Res 243
Significant

Contract Cover Sheet

Note: Shaded areas are for County Executive review.

Department: PWH&T - Solid Waste Division	Contract/Addendum #: 13230
1. This contract, grant or addendum: ■ AWARDS ☐ ACCEPTS	Contract / Addendum (If Addendum, please include original contract number)
2. This contract is discretionary ■ Yes ☐ No	
3. Term of Contract or Addendum: December 31, 2018	
4. Amount of Contract or Addendum: $13,066,300.00	
5. Purpose: Award for RFP 316039 - Biogas Cleaning Equipment for Pipeline Injection at Dane County Landfill Site #2 (Phase III - Equipment Procurement and Installation).	

[x]	POS	☐
☐	Grant	☐
☐	Co Lease	☐
☐	Co Lessor	☐
☐	Intergovernmental	☐
☐	Purchase of Property	☐
☐	Property Sale	☐
☐	Other	☐

6. Vendor or Funding Source: BIOFerm USA, Inc.
7. MUNIS Vendor Code: 18034
8. Bid/RFP Number: RFP 316039
9. If grant: Funds Positions? ☐ Yes ☐ No Will require on-going or matching funds? ☐ Yes ■ No
10. Are funds included in the budget? ■ Yes ☐ No
11. Account No. & Amount, Org & Obj. SWMETHGO 58087 - Pipeline Gas Project Amount $ 13,066,300.00
    Account No. & Amount, Org & Obj. _____ Amount $ _____
    Account No. & Amount, Org & Obj. _____ Amount $ _____
12. If this contract awards funds, a purchase requisition is necessary. Enter requisition # & year #2297 - 2017
13. Is a resolution needed? ■ Yes ☐ No If yes, please attach a copy of the Resolution.
    If Resolution has already been approved by the County Board, Resolution No. & date of adoption 2017 RES-243
14. Does Domestic Partner equal benefits requirement apply? ■ Yes ☐ No
15. Director's Approval: for JM

Contract Review/Approvals

Initials		Ftnt	Date In	Date Out
MG	Received		10/11/17	
CB	Controller			10/11/17
mwl	Corporation Counsel		10/11/17	10/12/17
[illegible]	Risk Management		10/11/17	10/11/17
PCP	Purchasing		10/12/17	10/12/17
	County Executive			

Vendor

Vendor Name
BIOFerm USA, Inc.
Contact Person
Dina Bertolini
Phone No.
608/229-6509
E-mail Address
BerD@biofermenergy.com

Footnotes:

1.
2.

Return to:	Name/Title: Traci Genz Phone: 608.266-4018 E-mail Address: genz@countyofdane.com	Dept.: DCPW - Solid Waste Division Mail Address: 1919 Alliant Energy Center Way Madison, WI 53713

Certification

The attached contract: *[check as many as apply]*

- ☐ conforms to Dane County's standard Purchase of Services Agreement form in all respects
- ☐ conforms to Dane County's standard Purchase of Services Agreement form with modifications and is accompanied by a revision copy[1]
- ☒ is a non-standard contract which has been reviewed or developed by corporation counsel and which has not been changed since that review/development
- ☐ is a non-standard contract previously review or developed by corporation counsel which has been changed since that review/development; it is accompanied by a revision copy[1]
- ☐ is a non-standard contract not previously reviewed by corporation counsel; it is accompanied by a revision copy
- ☐ contains non-standard/indemnification language which has been reviewed or developed by risk management and which has not been changed since that review/development
- ☐ contains non-standard insurance/indemnification language which has been changed since review/development or which has not been previously seen by risk management; it is accompanied by a revision copy
- ☐ contains non-standard affirmative action/equal opportunity language which has been reviewed or developed by contract compliance and which has not been changed since that review/development
- ☐ contains non-standard affirmative action/equal opportunity language which has been changed since the earlier review/development by contract compliance or which has not been previously seen by contract compliance; it is accompanied by a revision copy[1]

Date: 10-11-17 Signed: _____

Telephone Number 608/516-4154 Print Name: John Welch

Major Contracts Review (DCO Sect. 25.20) This review applies only to contracts which both exceed $100,000 in disbursements or receipts and which require county board review and approval.

Executive Summary (attach additional pages, if needed).

1. ***Department Head*** ☐ Contract is in the best interest of the County.
   Describe any deviations from the standard contracting process and any changes to the standard Purchase of Services Form Agreement.

   Date: _____ Signature: _____

2. ***Director of Administration*** ☐ Contract is in the best interest of the County.
   Comments:

   Date: _____ Signature: _____

3. ***Corporation Counsel*** ☐ Contract is in the best interest of the County.
   Comments:

   Date: 10-12-17 Signature: _____

[1] A revision copy is a copy of the contract which shows the changes from the standard contract or previously revised/developed contract by means of overstrikes (indicating deletions from the standard language) and underlining (showing additions to the standard language).

13230

CONTRACT FOR CONSTRUCTION AND INSTALLATION OF BIOGAS CLEANING SYSTEM

1. PREAMBLE

This contract is entered into by and between:

BUYER: Dane County, a quasi-municipal corporation organized and existing under the laws of the State of Wisconsin, (hereinafter "COUNTY").

SELLER: BIOFerm USA, Inc., a Wisconsin Corporation, (hereinafter the "BIOFerm").

Pursuant to the terms and conditions as outlined herein, COUNTY agrees to buy and BIOFerm agrees to sell the equipment, fixtures and services for good and valuable consideration to be paid by COUNTY ("Agreement").

2. SCOPE OF CONTRACT

A. Overview: Design, fabrication, delivery, installation, start-up, and commissioning of a biogas cleaning system at the Dane County Landfill Site #2 for converting landfill gas into high-BTU biomethane. The biogas cleaning system shall achieve the pipeline quality standards set by ANR Pipeline Company.

B. By accepting this Contract, BIOFerm represents that it possesses the necessary skill and other qualifications to perform work under this Contract and is familiar with the practices in the locality where such services and work shall be performed.

C. BIOFerm shall be professionally responsible for work performed under this Contract. Upon written approval of COUNTY, BIOFerm may subcontract work to an approved consultant or contractor under this Contract, to the specific extent authorized by COUNTY. The authorization to subcontract shall not relieve BIOFerm of professional or contractual responsibility for any work performed or delivered under this Contract. The authorization to subcontract shall not be construed to create any contractual relationship between COUNTY and such consultant.

D. WORK BY OTHERS: Work by Others will include connection to ANR Pipeline and registration of the gas purification facility under the U.S.E.P.A. Renewable Fuel Standard. BIOFerm shall support Work by Others by providing gas cleaning performance specifications and any other information relevant to scope of services in Paragraph 3 (Scope of Services to be Provided) below.

3. SCOPE OF SERVICES TO BE PROVIDED

A. The BIOFerm shall be responsible at its own cost and expense to provide materials, labor, and other accessories and materials necessary to fabricate, deliver and install the completed biogas cleaning system to include the items of "Major Equipment & Work" listed on Exhibit A which is attached hereto and fully incorporated herein.

B. BIOFerm shall provide a completed system in accordance with the specifications and conditions enumerated in the County's Request for Proposal No. 316039, Addendums #1-3 thereto, the BIOFerm's proposal dated February 28, 2017 and responses to follow up questions, BIOFerm's Proposal dated October 10, 2017 (Exhibit D), and the A/E Professional Services Agreements for Phase I and II, all of which are made a part hereof and collectively evidence and constitute the Contract. In the case of any conflict between the terms and this Agreement and any of the incorporated documents, the terms of this Agreement shall control.

C. The following rights and responsibilities are hereby expressly assigned to the parties:

1) BIOFerm will provide the COUNTY with layout drawings and required specifications for the System, related infrastructure pursuant to the A/E Professional Services Agreements for Phase I and II;

2) BIOFerm is responsible for all process flow diagrams and System specifications which shall conform to industry standards;

3) COUNTY shall cooperate with BIOFerm by providing all information within the COUNTY's possession and assistance required to acquire all permits that may be required for the operation of the System consistent with the operating parameters contained in this Agreement;

4) During installation of the System, BIOFerm shall provide qualified and trained field representative(s) who will be responsible for (i) review and approval of related infrastructure before System installation; (ii) oversight, review and approval of the installation of the System; and (iii) commissioning of the System;

5) BIOFerm shall deliver to COUNTY three (3) complete copies and an electronic copy of on-site operating, maintenance, troubleshooting (if applicable) and clean-in-place ("CIP") procedures (if applicable). BIOFerm will supply COUNTY with a list of any equipment or components of system which do not have troubleshooting procedures or are not able to be cleaned through CIP procedures;

6) BIOFerm agrees to update the materials provided in Subsection 5, above to reflect any changes made to the procedures it has made during the Guaranty period. All materials provided under this Paragraph shall be subject to the nondisclosure provisions of Paragraph 7 of this Agreement;

7) Delivery of two (2) complete sets of as-built drawings and specifications for the System as installed which drawings shall be subject to the trade secrets and intellectual property protections contained in this Agreement;

8) BIOFerm shall provide Construction and Management Services. BIOFerm shall also be responsible to oversee the placement, installation and interconnection of the System and other on-site electrical and mechanical and controls systems, concrete slab and foundation, and all on-site electrical, and sanitary sewer utilities.

4. Start-Up, Commissioning and Completion

A. The Start-Up Period will commence at the sole discretion of the COUNTY when all work associated with installation is complete and the system is operable, no latent residual work is required, and the site is free from debris, dirt, and discarded material. System shall be considered operable when BIOFerm informs COUNTY in writing that system is ready to accept raw gas and capable of producing product gas as specified in Exhibit C. However, in no event shall this beginning of Start-Up Period be delayed by the COUNTY for more than sixty days of receipt of written notice that the system is operable.

B. BIOFerm will provide trained personnel during the start-up, commissioning, and completion of the System ("Start-up" Period).

C. Labor, materials and all other costs for start-up and commission of the System are included in the Contract Price.

D. During Start-Up Period BIOFerm shall be responsible to:

1) Verify the correct assembly of the system and all components of the system will be put into operation; and

2) Train Dane County personnel on start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance and shutdown procedures of the system and each item of equipment.

E. Performance Test and Plant Hand Over

1) After commissioning, an acceptance test run including a performance test will be conducted. The guaranteed performance data according to Exhibit C shall be demonstrated in a successful performance test in the manner described herein. The performance test shall begin immediately after Plant commissioning is complete and the Plant is operating at full load and with stable raw biogas conditions within the ranges specified in Exhibit B. BIOFerm shall conduct the performance test based on 72 consecutive hours of Plant operations according to the instructions outlined in the BIOFerm Operations and Maintenance (O&M) manual. During the 72-hour test, BIOFerm shall measure and record all relevant operating parameters and performance data. The parameters and data consist of,

but are not limited to, flow, pressure, temperature and composition of incoming raw gas and outgoing product gas and as applicable the released off gas and liquids in and out. In general, all performance measurements shall be taken from the Plant meters and gauges, such as flowmeters for gases and liquids, pressure transmitters and gauges, temperature transmitters and gauges, gas analyzer for various gases, dew point meters and others. For those measurements, which are not possible to carry out with the Plant's instruments, BIOFerm and COUNTY will mutually agree on alternative measurements, such as temporary instruments and/or sampling, with suitable devices in specific time intervals, along with testing by external authorized labs. Data recording shall be done via the Plant PLC system and manually written measurements shall be recorded in hard copy signed by both BIOFerm and the COUNTY. Provided all recorded performance data are within the guaranteed ranges for product gas as specified in Exhibit C, the performance test will be deemed successful. COUNTY will issue the Final Acceptance Certificate (FAC) within a week of the completion of a successful performance test. Upon receipt of the FAC, BIOFerm will hand over the Plant to the COUNTY.

2) Interruptions and Repeated Performance Tests: If COUNTY is providing raw biogas within the quantity and quality ranges specified in Exhibit B, and the recorded performance data are not within the guaranteed ranges for product gas as specified Exhibit C, BIOFerm will remedy the Plant defects within a reasonable time through adjustments, repairs and replacements, and repeat the performance test. The performance test can be repeated a maximum of three times within three months of the date of completion of the Plant's commissioning. Stoppages due to causes which BIOFerm is not responsible shall entitle BIOFerm to a reasonable extension of time to conduct performance test(s).

   If after three months from the date the Plant is delivered (a) the COUNTY cannot provide raw biogas within the quantity or quality ranges specified in Exhibit B, or (b) the COUNTY causes or is responsible for other circumstances that impede a full load performance test, the Parties shall agree on a partial load performance test. The test procedure for the partial load test remains the same. COUNTY shall issue an FAC based on a successful partial load performance test demonstrating product gas as specified in Exhibit C. The COUNTY has the right to request a repeat performance test at full load conditions within three months after a successful partial load test, but the COUNTY shall bear all costs related to the test

3) Deferred Performance Test: In the event that the performance test after commissioning is not or cannot be executed due to some fault of the COUNTY or its contractors, the Parties agree to issue a PAC and the COUNTY shall take over operation of the Plant. Performance test(s), either full or partial as agreed by the Parties, shall be carried out no later than three months after Plant commissioning. All costs related to this test shall be borne by the COUNTY. The

deferral of the performance test within the three months after Plant commissioning shall not, however, relieve BIOFerm of demonstrating a successful performance test as specified herein.

F. For the purposes of this Agreement, the System will be deemed complete on the date that the BIOFerm submits to COUNTY a Commissioning Report certifying as to the following: (a) the System has been constructed substantially in accordance with the design drawings and specifications; (b) the System has been tested at varying operating ranges and is ready and capable of being used for its intended purpose; (c) the system has the expected mass balance based upon raw gas data provided by COUNTY; and (d) the biomethane composition meets the pipeline standards set by ANR Pipeline Company.

5. CONTRACT PRICE

The price for the installed and commissioned biogas cleaning system shall not exceed $13,066,300.00.

This price includes $1,550,000.00 for additional infrastructure and site Work (slab, foundation and utilities, including design materials, integration, installation, and management) outside the original scope of the RFP. Payment for this additional infrastructure and site Work will be based on actual costs plus overhead, as agreed by County and BIOFerm, with the total amount not to exceed $1,550,000.00.

All prices are in US Dollars.

