delivery of the initial notice, the executives of both parties shall meet at a mutually acceptable time and place, and thereafter as often as they reasonably deem necessary, to attempt to resolve the dispute.

If the dispute has not been resolved by non-binding means as provided herein within 60 days of the initiation of such procedure, either party is not precluded from initiating litigation; provided, however, that if one party has requested the other to participate in a non-binding procedure and the other has failed to participate, the requesting party may initiate litigation before the expiration of the above period.

25. ENTIRE AGREEMENT AND CONSTRUCTION

- a. The agreement between Buyer and Seller in respect of the Equipment identified on the face hereof consists in its entirety of the terms and conditions appearing on the face and back of this document in lieu of all others and supersedes all previous communications, representations or agreements, either oral or written, between the parties hereto with respect to the subject matter hereof. No modification shall be effected by the acknowledgment or acceptance of Buyer's purchase order forms or other documents containing terms and conditions different from or in addition to those contained herein.
- b. Acceptance or use by Buyer of any Equipment delivered hereunder shall be an acceptance of these as the only terms and conditions applying to the purchase and sale of said Equipment unless other terms and conditions are agreed to in writing signed by both parties specifically referring to this agreement.
- c. This agreement shall be interpreted in accordance with and the construction thereof shall be governed by the laws of the State of Wisconsin excluding the application of any conflict of law or choice of law provisions. Seller and Buyer hereby consent to the jurisdiction of the state circuit courts of Brown County, Wisconsin or the federal district court of the eastern district of Wisconsin, Green Bay Division, as applicable.
- d. If any court of competent jurisdiction holds that any provision of these terms and conditions is illegal, invalid, or unenforceable, the legality, validity, and enforceability of the remaining provisions of the terms and conditions will not be affected or impaired, and all remaining terms of these terms and conditions remain in full force and effect, provided that this provision shall not be applied to defeat the intent of the parties.

Captions as used in these terms and conditions are for convenience of reference only and shall not be deemed or construed as in any way limiting or extending the language of the provisions to which such captions may refer.

26. DISPUTE RESOLUTION

Seller and Buyer shall attempt in good faith to resolve any dispute arising out of or relating to the agreement by negotiation between executives who have authority to settle the controversy and who are at a higher level of management than the persons with direct responsibility for administration of the agreement. Either party may give the other party notice of any dispute not resolved in the normal course of business. Within 15 days after delivery of the notice, the receiving party shall submit to the other a written response. The notice and response shall include: (a) a statement of that party's position and summary of

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MEGTEC SYSTEMS, INC.

Buyer: _____
(Company)

By: _____

By: _____

Date: _____

Date: _____

Attachment F

Opinion of Total Project Cost

Opinion of Total Project Cost

New WESP with 316 SS Internals and Housing (MEGTEC), Carbon Adsorber Hg Reduction System (Bionomic)

DIRECT CAPITAL COSTS		
1	Purchased Equipment Costs	
	a. Basic Equipment and Auxiliaries (A)	\$771,000
	1) New WESP	\$461,000
	2) Carbon Adsorber	\$104,600
	3) New ID Fan	\$75,000
	4) Interconnecting Ductwork	\$30,000
	5) Drying Heat Exchanger	\$100,000
	b. Instrumentation and Controls (0.1 A)	\$77,100
	c. Freight (0.05 A)	\$38,550
	d. Sales Taxes (0.0625 A)	\$48,188
	TOTAL PURCHASED EQUIPMENT COST (B)	\$935,000
2	Direct Installation Costs	
	a. Foundations and Supports (0.12 B)	\$112,200
	b. Erection and Handling (0.4 B)	\$374,000
	c. Electrical (0.25 B1, B3; 0.01B2,B4)	\$136,346
	d. Piping (0.10 B)	\$93,500
	e. Insulation (0.05 B)	\$46,750
	f. Painting (0.01 B)	\$9,350
	g. Site Preparation and Demolition	\$100,000
	h. Building and Structural Modifications	\$100,000
	TOTAL DIRECT INSTALLATION COSTS (C)	\$972,000
INDIRECT CAPITAL COSTS		
3	Engineering & Supervision (0.12*[B+C])	\$228,840
4	Construction & Field Expenses (0.1*[B+C])	\$190,700
5	Contractor Fees (0.10*[B+C])	\$190,700
6	Start-up (0.05 B)	\$46,750
7	Equipment Acceptance Test	\$50,000
8	Contingency (0.15*[B+C])	\$286,050
	TOTAL INDIRECT CAPITAL COST	\$993,000
TOTAL INSTALLED CAPITAL COST		\$2,900,000
DIRECT ANNUAL COSTS		
1	Operating Labor, (0 hr/yr x \$30/hr)	\$0
2	Supervisory Labor, 0.15 X (1)	\$0
3	Maintenance Labor 2* (548 hr/yr x \$30/hr)	\$32,880
	Materials (100% of labor)	\$32,880
4	Utilities	
	a. Water (\$3.20/1000 gal * 0.75 gal/min * 525,600 min/yr)	\$1,261
	b. Electricity (\$0.0966/kwh * 26.81 kw * 24 hr/day * 365 day/yr)	\$54,239
5	Media Replacement (20 modules x \$8,628/module / 3 year frequency)	\$57,520
	TOTAL DIRECT OPERATING COSTS	\$179,000
INDIRECT OPERATING COSTS:		
5	Overhead - 60% Operating & Maintenance Labor	\$39,456
6	Property Tax - 0% Total Capital Cost	\$0
7	Insurance - 1% Total Capital Cost	\$29,000
8	Administration - 2% Total Capital Cost	\$58,000
9	Capital Recovery (5% Interest, 20 Years)	\$232,696
	TOTAL INDIRECT OPERATING COSTS	\$359,000
TOTAL ANNUALIZED OPERATING COST		\$538,000

Note: Opinion of costs are budgetary (+/- 25%) only