6. TERMS

A. The Contract Price shall be paid as follows:

1) **30%** on Contract Award;

2) **30%** on Final Design Submittal approval by COUNTY, or 30 days from delivery to COUNTY of the Final Design, whichever is earlier;

3) **20%** on Equipment Delivery;

4) **15%** on Commissioning Completion as defined in Paragraph 4, Subsection F; and

5) **5%** on Completion of Successful Performance Test, injection of biomethane into the pipeline, delivery of as-built drawings, delivery of all operational warranty documentation, and completion of obligations by BIOFerm noted in Paragraphs 3.C (5-7) and 4.E. In no event shall this payment be made more than sixty days after Successful completion of performance test.

B. Payment terms and invoiced amounts are due within 30 days of issuance of invoices for goods and services as per the above Payment Terms.

C. As a condition precedent to each installment payment due from COUNTY, BIOFerm shall provide partial lien releases and acknowledgment of payment for any goods, services, materials, or rental equipment covered by each invoice. This includes releases and acknowledgments from any subcontractors or suppliers of BIOFerm providing any goods, services, materials, or rental equipment covered by the invoice.

7. NON-DISCLOSURE

A. Definitions: For purposes of this agreement the term shall have the following definitions:

1) "**Confidential Information**" means information, to the extent it is a Trade Secret, which is possessed by or developed for a party and which relates to the said Party's existing or potential business, which information is not known or reasonable ascertainable by party's competitors or by the general public through lawful means. "Confidential Information" includes but is not limited to information pertaining to the design, specifications and other manufacture of the System as well as information regarding the Seller's business affairs, business plans, strategies, software and other products, code, designs, finances, costs, pricing strategy, research, customer development, purchasing, marketing, customer relations, and other non-public information. "Confidential Information" may be oral, written, recorded, magnetically or electronically or otherwise stored, and may be that which BIOFerm originates as well as that which otherwise comes into the possession or knowledge of COUNTY. "Confidential Information" also includes but is not limited to information received by COUNTY from others which COUNTY has an obligation to treat as confidential. "Confidential Information" shall not include information which: (a) at the time of such disclosure was within the public domain, (b) becomes part of the public domain other than through the act, omission, or fault of COUNTY, or (c) which is required to be disclosed under Wisconsin Public Records Law or any other applicable law, provided, COUNTY shall (i) immediately notify BIOFerm of such required disclosure so as to permit BIOFerm to seek a protective order for a court of competent jurisdiction, and (ii) limit any disclosure to only that information required by law to be disclosed.

2) "**Trade Secret**" means a trade secret as that term is defined in Wis. Stat. §134.90(1)(c).

B. BIOFerm Proprietary Information:

1) Except as required by law, COUNTY agrees not to disclose any confidential information of BIOFerm's as defined in Paragraph 7.A.1) to any third parties. This information includes, but is not limited to, equipment settings, operational parameters, trade secrets, or proprietary knowledge gained through testing and using

the equipment, or otherwise and whether communicated orally or in writing. This nondisclosure obligation shall not apply to (i) information in the public domain; (ii) information independently known or developed by COUNTY without the use of Seller's Confidential Information or Trade Secrets; (iii) information obtained by COUNTY from a third party who has a lawful right to disclose the information. BIOFerm acknowledges that information must qualify as a trade secret to be exempt from disclosure under the Wisconsin Public Records Law.

2) If any court or governmental body or regulatory agency having jurisdiction over the COUNTY compels COUNTY to disclose any Confidential Information pursuant to written court order, subpoena, regulation or process of law, the COUNTY shall provide prompt written notice of the proposed disclosure to BIOFerm pursuant to subparagraph (a) above. The entire burden of defending the trade secret designation shall be on BIOFerm. BIOFerm agrees to indemnify and hold recipient harmless from any award of damages or attorneys fees for violation of the Wisconsin Public Records Law.

3) COUNTY also agrees not to provide access to the System or any of the equipment to parties whom BIOFerm has not approved in writing and in advance of any access, inspection or viewing. No such access, inspection or viewing will be allowed without notification and express written permission of BIOFerm which permission may be reasonably withheld in the event that BIOFerm determines in its sole discretion that the Confidential Information or Trade Secrets of BIOFerm may be compromised due to granting such access, inspection or viewing. The COUNTY agrees not to sell, duplicate, lease, transfer or allow such conveyance of the System or the Confidential Information or Trade Secrets of BIOFerm to any third party without the express written consent of the Seller. The COUNTY further agrees that it will not attempt to use any Confidential Information as defined herein for commercial purposes. Any modifications to the System will not waive any of County's obligations under Section 7.B.

4) This provision shall survive the completion of this Agreement.

C. COUNTY Proprietary Information:

1) Except as required by law, BIOFerm agrees not to disclose information to any third parties that COUNTY has designated in writing as proprietary. This information includes, but is not limited to, equipment configurations and settings, , operational parameters, trade secrets, or proprietary knowledge relating to its landfill operations. This nondisclosure obligation shall not apply to (i) information in the public domain; (ii) information independently known or developed by Seller; (iii) information obtained by BIOFerm from a third party who has a lawful right to disclose the information.
2) This provision shall survive the completion of this Agreement.

8. WARRANTY

A. Material and workmanship warranty: BIOFerm warrants to the COUNTY that the equipment and work purchased from BIOFerm is free from defects in material and workmanship for a period of twenty-four (24) months from the date of completed performance test and plant handover as required in Section 4.E of this Contract. In the event COUNTY does not begin Start-Up period sixty days after BIOFerm provides written notice the System is operable as required in Section 4.A of this Contract, warranty period shall start on that date.

B. Conditions of material and workmanship warranty: The material and workmanship warranty set forth in Subsection A, above is expressly conditioned upon the following:

1) COUNTY regularly monitors and records the operating parameters of the process control system for the equipment and COUNTY shall without undue delay notify BIOFerm by written notice of any defect which appears. Such written notice shall under no circumstance be given later than ten (10) days after detecting the failure or after the warranty period.

2) The warranty obligations of BIOFerm do not apply for typical wear and tear, overloading the system, operating conditions other than as specified by BIOFerm or modifications or repairs to the equipment by COUNTY or any third party without prior written permission of BIOFerm.

3) The equipment is installed, used and maintained normally and properly in accordance with BIOFerm instructions as to installation, written O & M manual and instructions sheets furnished by BIOFerm unless a deviation from such written materials is approved in writing by BIOFerm.

4) The equipment is used solely for processing raw biogas consistent with the raw biogas specifications (except a flow rate below the minimum range but not above the maximum range) provided to BIOFerm and made part of the contract between BIOFerm and COUNTY.

5) The equipment and work has not been changed without the prior written approval of BIOFerm.

6) COUNTY preserves and permits reasonable inspection by BIOFerm of all allegedly defective equipment and work, parts or items and provides access to the equipment and work to observe its start-up, operation and maintenance, as applicable.

C. Material and workmanship warranty exclusions: This warranty shall not cover (i) any equipment or work furnished by COUNTY or any third party (other than a subcontractor of BIOFerm), (ii) any defects arising from corrosion, abrasion, use of unsuitable lubricants, operation outside of any prescribed temperature ranges, failure to follow prescribed cleaning procedures, or negligent attendance or faulty operation, (iii) ordinary wear and tear, (iv) any

defects caused by errors on the part of COUNTY in not providing suitable premises in which the equipment or work is to be located or adequate security, or (v)failure of the COUNTY to fulfill the conditions identified in Subsection B, above. Wear parts and consumable parts, such as seals, catalysts, membranes, lights, electrical fuses, etc. are also excluded from this warranty, unless excessive wear is the result of defects in material and workmanship.

D. Material and workmanship warranty remedy:

1) COUNTY's remedy, and BIOFerm's obligation, under this material and workmanship warranty is strictly and exclusively limited to BIOFerm furnishing repairs or replacements for equipment, parts or work determined to be defective on inspection by an authorized representative of BIOFerm.

2) Notwithstanding this exclusive remedy, if it is ultimately determined that the remedy for breach of the material and workmanship warranty fails in its essential purpose, and BIOFerm is unable to repair or replace equipment to remedy the breach, then any action which may be brought against BIOFerm subject to the terms of the Contract will be limited to 100% of the Contract price, or portion thereof, for the specific item of purchased equipment or work for which the exclusive remedy has so failed.

3) BIOFerm assumes no responsibility and shall have no liability for any repairs or replacements by COUNTY without BIOFerm's prior written authorization

E. Limitation of warranties:

1) THE WARRANTY OF MATERIAL AND WORKMANSHIP AND ANY GUARANTEES CONTAINED IN THE "GUARANTEES" SECTION OF THE CONTRACT, ARE THE ONLY WARRANTIES MADE BY BIOFerm AND ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED. BIOFerm DISCLAIMS ON BEHALF OF ITSELF, ITS SUBCONTRACTORS AND SUBSUPPLIERS ANY AND ALL IMPLIED WARRANTIES, INCLUDING, WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY, FITNESS FOR A SPECIFIC PURPOSE, SUITABILITY OR PERFORMANCE. Nothing contained herein shall act as a waiver of any warranty provided by any manufacturer or other third party regarding any component of the system. No other promise or affirmation of fact (including, but not limited to, statements regarding capacity or performance of the equipment or work) shall constitute a warranty of BIOFerm or give rise to any liability or obligation on the part of BIOFerm.

2) IN NO EVENT SHALL BIOFerm, ITS SUBCONTRACTORS OR SUBSUPPLIERS BE LIABLE IN CONTRACT OR IN TORT OR UNDER ANY OTHER LEGAL CONTEXT OR THEORY, INCLUDING NEGLIGENCE AND STRICT LIABILITY, FOR LOSS OF REVENUE OR PROFITS OR FOR ANY SPECIAL, PUNITIVE, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY KIND OR CHARACTER, INCLUDING, BUT NOT

LIMITED TO, LOSS OF USE OF PRODUCTIVE FACILITIES OR EQUIPMENT, PLANT DOWNTIME, DAMAGE TO OR LOSS OF CHEMICALS, CATALYSTS, FEEDSTOCK OR OTHER RAW MATERIALS, COSTS OF REPLACEMENT POWER, OR LOSS UNDER PURCHASES OR CONTRACTS MADE IN RELIANCE ON THE PERFORMANCE OR NONPERFORMANCE OF THE PURCHASED EQUIPMENT OR WORK, WHETHER SUFFERED BY COUNTY OR ANY THIRD PARTY, OR FOR ANY LOSS OR DAMAGE ARISING OUT OF THE SOLE OR CONTRIBUTORY NEGLIGENCE OF THE COUNTY, ITS EMPLOYEES OR AGENTS OR ANY THIRD PARTY.

3) NOTWITHSTANDING ANYTHING TO THE CONTRARY, THE AGGREGATE LIABILITY OF BIOFerm TM AND ITS SUBCONTRACTORS AND SUBSUPPLIERS, WHETHER ARISING OUT OF CONTRACT OR TORT, INCLUDING NEGLIGENCE AND STRICT LIABILITY, INCLUDING, BUT NOT LIMITED TO, ANY CLAIMS FOR BREACH OR WARRANTY, FAILURE TO PERFORM OR DELAY IN PERFORMANCE OR NONPERFORMANCE SHALL BE LIMITED TO 100% OF THE PRICE ACTUALLY PAID FOR THE SYSTEM

9. GUARANTY OF SYSTEM PERFORMANCE

A. Total availability of plant guaranty: For a period of three years after commissioning, provided BIOFerm is selected as the operator of the plant under the Operation and Maintenance Contract with the COUNTY but subject to the terms and conditions set forth herein, BIOFerm agrees that the Total Availability of the Plant shall be no less than ninety-six (96%). The Total Availability of the Plant shall be calculated per the following equation as described in RFP 316039 Response dated May 22, 2017 Section 7 - Operation and Maintenance Agreement:

The availability shall be calculated according to the following equation:

$$\text{Total Availability} = \frac{\text{ATH} - \text{SOH} - \text{OSH} - \text{FOH}}{\text{ATH} - \text{SOH} - \text{OSH}} \times 100$$

Where:

ATH = Available Time Hours. Available Time Hours shall be 8,760 hours for each year.

SOH = Scheduled Outage Hours. Hours during which Scheduled Maintenance of the Plant is scheduled.

OSH= COUNTY Shutdown Hours. Time when the Plant is available but not in operation due to reasons for which the COUNTY is responsible or as a result of Force Majeure.

FOH= Forced Outage Hours (BIOFerm Outage Hours). Time when the Plant is not able to operate without restrictions and at the load that the COUNTY desires, within the limits lined out as described in the Operations and Maintenance agreement.

When determining FOH, if the plant is running but providing less than 100 % capacity, this partial load availability will be considered with the percentage of partial load. For example, if 2,250 scfm capacity is being achieved instead of 2,500 scfm designed capacity, then the availability factor is 0.90 multiplied by the hours the plant is running in part load (e.g.10 hours : 0.9 x 10 hours = 9.0 hours = 1.0 hours of FOH.)

B. Product gas production guaranty: In addition to the Total Availability of Plant, set forth in Subsection A above, for a period of three years after commissioning, provided BIOFerm is selected as the operator of the plant under the Operation and Maintenance Contract with the COUNTY subject to the terms and conditions set forth herein, BIOFerm guarantees to COUNTY that the Plant will meet or exceed ninety-two percent (92%) of the Target Gas Production ("Product Gas Production Guaranty") based upon the specifications and provisions set forth in Exhibit C ("Product Gas Specifications"). The satisfaction of the Product Gas Production Guaranty will be demonstrated on the Landfill Gas during the commissioning of the Plant. BIOFerm shall be responsible for maintaining at least the Target Product Gas Production during the term of the guaranty, provided it continuously receives at least the corresponding specified amount of Landfill Gas that is within the range necessary to comply with Exhibit B ("Landfill Gas Specifications"). For each year of the guaranty, a calculation will be made to determine the actual cumulative amount of Product Gas produced by the Plant ("Actual Product Gas Production") for each year. If the Actual Product Gas Production for such year is less than the Product Gas Production Guaranty for such year, then BIOFerm will pay to COUNTY, as its sole and exclusive remedy for any such shortfall, liquidated damages in the amount established in 9.C below.

C. Liquidated damages cap & enforceability: The parties hereby acknowledge and agree that because of the difficulty of ascertaining, as of the date hereof, the exact damages that would be sustained by COUNTY as a result the system's failure to meet the Product Gas Production Guaranty and/or the Total Availability of the Plant Guaranty in any year, damages have been estimated, agreed upon and fixed as liquidated damages and the terms of the liquidated damages provision are fair and reasonable considering the risk involved and the damage COUNTY would sustain. This liquidated damage provision shall be applicable regardless of the actual amount of damages sustained. The amount shall be paid as liquidated damages and not as a penalty and shall be COUNTY's sole and exclusive remedy for the failure of the Plant to meet the Product Gas Production Guaranty. Such payment by BIOFerm shall pay to COUNTY, as its sole and exclusive remedy for any such shortfall, liquidated damages in the amount = $55,250.00.

10. INSURANCE AND INDEMNIFICATION

A. Liability –hold harmless and indemnification: BIOFERM shall indemnify, hold harmless and defend COUNTY, its boards, commissions, agencies, officers, employees and representatives against any and all liability, loss (including, but not limited to, property damage, bodily injury and loss of life), damages, costs or expenses which COUNTY, its officers, employees, agencies, boards, commissions and representatives may sustain, incur or be required to pay by reason of BIOFerm furnishing the services required to be provided under this Contract, provided, however, that the provisions of this paragraph shall not apply to liabilities, losses, charges, costs, or expenses caused or resulting from the acts or omissions of COUNTY, its agencies, boards, commissions, officers, employees or representatives. The obligations of BIOFerm under this paragraph shall survive the expiration or termination of this Contract.

B. Professional liability insurance: BIOFerm and its consultants retained under the terms of this Contract shall procure and maintain professional liability insurance providing for payment of the insured's liability for errors, omissions or negligent acts arising out of the performance of the professional services required under this Contract. BIOFerm shall provide up-to-date, accurate professional liability information, including amount of insurance, deductible, carrier and expiration date of coverage. Upon request by COUNTY, BIOFerm shall furnish COUNTY with a Certificate of Insurance showing the type, amount, deductible, effective date and date of expiration of such policy. Such certificate shall also contain substantially the following statement: "The insurance covered by this certificate shall not be canceled, the coverage changed or reduced by endorsement, by the insurance company, except after thirty (30) calendar days written notice has been received by COUNTY." BIOFerm shall not cancel or materially alter this coverage without prior written approval by COUNTY. BIOFerm shall be responsible for consultants maintaining professional liability insurance during the life of their Contract.

C. Other insurance: BIOFerm and its consultants retained under terms of this Contract shall:

1) BIOFerm shall provide Builder's Risk policy.

2) Maintain Worker's Compensation Insurance:

   i. Procure and maintain Worker's Compensation Insurance as required by State of Wisconsin Statutes for all of the BIOFerm's and consultant's employees engaged in work associated with the project under this Contract.

   ii. Maintain Employer's Liability Insurance with a policy limit of not less than $100,000/500,000/100,000 per occurrence

3) Procure and maintain during the life of this Contract, and until one year after the completion of this Contract, Commercial General Liability Insurance, including Products and Completed Operations for all claims that might occur in carrying out the Contract. Minimum coverage shall be $1,000,000 per occurrence, $1,000,000 general aggregate, combined single limit for bodily injury, personal injury, and

property damage. Such coverage shall be of the "occurrence" type form and shall include the employees of the BIOFerm as insureds.

4) Procure and maintain Commercial Automobile Liability Insurance for all owned, non-owned, and hired vehicles that are used in carrying out the Contract. Minimum coverage shall be $1,000,000 per occurrence combined single limit for bodily injury and property damage.

5) Provide an insurance certificate indicating the above Commercial Liability Insurance and property damage coverage, countersigned by an insurer licensed to do business in Wisconsin, covering and maintained for the period of the Contract. Upon request by COUNTY, the insurance certificate is to be presented on or before execution of the Contract.

11. TERMINATION BY COUNTY

This Contract may be terminated by COUNTY without cause upon ten (10) calendar days written notice to the CONTRACTOR. In the event of termination, the CONTRACTOR will be paid fees for services performed prior to the notice of termination, reimbursable expenses prior to receiving notice of termination, and the cost of any non-terminable contracts or commitments made by BIOFerm prior to the receipt of written notice of termination, which contracts and commitments were incurred by BIOFerm in performing the commitments of this contract and any reasonable expenses incurred by BIOFerm as a result of receiving this notice of termination in discontinuing work on this Contract. Upon termination, the results of such work shall immediately be turned over to COUNTY Project Manager and is a condition precedent to further payment by COUNTY. In the event of termination, COUNTY agrees they shall be bound by the non-disclosure agreement in Section 7 of this Contract for a period of 10 years measure from the date of the notice of termination reference above.

12. AFFIRMATIVE ACTION, EQUAL BENEFITS AND MINIMUM WAGE

A. During the term of this Contract, BIOFerm agrees to take affirmative action to ensure equal employment opportunities. BIOFerm agrees in accordance with Wisconsin Statute 111.321 and Chapter 19 of the Dane County Code of Ordinances not to discriminate on the basis of age, race, ethnicity, religion, color, gender, disability, marital status, sexual orientation, national origin, cultural differences, ancestry, physical appearance, arrest record or conviction record, military participation or membership in the national guard, state defense force or any other reserve component of the military forces of the United States, or political beliefs. Such equal opportunity shall include, but not be limited to, the following: employment, upgrading, demotion, transfer, recruitment, advertising, layoff, termination, training, rates of pay, and any other form of compensation. BIOFerm agrees to post in conspicuous places, available to all employees and applicants for employment, notices setting forth the provisions of this paragraph.

B. BIOFerm shall file an Affirmative Action Plan with the Dane County Contract Compliance Officer in accord with Chapter 19 of the Dane County Code of Ordinances. BIOFerm must file such plan within fifteen (15) business days of the effective date of this Contract. During the term of this Contract BIOFerm shall also provide copies of all announcements of employment opportunities to COUNTY'S Contract Compliance Office, and shall report annually the number of persons, by race, ethnicity, gender, and disability status, which apply for employment and, similarly classified, the number hired and number rejected.

C. During the term of this Contract, all solicitations for employment placed on BIOFerm's behalf shall include a statement to the effect that BIOFerm is an "Equal Opportunity Employer".

D. BIOFerm agrees to comply with provisions of Chapter 25.016 of the Dane County Code of Ordinances, which pertains to domestic partnership benefits.

E. BIOFerm agrees to furnish all information and reports required by COUNTY'S Contract Compliance Officer as the same relate to affirmative action and nondiscrimination, which may include any books, records, or accounts deemed appropriate to determine compliance with Chapter 19, Dane County Code of Ordinances, and the provisions of this Contract.

F. BIOFerm agrees that all persons employed by BIOFerm or any subcontractor shall be paid no less than the minimum wage established under Chapter 40, Subchapter II, Dane County Code of Ordinances. BIOFerm agrees to abide by and comply with the provisions of Chapter 40, Subchapter II of the Dane County Code of Ordinances, and said Subchapter is fully incorporated herein by reference.

13. CHANGES IN WORK

Either party may request changes in the Agreement by issuing requested modifications in writing to the Other. In the event that the requested modification is approved in writing by COUNTY, then BIOFerm may be ordered in writing by the COUNTY, without terminating the Agreement, to make changes in the work within the general scope of this Agreement consisting of additions, deletions or other revisions, including those required by modifications to the Agreement issued subsequent to the execution of this Agreement, the Contract Price and the delivery time being adjusted accordingly.

14. MISCELLANEOUS PROVISIONS

A. BIOFerm warrants that it has complied with all necessary requirements to do business in the State of Wisconsin, that the persons executing this Contract on its behalf are authorized to do so.

B. Legal Relations. BIOFerm shall comply with and observe federal and state laws and regulations and local ordinances applicable to this project and in effect on the date of this Contract.

C. Approvals or Inspections. None of the approvals or inspections performed by COUNTY shall be construed or implied to relieve the BIOFerm from any duty or responsibility it has for its professional performance, unless COUNTY formally assumes such responsibility in writing from COUNTY so stating that the responsibility has been assumed.

D. Successors, Subrogees and Assigns. COUNTY and BIOFerm each bind themselves, their partners, successors, subrogees, assigns, and legal representatives to the other party to this Contract and to the partners, successors, subrogees, assigns and legal representatives of such other party with respect to covenants of this Contract.

E. Claims. BIOFerm's project manager will meet with COUNTY's Project Manager to attempt to resolve claims, disputes and other matters in question arising out of, or relating to, this Contract or the breach thereof. Issues not settled are to be presented in writing to the COUNTY Assistant Public Works Director for review and resolution. The decision of the Assistant Public Works Director shall be final. Work shall progress during the period of any dispute or claim. Unless specifically agreed between the parties, venue will be in Dane County, Wisconsin.

F. Amendment of Contract. This Contract may be amended in writing by both COUNTY and BIOFerm.

G. It is expressly understood and agreed to by the parties hereto that in the event of any disagreement controversy between the parties, Wisconsin law shall be controlling. Venue for any legal proceedings shall be in the Dane County Circuit Court.

H. This Contract is intended to be an agreement solely between the parties hereto and for their benefit only. No part of this Contract shall be construed to add to, supplement, amend, abridge or repeal existing duties, rights, benefits or privileges of any third party or parties, including but not limited to employees of either of the parties.

I. The entire agreement of the parties is contained herein and this Contract supersedes any and all oral agreements and negotiations between the parties relating to the subject matter hereof. The parties expressly agree that this Contract shall not be amended in any fashion except in writing, executed by both parties.

IN WITNESS WHEREOF the parties have executed this Contract as of the dates below:

Dane County

By: _____ _____
(Signature) Title

_____
(Printed)

Date:_____

By: _____ _____
(Signature) Title

_____
(Printed)

Date:_____

BIOFERM USA, INC

By: Nadeem Afghan PRESIDENT & CEO
(Signature) Title

NADEEM A. AFGHAN
(Printed)

Date: 10-11-2017

Exhibit A – Major Equipment & Work

BIOFerm shall provide a 2-stage Carbotech pressure swing adsorption (PSA) biogas upgrading plant to process and clean raw landfill gas with a flow of flow of 500 to 2,500 scfm. Major System components include:

Major Equipment Description	Number of Units	Capacity Per Unit	Total Capacity
Biological Desulfurization Tank	2	16 lb/hr H2S	32 lb/hr H2S
Biological Desulfurization Pump Skid	1	2,500 scfm 32 lb/hr H2S	2,500 scfm 32 lb/hr H2S
Landfill Gas Blower	2	1,250 scfm	2,500 scfm
Landfill Gas Compressor	2	1,000 scfm	2,000 scfm
Desulfurization Polishing Beds	2	0.7 lb/hr H2S	0.7 lb/hr H2S
TSA Skid for VOC Removal	1	Min. 2,500 scfm	Min. 2,500 scfm
PSA Valve Skid, 1st Stage	2	Min. 1,250 scfm	Min. 2,500 scfm
PSA Valve Skid, 2nd Stage	1	Min. 2,500 scfm	Min. 2,500 scfm
Vacuum Pumps	8	350 scfm	2,800 scfm
Product Gas Compressor	2	1,250 scfm	2,500 SCFM
Radiator, Dry Cooler	2	Min. 1,250 scfm	Min. 2,500 scfm
Chilled Water Unit, Gas Cooling	2	Min. 1,250 scfm	Min. 2,500 scfm
Chilled Water Unit, Dehydration	1	Min. 2,500 scfm	Min. 2,500 scfm
Off-gas Blower	2	2,500 scfm	5,000 scfm
Regeneration Gas Blower	2	2,500 scfm	5,000 scfm
Off-gas Combustion System, TOX	1	Min. 2,500 scfm	Min. 2,500 scfm
Exchange Heaters	1 (set)	Min. 2,500 scfm	Min. 2,500 scfm
Instrument Air Compressor Skid	2	35 scfm air	70 scfm air

Phase III: Construction & Installation Scope of Supply

1. Installation of foundation under biogas cleaning system
    a. Materials, and installation for small area beyond the footprint of the biogas cleaning system and any area disturbed by installation.
        i. Materials include, but are not limited to, erosion matting, sediment logs, silt socks, and seeding.
    b. Provide grading, excavation, and materials necessary for installation of foundation under biogas cleaning system
        i. Materials include, but not limited to, concrete, rebar, fill, and aggregate.
        ii. Subsurface Conditions Found Different
        Unsuitable soil conditions adversely impacting the viability (an unsuitable soil condition creating time, cost and logistics conflicts) of foundation installation are outside the Scope of Services. If BIOFerm encounters subsurface conditions at the site that meet the above definition, BIOFerm shall immediately give notice to Public Works Project Manager of such conditions. Public Works Project Manager will thereupon promptly investigate conditions, and if Public Works Project Manager finds that they meet the above definition, Public Works Project Manager will at once order such design changes as necessary, any

increase or decrease of cost resulting from such changes to be agreed upon in writing via Change Order.

c. COUNTY shall be responsible for clearing and grubbing off all areas within the limits of construction, including areas for construction access.

2. Installation of utilities from main up to and within the biogas cleaning system
    a. Provide grading, excavation, and materials necessary for installation of utility lines from main service to biogas cleaning system. This will include utilities up to, under, and within the foundation.
        i. Materials include, but are not limited to, piping, utility lines (e.g. fiber, etc.), fill, and aggregate. Waste materials may be discarded at Dane County Landfill Site #2 or recycled, if applicable.
    b. Provide erosion control materials, and installation for areas disturbed by utility placement.
        i. Materials include, but are not limited to, erosion matting, sediment logs, silt socks, and seeding.

3. Installation, commissioning, and start-up of biogas cleaning equipment as outlined in Paragraph 4 of Contract for Construction and Installation of Biogas Cleaning System.

Exhibit B – Landfill Gas Specifications

Parameter	Raw Landfill Gas	Raw landfill Gas nominal/ average values	Raw Landfill Gas (required to meet the 92% Methane Recovery) [1]
Flow (scfm)	500 < F < 2,500	2,200	1,000 < F < 2,500
Heating Value (BTU/ft^3)	505 < HV < 606	-	N/A (see CH_4 content
Hydrogen Sulfide (ppmv)	0 < H2S < 800	430	0 < H2S < 800
Total Sulfur (ppmv)	0 < S < 850	-	N/A
Oxygen (% by volume)	0.2 < O2 < 2	0.3	0.2 < O2 < 0.7
Carbon Dioxide (% by volume)	30 < CO2 <46	37.4	30 < CO2 <40
Carbon Dioxide (% by volume)			40 < CO2 < 46 With N2 below 1% and O2 below 0.4%
Nitrogen (% by volume)	0 < N2 < 14	6.6	0 < N2 < 7.5
Water Vapor (lb./1x10^6 ft^3)	1,000 < WV < 1,800	1,381	0 < WV < 1,800
Temperature (deg. F)	86 < T < 130	123	86 < T < 130
Hydrocarbon Dewpoint (deg. F)	-	-	See other constituents
Other constituents	As per Dane County gas sample	-	0%< X < 120% rel. deviation from sample value
Pressure (psig)	2 < P < 4	3.1	2 < P < 4
Methane (% by volume)	50< CH_4 <60	55.7	50 < CH_4 < 60

[1]Value ranges are not interdependent on one another

Exhibit C – Product Gas Specifications

Parameter	ANR Pipeline Specifications
Heating Value (BTU/ft^3)	967 - 1,200
Hydrogen Sulfide (ppmv)[1]	< 4
Total Sulfur (ppmv)[2]	< 320
Oxygen (% by volume)	< 1
Carbon Dioxide (% by volume)	< 2
Nitrogen (% by volume)	< 3
Water Vapor (lb./1x10^6 ft^3)	< 7
Temperature (deg. F)	40 < T < 120
Hydrocarbon Dewpoint (deg. F)[3]	> 15
Pressure (psig)[4]	600-852

[1] 16 ppmv ~1 grain/100 ft^3

[2] Including sulfur in any hydrogen sulfide and mercaptans

[3] Additional language in Federal Energy Regulatory Commission (FERC) Gas Tariff for ANR Pipeline Company (Third Revised Volume No. 1) – Section 6.13

[4] Additional language in FERC Gas Tariff for ANR Pipeline Company (Third Revised Volume No. 1) – Section 6.11

The values on below table are based on the average raw gas composition as described in Exhibit B.

Example Values for Product Gas Guaranty

Raw Gas Flow (scfm)	Product Gas Flow (scfm)	Methane Recovery
900	475	92%
1400	739	92%
1700	897	92%
2500[1]	1319[1]	92%

Product gas production per hour shown in performance test

[1] Conditional to third 40% compressor installation

Exhibit D – Proposal No. 316039 Dated October 10, 2017

BIOFERM™
ENERGY SYSTEMS

PROPOSAL NO. 316039

Biogas Cleaning Equipment for Pipeline Injection

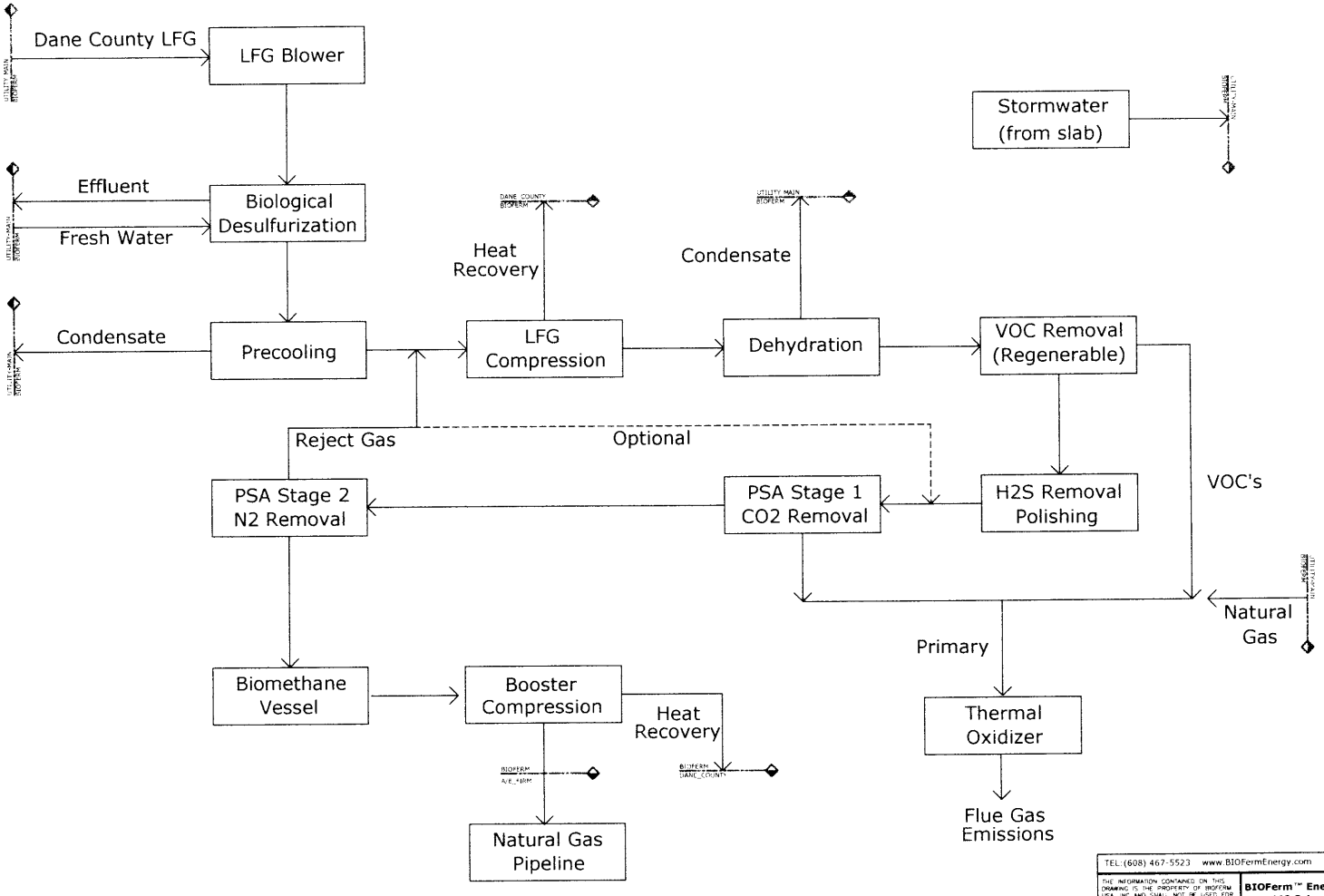
Attn: John Welch, Solid Waste Manager
Dane County Department of Public Works,
Highway & Transportation
1919 Alliant Energy Center Way
Madison, Wisconsin 53713
October 10, 2017

TABLE OF CONTENTS

Note, this document has been modified for public use.

1 PROGRAMMING, PLANNING, AND DESIGN TECHNIQUES

1.1 Block Flow Diagram



TEL:(608) 467-5523 www.BIOFermEnergy.com info@biofermenergy.com FAX:(608) 233-7085

BIOFerm™ Energy Systems
440 Science Drive
Madison, WI 53711

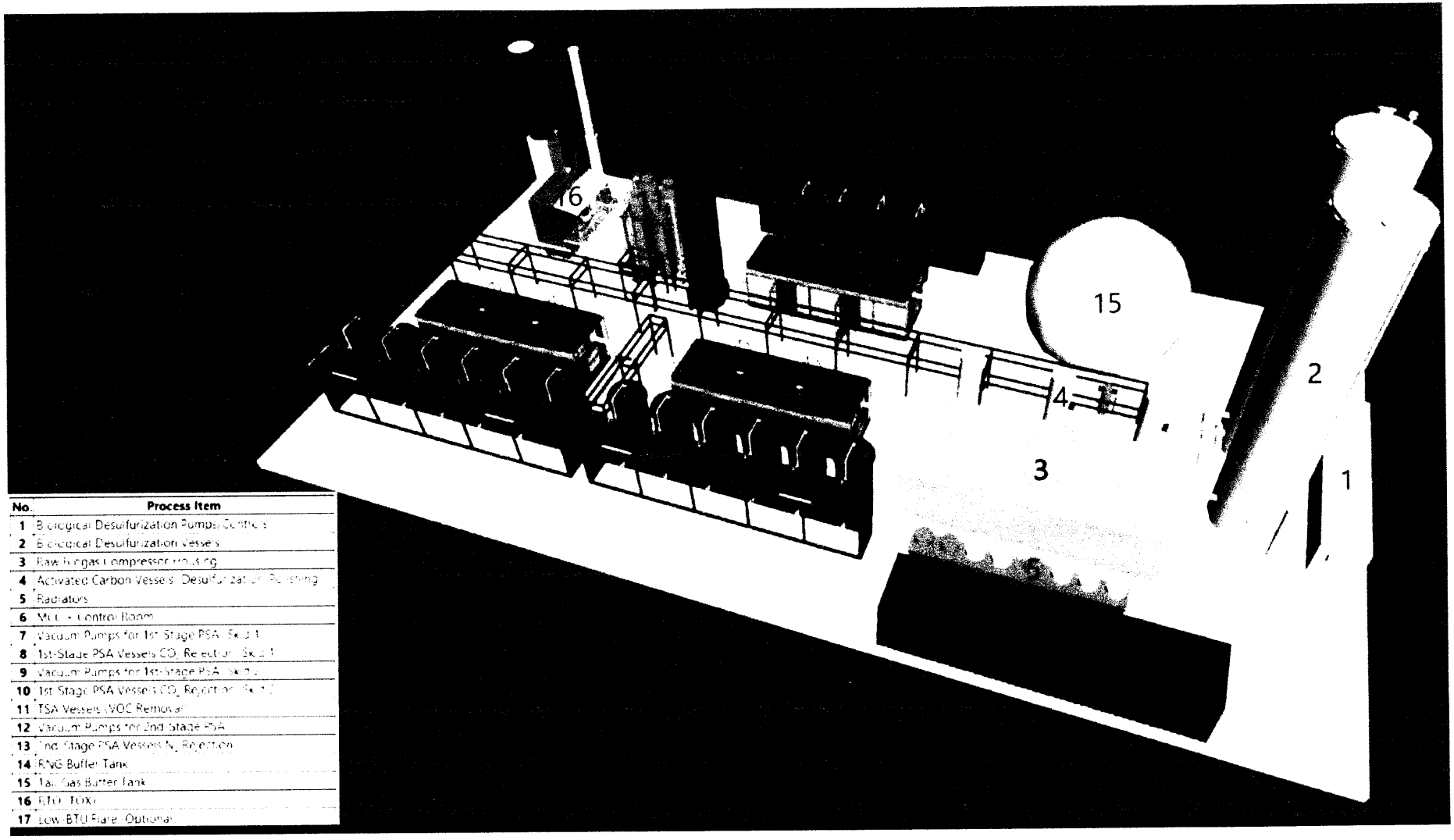
FERM

Document: Dane County Landfill Site #2 Block Flow Diagrams	Scale: NTS	Sheet: 1 of 1
	Drawn by: SelS	Rev: 0
Drawing title: 2-Stage BUP for Dane County	Date: 09/26/2017	

1.2 Footprint Required for Construction and System

The Carbotech PSA system will require approximately 16,625 ft^2 for final footprint with approximate dimensions of 95 ft. x 175 ft. Values are subject to change with the orientation and spacing agreed upon with Dane County and impact of further site investigation.

A similar layout and orientation is shown on the next page:



No.	Process Item
1	Biological Desulfurization Pumps/Controls
2	Biological Desulfurization Vessels
3	Raw biogas Compressor (10-4 hp
4	Activated Carbon Vessels Desulfurization Polishing
5	Radiators
6	MCC + Control Room
7	Vacuum Pumps for 1st Stage PSA Skid 1
8	1st-Stage PSA Vessels CO2 Rejection Skid 1
9	Vacuum Pumps for 1st-Stage PSA Skid 2
10	1st Stage PSA Vessels CO2 Rejection Skid 2
11	TSA Vessels VOC Removal
12	Vacuum Pumps for 2nd Stage PSA
13	2nd Stage PSA Vessels N2 Rejection
14	RNG Buffer Tank
15	Tail Gas Buffer Tank
16	RTO/TOX
17	Low-BTU Flare (Optional)

Dane County Proposed Site Layout

1.3 Dust Considerations

Our Carbotech PSA is an integrated system with containers delivered onsite which house and protect most the equipment from the elements. All instruments comply with protection class IP54 or higher.

Dust within the raw biogas will be removed through the biological inlet scrubber (see Section Methods Used to Remove H_2S) and dust filters.

1.4 Methods Used to Remove H_2S

Since the average H_2S concentration is >400 ppm, a biological H_2S removal system was initially proposed to reduce most of the H_2S Dane County provided for the anticipated flow. The system sizing has been increase to an approximate 45,000 gallon/vessel based on Dane County's request to have capacity for any future changes to the landfill increases in H_2S. The Biogas is first processed through a continuously-operating bio-scrubber with microorganisms that reduce H_2S to sulfuric acid. These sulfur-metabolizing microorganisms grow on media inside a FRP tank. After passing the biological scrubbing tower, the H_2S concentration of the landfill gas is reduced to less than 50 ppm. The system requires only fresh water and standard commercial fertilizer (nitrate, potassium, phosphorus).

For the additional H_2S polishing of biogas, it is heated to a temperature of approximately 140° and fed through two vessels (lead/lag) filled with catalytic- active activated carbon to adsorb hydrogen sulfide and produce sulfur and water through a reaction with oxygen, as shown below:

$$2\,H_2S + O_2 \rightarrow \tfrac{1}{4}\,S_8 + 2\,H_2O$$

While water evaporates, the sulfur remains irreversibly in the activated carbon.

The proposed combination of biological desulfurization and activated carbon polishing beds offer the following advantages:

- no chemicals (i.e. NaOH, H_2O_2 or iron) required, therefore, no associated disposal cost
- biological desulfurization requires only fertilizer and water

- optimized operation cost due to bulk H_2S removal with biological scrubber[1]
- highly reliable even in case of H_2S peaks exceeding a multiple of the average value
- sulfur-free landfill gas upstream of PSA upgrading system increases lifetime of the adsorbent[2]

The proposed design is a FRP tank with an approximate 45,000 gal/vessel size. Apart from H2S removal capacity, the tanks provide additional gas buffer volume.

1.5 Methods Used to Remove VOC's and Siloxanes

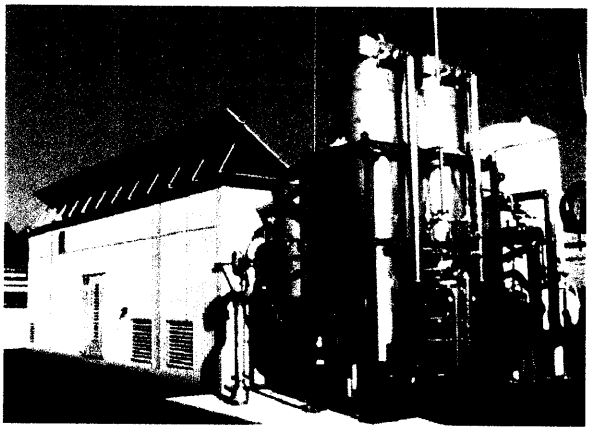
Due to the significant amount of VOC in landfill gas, a VOC removal system captures organic compounds which are not desired in the product gas and could interfere with the desulfurization process or the downstream PSA upgrading process.

VOC are removed in a Carbotech system upstream of the desulfurization stage by an adsorption system consisting of two vessels filled with a specialized activated carbon. VOC as well as siloxanes will be adsorbed at ambient temperature. After some time, the adsorbent bed will be saturated with VOC and therefore must be regenerated. During regeneration, the second vessel is switched to operation and loaded with VOC to allow uninterrupted gas processing.

[1] When using only either iron-based or activated carbon-based solid scavenger systems, the media cost is approx. $4 USD/lb H_2S. With bulk removal through biological desulfurization, the media cost (activated carbon, fertilizer, and water) are approx. $1.2 USD/lb H_2S.

[2] Any PSA system is in general capable of removing H_2S. However, due to the presence of oxygen, any adsorbent will promote the reaction of H_2S and O_2 to elemental sulfur due to its large internal surface. Elemental sulfur cannot be regenerated during the normal PSA cycle and would therefore slowly reduce the CO_2 and air removal capacity of the PSA.

For regeneration of the VOC filter, part of the off-gas from the tail gas bladder tank is heated and used as purge gas to regenerate the loaded VOC filter bed. While heating up the bed, VOC will be desorbed and carried out of the filter bed along with the purge gas. A gas blower extracts the VOC loaded purge gas stream from the filter bed and sends it to the off-gas combustion system.



After regeneration, heating of the purge gas stream is stopped and the gas stream is applied to cool the VOC filter. Once the filter bed is completely cooled, the VOC filter is in stand-by until it is switched to operation again.

In general, the level of VOCs and siloxanes present in the raw biogas can be removed via the pressure swing adsorption or temperature swing adsorption:

- **VOC & Siloxane Removal System with Regenerative PSA:** VOC/Siloxanes can be removed by a simple, cost effective two- bed PSA system. Instead of a thermal regeneration as described above, the regeneration is achieved purely by lowering the pressure and purging the loaded activated carbon bed. This system is typically operated at several loading cycles per hour. As the off-gas during regeneration also carries significant amounts of methane, the PSA process creates higher methane losses compared to a TSA system. Re-processing of the off-gas to reduce methane losses is not desired since VOC would otherwise build-up in the process.

- **VOC & Siloxane Removal System with Regenerative TSA:** For high VOC loads at the Dane County Landfill Site #2, a thermal regenerative VOC removal is included. A typical TSA cycle takes 12- 24 hrs. Thus, methane losses in comparison to a PSA system are significantly reduced.

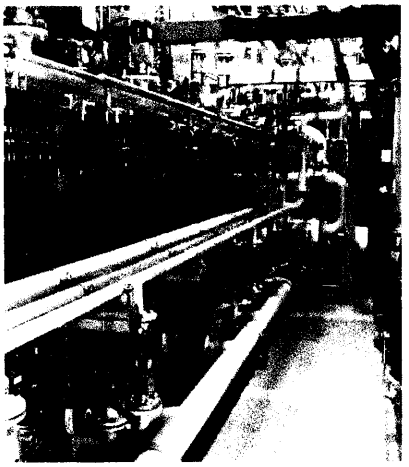
1.6 Methods Used to Remove CO_2

Our Carbotech PSA biogas upgrading process is based on the preferred adsorption of carbon dioxide over methane on the internal surface of carbon molecular sieve (CMS) adsorbents. This separation effect is based on both the preferred physical adsorption of CO_2 and the difference in size between these molecules.

The Carbotech PSA process works between two pressure levels:

1. Adsorption of CO_2 takes place at high pressure to increase the partial pressure, and therefore, the loading of CO_2 on the adsorbent material
2. Desorption (reversion of adsorption) or regeneration takes place at low pressure to reduce the partial pressure of CO_2, and subsequently, the loading capacity of the adsorbent material

Our PSA gas upgrading unit includes 6 adsorber vessels filled with layers of different adsorbent materials, primarily consisting of a dedicated CMS. Each adsorber operates in an alternating cycle of adsorption, regeneration, and pressure build-up during normal operation.



The adsorption process takes place in alternating cycles, as described below.

Adsorption

During adsorption, biogas enters one of the adsorption vessels from the bottom. Upon entering the vessel, CO_2, H_2O, and some of the O_2 and N_2, are kept on the internal surface of the adsorbent material to ensure highly-enriched methane leaves the adsorber vessel at the vessel top. The adsorption phase is stopped before the adsorbent material is completely saturated with adsorbed gas components and is switched to the next freshly regenerated adsorber vessel to ensure a continuous methane product gas flow.

Regeneration

Saturated adsorbent material is regenerated through stepwise depressurization of the adsorber vessel to atmospheric pressure and then to vacuum conditions. Through these steps, all adsorbed gas molecules will be released from the adsorbent material into the gas phase.

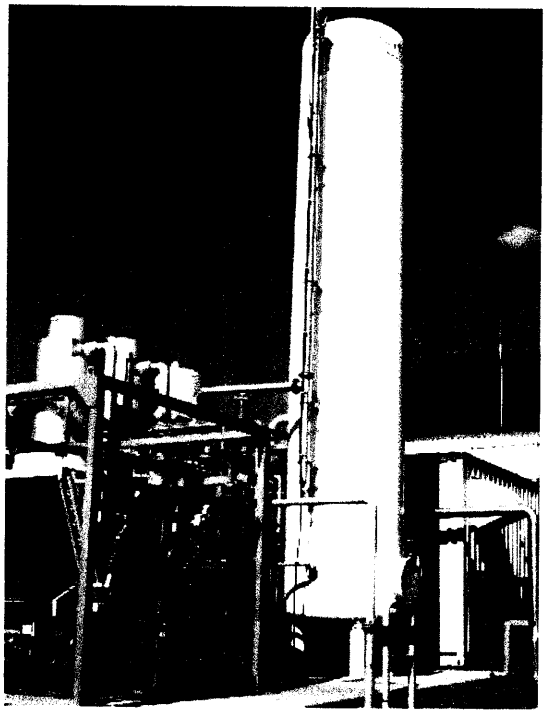
First, pressure is reduced by a pressure balance with a regenerated adsorber vessel. This step is followed by a second depressurization step to near atmospheric pressure. Gas leaving the adsorber vessel during this step contains significant amounts of methane, and is therefore recycled to the suction side of the biogas compressor to assure a high methane yield.

Finally, the adsorber vessel is evacuated by a vacuum pump to achieve complete regeneration. Note, separated gas can no longer be utilized to increase the methane yield although it still contains very low levels of methane.

After the evacuation step, adsorbent material is completely regenerated and ready for the next adsorption phase.

Pressure Build-Up

Before the adsorption phase begins again, the adsorption vessel is re-pressurized stepwise to the final adsorption pressure.



Final pressure build- up is achieved with feed gas after a pressure balance with an adsorber that has been in adsorption mode before.

Flow Equalization

Product gas flow varies during a PSA cycle due to the nature of the PSA process. To provide a continuous flow downstream of the PSA unit, product gas is homogenized in a product gas surge drum.

Methane Yield vs. Air Rejection

As a result of continuous research and development over the last two decades, our Carbotech PSA process has reached a methane yield of >99%. As described, our Carbotech PSA process also can reject N_2 and O_2 as a "side- effect" to the actual CO_2 removal. Depending on the raw gas quality and the required pipeline specification, the PSA cycle can be adjusted to reject higher levels of N_2 and O_2. A standard single stage PSA system reaches N_2 and O_2- rejection rates of 60-80%. However, increased air rejection rates will also increase methane losses in a standard PSA system.

1.7 Methods Used to Remove O_2

As described in Section E, O_2 will be removed in the standard PSA process for CO_2 removal. Thus, with an average raw gas composition, there is no need to further reduce oxygen by other means to meet pipeline quality.

1.8 Methods Used to Remove N_2

For nitrogen concentrations below ~5%, the Carbotech single-stage PSA system would typically be sufficient. However, with the variability in nitrogen concentration, BIOFerm is proposing to install a two-stage PSA system:

A Carbotech single-stage PSA system can typically remove 60-80% of nitrogen and oxygen when air concentrations are up to 5-6% by volume within the raw gas stream and still produce biomethane with >960 BTU/scf. However, in the case of higher air concentrations in the raw biogas stream, the product gas from the first stage PSA unit must be processed in a second stage PSA unit with similar air rejection rates as the first unit. This allows raw gas containing air concentrations up to 14% by volume to be processed with a product gas having more than 960 BTU/scf.

To avoid accumulation of air inside the upgrading system, the off-gas stream from the first stage PSA unit must be vented or sent to off-gas treatment. However, the off-gas stream from the second stage PSA unit containing lower amounts of air can be recycled to the inlet of the first PSA unit and re-processed to increase the methane recovery rate. Therefore, even a two-stage PSA system can reach up to 95% methane recovery as the methane losses from the second stage are fully eliminated.

The ability to re-process off-gas from the second stage to reduce methane losses is a considerable advantage over other upgrading systems that provide no or limited ability to reject nitrogen in the first stage. This results in significantly lower methane yields.

1.9 Compressor System Design

Most of our Carbotech PSA systems have been supplied as turnkey packages including raw gas compression. Over 200 compressors have been supplied over the last decade as part of our systems. More than the actual compressor brand, the following criteria are considered most important for a successful integration of the raw gas compressor:

- pre-conditioning of raw gas
- selection of oil and efficient oil removal
- prevention of condensation during compression
- sufficient instrumentation to monitor and track vital compression parameters

BIOFerm proposes the use of two direct-driven oil injected screw compressors for the landfill gas compression.

Pre-Conditioning of Raw Gas

Inside a raw gas surge drum where entrained water and particles are also separated from the biogas, raw biogas is mixed with some recycle gas from the PSA unit prior to compression. The mixed gas stream is then compressed in two stages, first by a centrifugal blower followed by a single-stage oil-injected screw compressor to a pressure of approximately 120 psi(g).

After the first stage compression, gas is cooled to 70° F and liquid water is removed by highly-efficient water separators. The risk of moisture condensation during downstream compression is reduced by reducing the dew point of the raw gas. This is important as liquid water would otherwise change the oil viscosity, resulting in deficient lubrication, and causing significant damage. Also, moisture-related complications, such as rusting, will be prevented. This pre-cooling stage is designed to protect compressors from being damaged while minimizing their size and power usage.

Oil and Oil Removal

The oil is selected to provide a high acid-gas resistance and a low vapor pressure to maintain the required oil viscosity and avoid high oil consumption. Downstream, the oil injected screw compressor block an efficient oil separation system ensures most of the oil remains inside the compressor to minimize oil consumption.

Oil temperature controls ensure that the compressors can only be started once a certain viscosity of the oil is reached.

Water Condensation Prevention

The above described pre-cooling stage avoids water condensation during normal operation. In addition, the oil tank and piping is insulated and the tank is heated to ensure no condensation occurs, even during start-up or stop of the compressors or at low ambient temperatures.

Compressor Instrumentation

The compressor instrumentation allows continuous reading and tracking of all relevant gas and oil pressures, temperatures, and flows. This ensures early detection of upset conditions, and helps troubleshooting and planning of maintenance.

Product Gas Compression

Once upgraded, the product gas will be pressurized from 120 psi(g) to >500 psi(g) via a reciprocating compressor due to the flow and pressure requirements of the product gas. The compressor will feature air cooled cylinders for easier maintenance, fully balanced pistons and rods for low vibration, and a roller bearing connecting rod-cross head joint for longer life. Additionally, the compressor will conform to ASME and API standards/requirements.

1.10 Off-Product Destruction Methods

This section addresses both gas that is off-product (does not meet specifications) and off-gas (gas that is extracted and not part of the product gas).

Off-Product Treatment

Our PSA system is meant to have a high uptime and methane recovery. However, in the event the system does not meet specification and cannot be injected into the pipeline, the first option is to recycle the gas back through the biogas upgrading facility to meet the treatment requirements. If gas cannot be cleaned at an equivalent rate and keep up with the system, landfill gas will be routed to the existing flare to mitigate any release of methane to the atmosphere.

Off-Gas Treatment

During normal operation, there are two off-gas sources:

- 1st stage PSA off-gas
- TSA off-gas carrying the contaminants from VOC removal

Both streams are blended and then combusted in a thermal oxidizer or backup low-BTU flare. Due to the pressure swing cycle, the regeneration gas from the first stage PSA unit (tail gas) will be fluctuating in flow and composition. To provide a constant and homogeneous flow to the off-gas system, the tail gas stream is homogenized in a tail gas bladder tank. A small stream of tail gas from the bladder tank is used to regenerate the TSA system (see section D) where it picks up VOC during regeneration of the TSA system. The main tail gas stream is directly sent from the tail gas bladder tank to the thermal oxidizer. Whenever TSA off-gas is available, it's mixed with the main off-gas stream before it's combusted.

A) Recuperative Thermal Oxidization (RTO)

Thermal oxidation of the off-gas is carried out with more than 98% destruction of the Non-Methane Organic Compounds (NMOC)[3]. When in normal operation, this combustion is carried out without adding additional fuel (autothermal operation). This is achieved by preheating the off-gas and the combustion air with flue gas in highly efficient recuperative burners. Flue gas is then vented through a stack to the atmosphere.

The RTO unit is skid mounted and consists of the following main components:

- two independent combustion chambers
- start-up burners operated on product gas or LPG (optional)
- high performance recuperative burners
- hot bypass for temperature control within the combustion chamber
- flue stack with vent approx. 30 ft. above ground level
- centrifugal blower for combustion air and PSA off-gas
- bladder tank to homogenize PSA off-gas

B) Backup Low-BTU Flare

A low-BTU flare is an option Dane County can choose to add on in the future if needed.

1.11 Byproduct Recovery Methods and Uses

The only byproducts that could potentially be recovered are CO_2 and sulfur. The latter cannot be economically recovered due to the comparatively small amount available from the landfill gas. Although CO_2 could potentially be recovered, BIOFerm believes that CO_2 from a landfill source can practically not be sold due to the risk of carrying harmful substances.

Apart from the previously mentioned byproducts, there is a possibility to recover heat of compression (**approximately a minimum of 1.2 MMBTU/hour**). This could be connected to the County's existing hydronic heat offtake manifolds. Depending on the County's heating requires, additional heat may be able to be recovered from the gas cleaning and compression system.

[3] Higher destruction rates are available on request if required.

1.12 Installation, Start-up, and Operation of the System

The following activities will be under the care, direction, and control of BIOFerm:

- during commissioning, the correct assembly of the Scope of Works will be verified, all components of the plant will be put into operation
- after commissioning, an acceptance test run including a performance test will be carried out
- during commissioning and test run activities, the training of the Dane County personnel will be carried out at Site
- for commissioning, training, and test run, BIOFerm will provide sufficient qualified personnel
- commissioning and operator training require approximately 12 weeks

The resulting operational BUP system will have the following expected mass balance based on the raw gas data provided by Dane County:

Table 1 and Table 2 below include the process parameters upon which this proposal is based. Table 3 gives the estimated condensate production from the process. The handling, disposal, treatment of condensate will be the responsibility of the customer.

Table 1: Raw supply and product gas parameters

Raw Supply: Biogas (dry basis)					
Composition:					
CO_2:	37.4%	**H_2S:**	430 ppm	**Flow (scfm):**	900-2500
CH_4:	55.7%	**H_2O:**	1,381 lb/MMscf	**Pressure (psig):**	3.1
O_2:	0.32%	**Siloxane:**	Unknown	**Temp (°F):**	123°F
N_2:	6.56%				
Product Gas Requirements: Renewable Natural Gas (RNG)					
ANR Pipeline Composition:					
CO_2:	<2%	**H_2S:**	<4 ppmv	**Pressure (psi):**	>600 psi
Heating Value:	>967 BTU/scf	**Total Sulfur:**	<320 ppmv	**Tempe (°F):**	40 to 120°F
O_2:	<1%	**H_2O:**	<7 lb/MMscf	**Dust:**	commercially free
N_2:	<3%				

Table 2: Simplified mass balance for average conditions

Simplified Mass Balance							
		Raw Biogas (dry)		RNG (Product Gas)		Flue Gas	
	Unit	Average	Min-Max* for Guaranteed Methane Recovery	Average	Min-Max	Average	Min-Max
Pressure:	**psig**	3.1	2-4	600	600-850	0.1	0.1-0.3
Temperature:	**°F**	123	86-130	70	40-120	500	300-1,400
CH_4:	**%**	55.7%	50-60	97.1	95.6-100	0.0	
CO_2:	**%**	37.4%	30-40	0.1	0-2	45.2	
N_2:	**%**	6. 6%	0-14	2.3	0-3	45.7	
O_2:	**%**	0.3%	0.2-2	0.1	0-1	5.2	
H_2S:	**ppmv**	430	0-800	< 1	0-4	0	
NH_3:	**ppmv**	-	-	-	-	-	-
Siloxanes:	**gr/100scf**		*	-	0-0.04		
H_2O:	**lb/MMscf**	1,381	1,000-1,800	2.4	0-7	1,890	
Mercaptanes:	**ppmv**	*	*	-	-	-	-
Total Sulfur:	**ppmv**	*	*	-	0-320	-	-
HHV:	**BTU/scf**	-	-	985	967-1,200	-	-
C_{org} (e.g. CH_4):	**gr/100 scf**	-	-	-	-	0.4	0-2
NO_x:	**gr/100 scf**	-	-	-	-	4.0	0-8
SO_2:	**gr/100 scf**	-	-	-	-	0.8	0-2
CO:	**gr/100 scf**	-	-			2.0	0-4
Flow:	**scfm**	2,200	900- 2,500	1,175	480- 1,340	2,000	810- 2,300

Table 3: Liquid effluent

Liquid Effluents			
Condensate[4]	**Unit**	**Average**	**Min-Max**
Pressure:	psig	3	2-4
Temperature:	°F	70	60-90
Flow:	gpm	0.4	0.1-0.5
Effluent biol. desulfurization[5]			
Pressure:	psig	20	15-25
Temperature:	°F	80	60-105
Flow:	gpm	12	7-15

1.13 Media/Filters Proposed

The consumption of media is dependent on the amount and composition of the processed raw landfill gas. Thus, the consumption of activated carbon may vary with time. The following consumptions refer to the average conditions as described in Table 2 (simplified mass balance). The change-out frequency of activated carbon beds is typically one change per year. Activated carbon can be disposed at the landfill.

[4] Condensate produced during the biogas drying step. Condensate will contain condensed VOCs

[5] Contains approx. 2-4% sulfuric acid

Table 4: Proposed media required for gas processing at average gas flow

Proposed Media Required for Gas Processing at Average Gas Flow			
Type	**Quantity lb/a**	**Unit Cost $USD/lb**	**Total Cost Per Year $USD**
Activated carbon, desulfurization	8,500	2.2	18,700
Activated carbon, VOC removal	17,000	2.5	42,500
Fertilizer, biol. desulfurization	34,000	0.5	17,000

1.14 Parasitic Load for System

The biogas upgrading plant will have an installed capacity of approx. 2,250 kW; the facility will use approximately 1,160 kW at the nominal flow of 2,200 scfm.

Power use will be mainly dependent on the amount of landfill gas processed and the nitrogen content in the landfill gas. The latter determines whether the upgrading system must be operated in single PSA or two stage mode. In case of single stage operation, the power use will be reduced as there will be no need to re-process off-gas from the second stage PSA.

Although the system can be operated in a single stage mode up to approx. 5% of nitrogen, it is recommendable to switch to 2 stage mode from approx. 1.9% onwards, as it will significantly increase the methane yield. The higher revenues will overcompensate the higher power use. The outlined power use for the biogas upgrading plant also includes the power use for biological desulfurization, product gas booster compressor as well as all accessories such as instrument air compressor, cooling, and chilled water supply.

1.15 System Efficiency

System efficiency varies with the nitrogen content in the landfill gas.

System efficiency is defined as the ratio of methane injected into the pipeline to methane contained at the landfill gas inlet.

1.16 Volume of Landfill Gas Required for Byproduct Destruction

As stated in Section (i), the thermal oxidizer does not require additional fuel gas during normal operation. For start-up purposes, either RNG or (optional) LPG can be used.

1.17 Total Life Expectancy of Components

Design life of components that are not subject to wear in tear is, in general, 20 years. Rotating equipment - such as screw compressor blocks and vacuum pumps - typically receive a major overhaul every five years in combination with the exchange of bearings.

1.18 Optional Items to Save Operation/Maintenance Costs

After the workshop with Dane County the following option(s) were formed to potentially reduce operation and maintenance costs:

Electrical Cabinet Option

Please refer to Appendix A for technical memo on options for the electrical cabinets. There are three options for Dane County:

1. keep the originally proposed system configuration
2. install an MCC system
3. install a modified cabinet design with door mounted controls in place

As referenced in the technical memo in Appendix A, there is an additional cost for these add on optional items. If the third option is selected, BIOFerm would suggest adding this as a change order once it is more clear on the true cost further into the project design development. The current design is (1) the original proposed electrical cabinet configuration.

2 MAJOR EQUIPMENT

BIOFerm will be supplying all the equipment found within the list below.

Design, materials, construction, and inspection will generally be in accordance with the latest editions of the standards and guidelines as required for installation and operation in the USA.

- Pressure vessel: ASME
- Heat exchangers: ASME
- Hazardous area classification: NEC500
- Piping code: ANSI B31.3
- Electrical certification: UL

Table 5: Major Equipment

Please see the following pages for major equipment list for the price breakdown described below in Section 6.

Major Equipment	No. of Units	Capacity Reference	Capacity per Unit	Total Capacity	Motor Rating	Description/ Comments
FRP Tank Biol. desulfurization	2	max. 10.8 lb/h H_2S	16.0 lb/h H_2S	32 lb/h	n.a.	FRP tank with random packing, approx. 45,000 gal/vessel (copy of example plant). Apart from H_2S removal capacity, tanks provide additional gas buffer volume.
Pump Skid Biol. desulfurization	1	max. 2,500 scfm 10.8 lb/h H_2S	2,500 scfm 32 lb/h H_2S	2,500 scfm 32 lb/h H_2S	40 BHP	Single pump skid to serve two FRP tanks. FRP tanks can be operated independently due to lead/lag valve arrangement. Copy of example plant.
Landfill Gas Blower	2	max. 2,500 scfm	1,250 scfm	2,500 scfm	100 BHP	Multi-Stage centrifugal blower. Load adjustment through throttle valve or VFD and bypass within a range of approximately 0 – 100% load.
Landfill Gas Compressor	2	max. 2,500 scfm	1,250 scfm	2,500 scfm	500 BHP	Single-Stage, oil lubricated, water cooled screw compressor for landfill gas compression. Load adjustment through either slide vane or VFD within a range of approximately 40 – 100% load.
Polishing beds desulfurization	2	0.7 lb/h H_2S (approx. 50 ppm)	0.7 lb/h H_2S	0.7 lb/h H_2S	n.a.	Stainless steel pressure vessels filled with H_2S polishing media. Lead/ lag configuration. Life time media/ vessel approx. 4,000 hrs.
TSA skid for VOC removal	1	max. 2,500 scfm	min. 2,500 scfm	min. 2,500 scfm	n.a.	Stainless steel pressure vessels filled with media for VOC removal. TSA cycle time approx. 12h @ 2,500 scfm
PSA valve skid, 1st stage	2	max. 2,500 scfm	min. 1,250 scfm	min. 2,500 scfm	n.a.	Valve system for PSA-Cycle as double- eccentric butterfly valves with single acting (spring return) pneumatic actuators
Vacuum Pumps	8	max. 2,500 scfm	350 scfm	2,800 scfm	60 BHP	Water cooled rotary vane vacuum pump with oil lubrication. Load adjustment by stepwise turn down.

Major Equipment	No. of Units	Capacity Reference	Capacity per Unit	Total Capacity	Motor Rating	Description/ Comments
PSA valve skid, 2nd stage	1	max. 2,500 scfm	min. 2,500 scfm	min. 2,500 scfm	n.a.	Shift valve system for PSA-Cycle as double- eccentric butterfly valves with single acting (spring return) pneumatic actuators
Product gas compressor	2	max. 2,500 scfm	1,250	2,500 scfm	200 BHP	Two- Stage reciprocating booster compressor. Load adjustment through VFD within a range of approximately 60 – 100% load.
Radiator, dry cooler	2	max. 2,500 scfm	min. 1,250 scfm	min. 2,500 scfm	30 BHP	Finned tube air cooled radiator with closed loop cooling circuit expansion tank and double pump station to supply cooling water for the rotating equipment.
Chilled water unit, gas cooling	2	max. 2,500 scfm	min. 1,250 scfm	min. 2,500 scfm	120 BHP	Air cooled compact chiller with dual closed loop refrigerant circuit, refrigerant tank and double pump station to supply chilled water to gas coolers.
Chilled water unit, dehydration	1	max. 2,500 scfm	min. 2,500 scfm	min. 2,500 scfm	30 BHP	Air cooled compact chiller with dual closed refrigerant circuits, refrigerant tank and double pump station to supply chilled water to dehydration gas cooler.
Off-gas blower	2	max. 2,500 scfm	2,500 scfm	5,000 scfm	misc.	Centrifugal Blowers for PSA and TSA off-gas. For each category one blower operating, one stand-by.
Regeneration gas blower	2	max. 2,500 scfm	2,500 scfm	5,000 scfm	misc.	Centrifugal blowers for TSA purge gas. One blower operating, one stand-by.
Off-gas combustion system, TOX	1	max. 2,500 scfm	min. 2,500 scfm	min. 2,500 scfm	misc.	Thermal oxidation unit with recuperative pre-heating of combustion air and PSA off-gas.
Heat Exchangers	1 (set)	max. 2,500 scfm	min. 2,500 scfm	min. 2,500 scfm	n.a.	Tube and shell heat exchangers.
Instrument air compressor skid	2	35 scfm air	35 scfm air	70 scfm air	15 BHP	Instrument air skid with oil flooded screw compressor, oil filters and adsorption dryer. One skid operating, one skid stand-by.

3 CONTROLS AND TRAINING INFORMATION

The Plant is equipped with an independent process control system. It manages all functions required for a secure and automatic operation of the plant. Among others, the following functions are included:

- Automatic operation allows for fully automatic operation of the BUP or individual parts thereof. Start, Stop and load changes will be carried out automatically
- Malfunction interruption monitors all parameters required for the operation of the BUP and manages a secure status of the BUP under abnormal operational situations
- Manual operation allows the independent and manual control of valves and drives for inspection and service purposes

Switch Cabinets

All components are connected within several switch cabinets. The main components are:

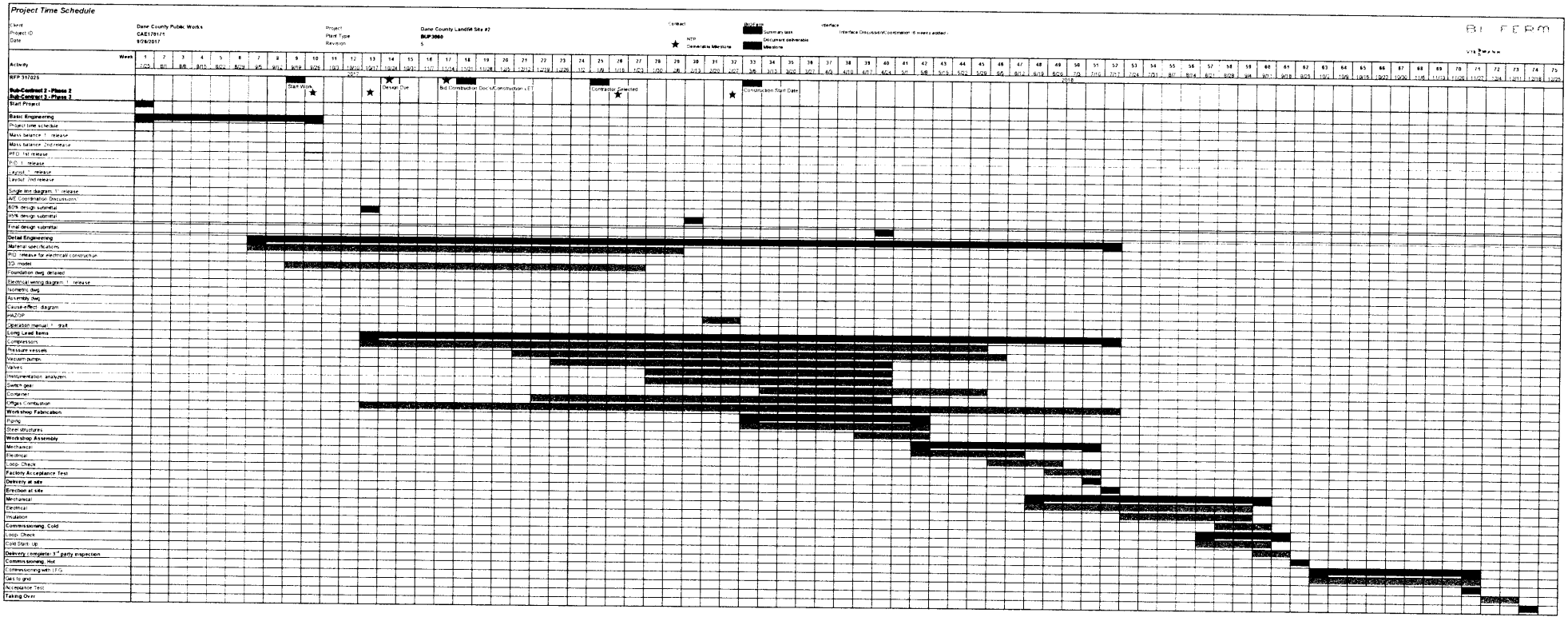
- 120V / 24VDC power supply
- Safety PLC CPU
- digital and analogue in and output cards, partially as remote I/O installed in field-junction boxes
- operator station with a desktop-PC to be installed in a safe control room or as touch screen panel mounted in one of the electrical switch cabinet panels
- remote service via Internet connection through "Team Viewer" software (Internet connection to be provided by Purchaser)
- motor switch equipment
- frequency inverter
- overload protection relay
- thermal resistor motor protector
- motor protector switch
- fuse switch-disconnector
- switchboard lighting with power plug
- terminal clamps for hard wired signal exchange (i.e. emergency stop) with position feedback
- Optional: Profibus connection via fiber optic
- Optional: DP / DP Profibus coupler to biomethane conditioning and/or injection plant

Uninterrupted Power Supply

In case of power failure, the 24 VDC control voltage system and the LEL monitoring installed in container will be supplied with power for approximately 30 minutes through a battery unit.

4 PROJECT TIMETABLE/SCHEDULE

Please see the following pages for a tentative project timetable (Gantt Chart).


Project Time Schedule
Client
Project ID
Date
Dane County Pubic Works
CAE1701/1
9/26/2017
Project
Plant Type
Revision
Dane County Landfill Site #2
BUP3060
5
Contract
NTP
Deliverable Milestone
Program
Summary task
Deliverable milestone
Milestone
Interface
Interface Discussion/Coordination (6 weeks added)
Activity
Week
RFP 317025
Sub-Contract 2 - Phase 2
Sub-Contract 3 - Phase 2
Start Work
Design Due
Bid Distribution Doc's/Construction LET
Contractor Selected
Construction Start Date
2018
Start Project
Basic Engineering
Project time schedule
Mass balance 1st release
Mass balance 2nd release
PFD 1st release
PID 1st release
Layout 1st release
Layout 2nd release
Single line diagram 1st release
A/E Coordination Discussion's
60% design submittal
90% design submittal
Final design submittal
Detail Engineering
Material specifications
PID release for electrical/ construction
3D model
Foundation dwg detailed
Electrical wiring diagram 1st release
Isometric dwg
Assembly dwg
Cause-effect diagram
HAZOP
Operation manual 1st draft
Long Lead Items
Compressors
Pressure vessels
Vacuum pumps
Valves
Instrumentation analyzers
Switch gear
Container
Offgas Combustion
Workshop Fabrication
Piping
Steel structures
Workshop Assembly
Mechanical
Electrical
Loop Check
Factory Acceptance Test
Delivery at site
Erection at site
Mechanical
Electrical
Insulation
Commissioning, Cold
Loop Check
Cold Start -Up
Delivery complete/ 3rd party inspection
Commissioning, Hot
Commissioning with LFG
Gas to grid
Acceptance Test
Taking Over

5 ADDITIONAL DATA/INFORMATION

The following services and respective conditions must be ensured by the Customer before shipping and erection at site is executed:

- unhindered access and sufficiently access ways for all transportation vehicles to construction site
- provision of sufficient space for unloading of the plant and auxiliaries with a max. mobile crane outreach of 30 ft.
- construction of interconnecting piping up to the battery limits
- laying of interconnecting cables and grounding strips/ wires up to battery limits; the cable and strip/ wire length must allow for a direct connection to the terminal points of the designated components
- provision of work-site power inside the plant installation area
- required work permits must be supplied in time, BIOFerm's personnel (including their subcontractors) must be instructed regarding the prevailing local safety and work regulations on site
- the Customer shall ensure that the erection can be carried out under conditions which satisfy the laws and regulations applicable to the working conditions on Site; the Customer shall by written notice inform BIOFerm of the safety regulations in force on the Site
- provision of electricity and water on site free of charge to BIOFerm's personnel
- provision of space for two 40 ft. containers (material storage) close to the construction site
- should transportation and/ or erection be deferred or delayed for reasons beyond BIOFerm's control, the additional cost arising from such a delay shall be the Customer's responsibility.

The following items are not part of the BIOFerm Scope of Supply:

- building design (site foundation), preparation, construction, and erection
- procurement of all permits required for erecting, testing and operating of the plant at site
- civil works and civil engineering outside the battery limits
- electrical and mechanical installation outside the battery limits
- piping, wiring, heat tracing and insulation outside battery limits
- personnel safety equipment
- all technical gases required for start-up and normal operation such as nitrogen, calibration, and carrier gases

- energy measurement for fiscal metering
- condensate treatment (an oil separator will be included in scope of supply)
- noise insulation for higher requirements than 80 dB(A) at 3 ft from enclosure
- fire protection systems
- external lightning protection
- spare parts
- inspection charges by the Customer or external agent

6 SAMPLE PERFORMANCE GUARANTEE

6.1 Performance Test and Plant Handover

The guaranteed performance data shall be demonstrated in a successful performance test in the manner described herein.

The performance test shall begin immediately after Plant commissioning is complete and the Plant is operating at full load and with stable raw biogas conditions within the ranges specified in Tables 1 and 2. BIOFerm shall conduct the performance test based on 72 consecutive hours of Plant operations according to the instructions outlined in the BIOFerm Operations and Maintenance (O&M) manual. During the 72-hour test, BIOFerm shall measure and record all relevant operating parameters and performance data. The parameters and data consist of, but are not limited to, flow, pressure, temperature and composition of incoming raw gas and outgoing product gas and as applicable the released off gas and liquids in and out.

In general, all performance measurements shall be taken from the Plant meters and gauges, such as flowmeters for gases and liquids, pressure transmitters and gauges, temperature transmitters and gauges, gas analyzer for various gases, dew point meters and others. For those measurements, which are not possible to carry out with the Plant's instruments, BIOFerm and Purchaser will mutually agree on alternative measurements, such as temporary instruments and / or sampling, with suitable devices in specific time intervals, along with testing by external authorized labs.

Data recording shall be done via the Plant PLC system and manually written measurements shall be recorded in hard copy signed by both BIOFerm and the Purchaser.

Provided all recorded performance data are within the guaranteed ranges for product gas as specified in Table 2, the performance test will be deemed successful. Purchaser will issue the Final Acceptance Certificate (FAC) within a week of the completion of a successful performance test. Upon receipt of the FAC, BIOFerm will hand over the Plant to the Purchaser.

Interruptions and Repeated Performance Tests

If Purchaser is providing raw biogas within the quantity and quality ranges specified in Tables 1 and 2, and the recorded performance data are not within the guaranteed ranges for product gas as specified Tables 1 and 2 BIOFerm will remedy the Plant defects within a reasonable time through adjustments, repairs and replacements, and repeat the performance test. The performance test can be repeated a maximum of three times within three months of the date of completion of the Plant's commissioning.

Stoppages due to causes which BIOFerm is not responsible shall entitle BIOFerm to a reasonable extension of time to conduct performance test(s).

If after three months from the date the Plant is delivered (a) the Purchaser cannot provide raw biogas within the quantity or quality ranges specified in Table 2, or (b) the Purchaser causes or is responsible for other circumstances that impede a full load performance test, the Parties shall agree on a partial load performance test. The test procedure for the partial load test remains the same. Purchaser shall issue an FAC based on a successful partial load performance test demonstrating product gas as specified in Tables 1 and 2. The Purchaser has the right to request a repeat performance test at full load conditions within three months after a successful partial load test, but the Purchaser shall bear all costs related to the test.

Deferred Performance Test

In the event that the performance test after commissioning is not or cannot be executed due to some fault of the Purchaser or its contractors, the Parties agree to issue a PAC and the Purchaser shall take over operation of the Plant. Performance test(s), either full or partial as agreed by the Parties, shall be carried out no later than three months after Plant commissioning. All costs related to this test shall be borne by the Purchaser. The deferral of the performance test within the three months after Plant commissioning shall not, however, relieve BIOFerm of demonstrating a successful performance test as specified herein.

6.2 Performance Guarantees

Subject to the following four conditions:

- The plant is installed, commissioned, and operated strictly according to the instructions of BIOFerm and the O&M manual,
- When the Plant is in operation, utilities without interruption, and raw biogas are supplied in accordance with the specification ranges provided in Table 2,
- The installation conditions are satisfied, and
- All relevant operating data is stored for a minimum of the existence of the performance guarantee,

BIOFerm guarantees performance of the Plant as provided below and provides warranties in Section 6.3. With the exception of the product gas quality, all performance and utility consumption

data are to be understood as one hour averages. All measured data is subject to the tolerances of the relevant instruments and the methods used.

Product Gas Quality

The product gas quality will be equal to or better than the values given in Tables 1 and 2.

Raw Biogas Processing Capacity

At average raw biogas conditions as stated in Tables 1 and 2 and average Plant performance, the raw biogas processing capacity will be minimum of 2,500 scfm.

Product Gas Flow

The product gas flow will be 1,175 scfm at average raw biogas composition.

Power Consumption

At average ambient conditions, average biogas flow, and average raw biogas composition, the total power consumption will not exceed 1,160 kW ± 5%.

Plant Availability

The availability of the plant will exceed 96%.

6.3 Warranty

BIOFerm™ USA, Inc.
Standard Warranty Terms for Carbotech Equipment

1. MATERIAL AND WORKMANSHIP WARRANTY AND REMEDY.

1.1 MATERIAL AND WORKMANSHIP WARRANTY.

BIOFerm™ USA, Inc. ("BIOFerm™") warrants to the purchaser of its Carbotech equipment products ("Purchaser") that the equipment and work purchased from BIOFerm™ is free from defects in material and workmanship for a period of twelve (24) months from the date of start-up of the equipment (start-up is when the equipment is capable of processing gas) but not more than thirty (30) months from the date of delivery of the equipment.

1.2 CONDITIONS OF MATERIAL AND WORKMANSHIP WARRANTY.

The material and workmanship warranty set forth in section 1.1 above is expressly conditioned upon the following:

1.2.1 The Purchaser regularly monitors and records the operating parameters of the process control system for the equipment and the Purchaser shall without undue delay notify BIOFerm™ by written notice of any defect which appears. Such written notice shall under no circumstance be given later than ten (10) days after detecting the failure or after the warranty period.

1.2.2 The warranty obligations of BIOFerm™ do not apply for typical wear and tear, overloading the system, operating conditions other than as specified by BIOFerm™ or modifications or repairs to the equipment by the Purchaser or any third party without prior written permission of BIOFerm™.

1.2.3 The equipment is installed, used and maintained normally and properly in accordance with BIOFerm™ instructions as to installation, written O & M manual and instructions sheets furnished by BIOFerm™ unless a deviation from such written materials is approved in writing by BIOFerm™.

1.2.4 The equipment is used solely for processing raw biogas consistent with the raw biogas specifications (except a flow rate below the minimum range but not above the maximum range) provided to BIOFermTM and made part of the contract between BIOFerm™ and Purchaser.

1.2.5 The equipment and work has not been changed without the prior written approval of BIOFerm™.

1.2.6 Purchaser preserves and permits reasonable inspection by BIOFerm™ of all allegedly defective equipment and work, parts or items and provides access to the equipment and work to observe its start-up, operation and maintenance, as applicable.

1.3 MATERIAL AND WORKMANSHIP WARRANTY EXCLUSIONS.

This warranty shall not cover (i) any equipment or work furnished by Purchaser or any third party (other than a subcontractor of BIOFerm™), (ii) any defects arising from corrosion, abrasion, use of unsuitable lubricants, operation outside of any prescribed temperature ranges, failure to follow prescribed cleaning procedures, or negligent attendance or faulty operation, (iii) ordinary wear and tear, or (iv) any defects caused by errors on the part of the Purchaser in not providing suitable premises in which the equipment or work is to be located, adequate foundation works, or adequate security. Wear parts and consumable parts, such as for example seals, catalysts, membranes, lights, electrical fuses, etc. are also excluded from this warranty, unless excessive wear is the result of defects in material and workmanship.

1.4 MATERIAL AND WORKMANSHIP WARRANTY REMEDY.

1.4.1 Purchaser's remedy, and BIOFerm™'s obligation, under this material and workmanship warranty is strictly and exclusively limited to BIOFermTM furnishing repairs or replacements for equipment, parts or work determined to be defective on inspection by an authorized representative of BIOFerm™.

1.4.2 Notwithstanding this exclusive remedy, if it is ultimately determined that the remedy for breach of the material and workmanship warranty fails in its essential purpose, and BIOFerm™ is unable to repair or replace equipment to remedy the breach, then any action which may be brought against BIOFerm™ subject to the terms of the Contract will be limited to 100% of the Contract price, or portion thereof, for the specific item of purchased equipment or work for which the exclusive remedy has so failed.

1.4.3 BIOFermTM assumes no responsibility and shall have no liability for any repairs or replacements by Purchaser without BIOFerm™'s prior written authorization.

BIOFerm™ assumes that the equipment will always be installed by BIOFerm™ or its approved subcontractor. If this is not the case, additional language should be added to this Standard Warranty.

2. LIMITATION OF WARRANTIES.

2.1 THE WARRANTY OF MATERIAL AND WORKMANSHIP SET FORTH IN SECTION 1.1 HEREOF AND ANY GUARANTEES CONTAINED IN THE "GUARANTEES" SECTION OF THE CONTRACT, ARE THE ONLY WARRANTIES MADE BY BIOFerm™ AND ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED. BIOFerm™ DISCLAIMS ON BEHALF OF ITSELF, ITS SUBCONTRACTORS AND SUBSUPPLIERS ANY AND ALL IMPLIED WARRANTIES, INCLUDING, WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY, FITNESS FOR A SPECIFIC PURPOSE, SUITABILITY OR PERFORMANCE. No other promise or affirmation of fact (including, but not limited to, statements regarding capacity or performance of the equipment or work) shall constitute a warranty of BIOFerm™ or give rise to any liability or obligation on the part of BIOFerm™.

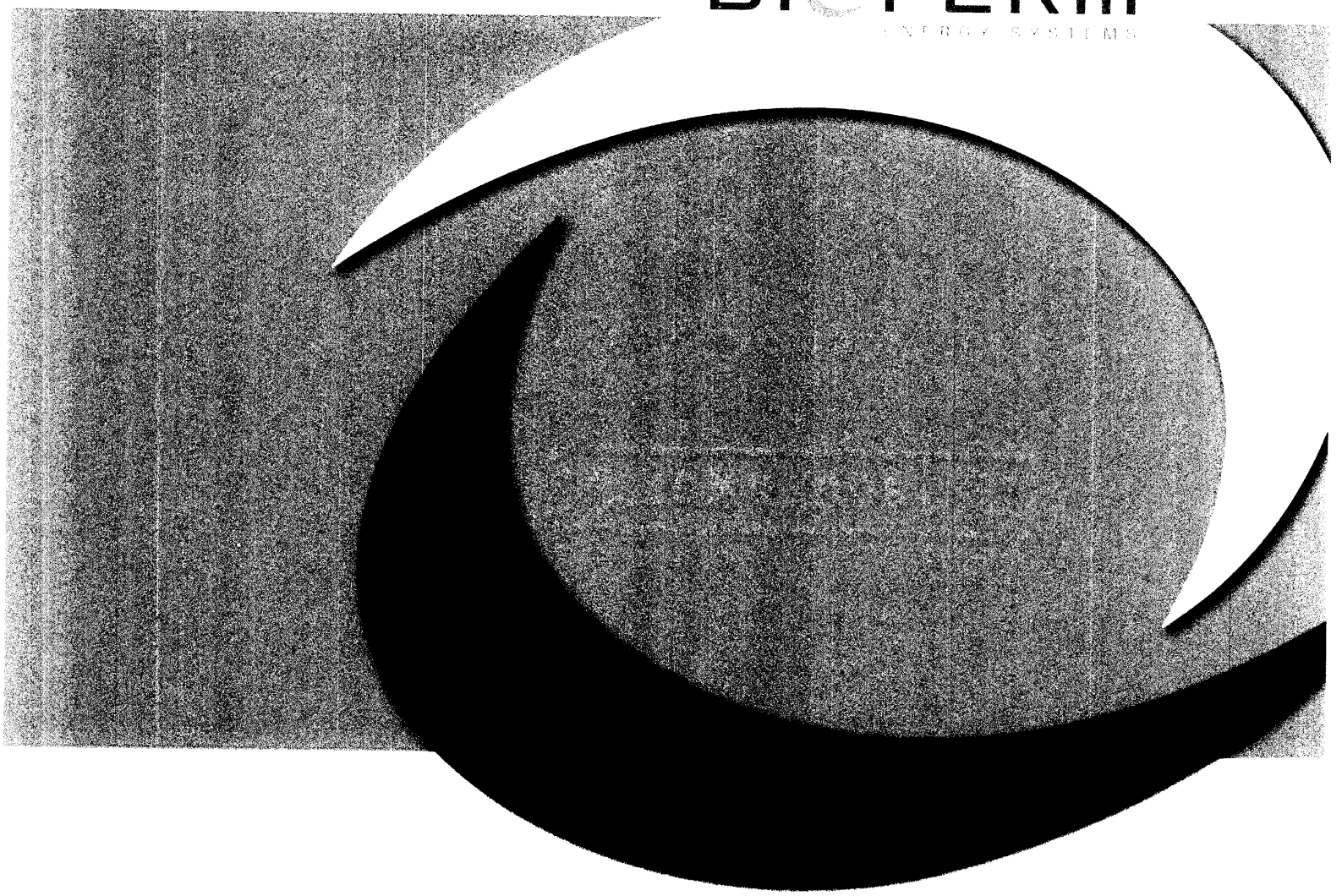
2.2 IN NO EVENT SHALL BIOFermTM, ITS SUBCONTRACTORS OR SUBSUPPLIERS BE LIABLE IN CONTRACT OR IN TORT OR UNDER ANY OTHER LEGAL CONTEXT OR THEORY, INCLUDING NEGLIGENCE AND STRICT LIABILITY, FOR LOSS OF REVENUE OR PROFITS OR FOR ANY SPECIAL, PUNITIVE, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY KIND OR CHARACTER, INCLUDING, BUT NOT LIMITED TO, LOSS OF USE OF PRODUCTIVE FACILITIES OR EQUIPMENT, PLANT DOWNTIME, DAMAGE TO OR LOSS OF CHEMICALS, CATALYSTS, FEEDSTOCK OR OTHER RAW MATERIALS, COSTS OF REPLACEMENT POWER, OR LOSS UNDER PURCHASES OR CONTRACTS MADE IN RELIANCE ON THE PERFORMANCE OR NON-PERFORMANCE OF THE PURCHASED EQUIPMENT OR WORK, WHETHER SUFFERED BY PURCHASER OR ANY THIRD PARTY, OR FOR ANY LOSS OR DAMAGE ARISING OUT OF THE SOLE OR CONTRIBUTORY NEGLIGENCE OF THE PURCHASER, ITS EMPLOYEES OR AGENTS OR ANY THIRD PARTY.

2.3 NOTWITHSTANDING ANYTHING TO THE CONTRARY, THE AGGREGATE LIABILITY OF BIOFerm TM AND ITS SUBCONTRACTORS AND SUBSUPPLIERS, WHETHER ARISING OUT OF CONTRACT OR TORT, INCLUDING NEGLIGENCE AND STRICT LIABILITY, INCLUDING, BUT NOT LIMITED TO, ANY CLAIMS FOR BREACH OR WARRANTY, FAILURE TO PERFORM OR DELAY IN PERFORMANCE OR NON-PERFORMANCE SHALL BE LIMITED TO 100% OF THE PRICE ACTUALLY PAID FOR THE EQUIPMENT

APPENDIX A: ELECTRICAL CABINETS TECHNICAL MEMO

Please see the following pages for the electrical cabinets technical memo.

BIOFERM™
ENERGY SYSTEMS



17 TECHNICAL MEMO_V2

Reference: Dane County
Date: 6 September 2017
Subject: Electrical Cabinet Design

From: BIOFerm ™ Energy Systems
440 Science Drive, Suite 300
Madison, WI USA 53711

SUMMARY

Three options are presented for the electrical cabinet design for Dane County.

1) Traditional N. American style MCC (NEMA Motor Control Center)

2) Standard Carbotech design (like installed in example project)

3) Modified design Carbotech's standard

BACKGROUND

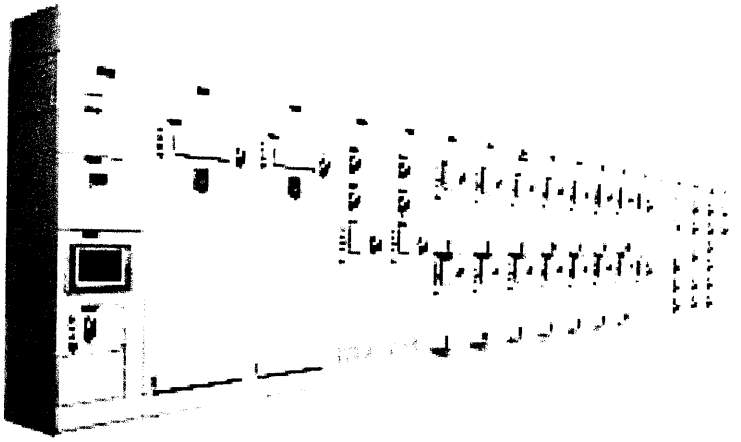
The Dane County has requested an option to install a different control cabinet configuration to allow easy access to operate the system without dependence on an electrician at the project site at all times. A possible option Dane County would like to discuss is a traditional N. American NEMA style MCC (Motor Control Center). The Carbotech standard is to install an IEC style Motor Starter Cabinet.

A NEMA style MCC allows operators to access motor disconnects on the outside of the cabinet, while the standard IEC style cabinet used by Carbotech requires the operator to open a cabinet door to access motor disconnects and circuit breakers. As an additional third option, Carbotech's standard design could be modified to allow operators to access motor disconnects without calling an electrician.

COMPARISON OF OPTIONS

1. NEMA Motor Control Center

Siemens Tiastar MCC System



PROS

1. North American operators are familiar with this style of control cabinet

2. Front access to internal parts

- Motor or compressor maintenance can be performed without opening cabinet doors.
- Single motors can be "Locked-out" quickly without turning off other motors or shutting off power to the entire plant.
- Motor Circuit Breakers can be reset quickly without shutting off power to the entire plant.

CONS

1. Larger than IEC design

- 30-50 % larger depending on the size and number of motor loads

2. More Expensive than IEC design

- An estimated extra $4X in hardware costs, expanding the electrical room, and engineering costs.
- A final additional cost would be determined during the phase 2 detailed engineering phase.

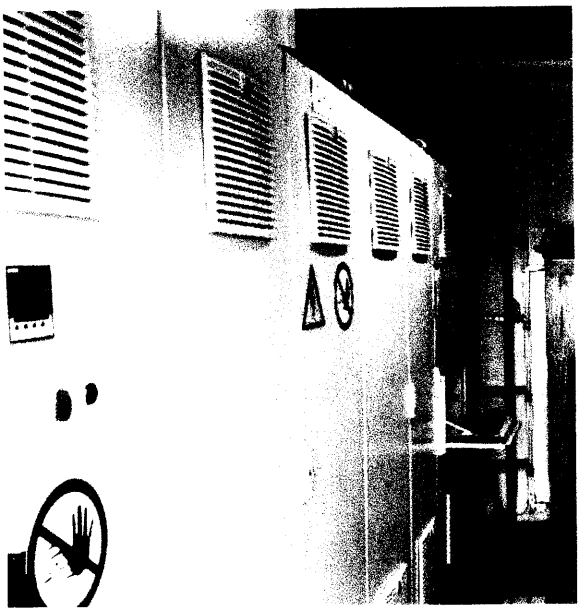
3. Eight weeks' additional lead-time to the project for engineering and equipment lead-time

4. Cannot have separate safety contactor and standard contactor for a motor.

Separate delivery of MCC to site requires more field wiring to connect PLC signals

2) IEC – Carbotech Standard Design

Standard Carbotech Design, Guymon OK



PROS

1. Electrical cabinets can be completely assembled in workshop before delivery to site

2. Smaller footprint

3. Standard Carbotech design which has been designed and built for example project

CONS

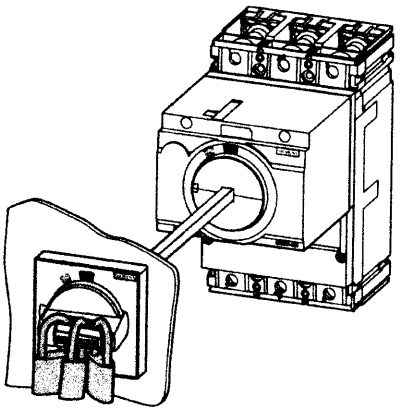
1. An electrician may be needed for routine maintenance of compressors or pumps that require power to be disconnected to equipment.

2. To lock single starter in an IEC style panel, an operator may need to:

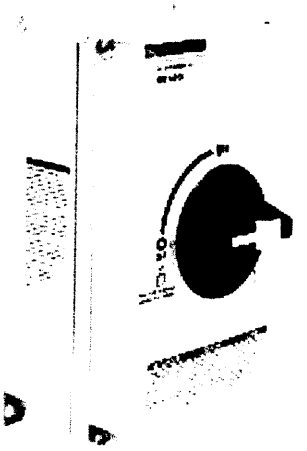
i. Suit up in appropriate PPE.
ii. Turn off the main disconnect that is adjacent to the IEC panel. NOTE: This shuts down all motors in the panel.
iii. Lock the disconnect in open position.
iv. Open the starter enclosure door.
v. Lock out the desired starter.
vi. Close the starter enclosure door.
vii. Remove lock and re-energize the main disconnect.

3. Carbotech Modified Design

Door Mounted Lock-out



Local Motor Disconnect



PROS

1. Door mounted rotary handle operators and local field disconnect switches can be added to lock-out power to individual equipment and re-set circuit breakers without opening cabinet doors.

2. Electrical cabinets can be completely assembled in workshop before delivery to site

3. Smaller footprint than MCC

4. Standard Carbotech design for components inside the cabinet

5. Carbotech's example site cabinet design can be used as a starting basis for engineering

CONS

1. More Expensive than IEC design

- An estimated extra $2X in hardware costs, expanding the electrical room, and engineering costs. A final additional cost would be determined during the phase 2 detailed engineering phase.

BIOFERM'S RECOMMENDATION:

BIOFerm's recommendation would be to modify the Carbotech's Standard electrical cabinet design to make maintenance possible without the need to open cabinets. Option 3 would provide many of the benefits Dane County would hope to achieve with an NEMA MCC system, without the higher additional cost, the additional time needed to the project schedule and the additional room needed to store the additional hardware.

ADDITIONAL RECOMMENDATIONS:

In addition to the BIOFerm's recommendation to proceed with Option 3, BIOFerm has these additional suggestions. An advantage of a NEMA style MCC is the power can quickly be shut off to an individual compressor or pump for maintenance. Another advantage is the electrical power can be "Locked-out" without calling an electrician to open the doors of the electrical cabinet. Below are additional design changes that could be added to Carbotech's standard electrical cabinet design to reduce the need of an on-site electrician during operation of the plant.

1. Local disconnect switches can be added near equipment (i.e. compressors, blowers, vacuum pumps, chillers) to ensure power can be "Locked-out" during maintenance by operators.

2. Door panel mounted accessories from Siemens can be added on electrical cabinet doors to reset motor CB's without opening doors.

3. Cabinet door Interlock switches can be added to trip main power circuit breaker if electrical cabinet doors are opened.