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January 12, 2022

Mr. Jordan Matthews, P.E.
Engineer
DNREC - Division of Air Quality
100 W. Water Street, Suite 6A
Dover, Delaware 19904

Re: Project No. 12393.EB
Air Permit Applications
Bioenergy Devco, Bioenergy Innovation Center
28338 Enviro Way
Seaford, Delaware

Dear Mr. Matthews:

On behalf of Bioenergy Devco (Bioenergy), Verdantas LLC (Verdantas) is enclosing pdf files of air permit applications for a new emergency generator, flare, and thermal oxidizer at the Bioenergy Innovation Center facility in Seaford, Delaware. The sole owner and operator of the facility is Bioenergy.

On November 5, 2021, we submitted draft air permit applications for the flare and thermal oxidizer for your review and comment. On December 8, 2021, you responded with 15 comments (attached). We have modified the draft air permit application forms to address comments 1, 6, 8 through 12, and 14. You had confirmed via email that those comments were adequately addressed.

In response to comments 2 and 5, we are including the relevant parts of an engineering report that is part of a Resource Recovery Facility (RRF) permit application for the facility. The engineering report includes the biogas production process operating details sought in comment 2. In addition, we are enclosing typical digester operating parameters, identified as "Typical Digester Operating Parameters", that Bioenergy plans on monitoring as part of plant operations.

In response to comments 3, 7 and 13, we are *voluntarily* including a form AQM-4.2 for each of four different filters that are part of the biogas conditioning process. These forms were completed by each of the equipment vendors for the respective filters, and as such, represent the best information available. As indicated on form AQM-3.1 and the Department's website, series AQM-4 series forms, including AQM-4.2, are intended for and required for control devices.

We do not believe the filters meet the Department's definition of "air contaminant control device or system" as defined in Regulation No. 1101 which reads "any method, process, equipment, or stack which removes, or reduces, or renders less noxious air contaminants discharged into the atmosphere". The filters are included in the biogas conditioning process to purify the biogas, not to control emissions. The filters have no direct discharge to the atmosphere and therefore are not an air contaminant control device as defined by the regulation. Additionally, the regulation defines "process operation" as "chemical, industrial, or manufacturing operation including, but not limited to, heat transfer, fluid flow, evaporation, humidification, absorption, extraction, distillation, drying, mixing, classification, sedimentation, decantation, filtration, crystallization, centrifugation, disintegration and material handling". Through separate correspondence on the subject on November 23, 2021, you had confirmed that the filters should be considered "process equipment" rather than "control equipment" based on cited EPA guidance.

As a comparison, the flare and thermal oxidizer each have a unique process gas stream that terminates at that equipment (see attached process flow diagram). Those gas streams are waste streams that would be emitted to the atmosphere. Clearly, the flare and thermal oxidizer "renders less noxious air contaminants discharged to the atmosphere", and as such, are control devices. The filters neither process waste streams nor have emissions.

In response to comment 4, we have modified AQM-3.1, item 7.1 to reflect feedstock materials approved by Sussex County, while clarifying the components of DAF that the facility intends to receive.

In response to comment 15, we are including a description of the operation of the filters, identified as "Filter Operations".

On July 24 and December 15, 2020, we made similar submissions to the Department for an emergency generator, flare, and thermal oxidizer, respectively, that were planned at that time. The permit and advertisement fees were submitted to the Department along with those applications. On August 5, 2021, the Department deemed the applications incomplete. However, the Department retained the fees that were submitted at that time. It is our understanding that the retained fees can be applied to the applications included with this submission. Thus, no additional fees are included with this submission.

Please contact me should you require further information for the issuance of construction permits for the subject equipment.

Sincerely,

VERDANTAS LLC

Brian Lyncha, P.E.
Sr. Project Manager

BL:mes
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Enclosure: Air permit application package

cc: Mr. Peter Ettinger – Bioenergy Devco
Ms. Christine McKiernan – Bioenergy Devco

DNREC COMMENTS 12/8/21

Comments on Draft Permit Applications

1. Item 28.2 on AQM-1, Item 20.1 on AQM-3.1, Item 30.1 on AQM-4.3, & Item 24.1 on AQM-5 indicate a proposed limit on the flare's operation of 2,453 hours/year.
    a. As we've previously discussed, I would recommend you include the maximum volume of fuel combusted during that period instead.
    b. If the process were to require flaring a low flowrate of biogas over an extended period of time, it may be beneficial to BioEnergy to be permitted for the volume of gas (it could be maximum volume of gas combusted over the 2,453 hour period) rather than a time-based limitation.
2. Item 33 on AQM-1 indicates a cover letter is attached. Please be sure to include this cover letter when application is submitted.
    a. A narrative describing the operation of the digester and its associated control/process equipment (especially those having an impact on the formation/reduction of air pollutants) should be included in the cover letter or elsewhere in the application.
    b. Some additional information which may be useful to include in your cover letter/narrative description:
        i. The number of digesters proposed for construction and the proposed construction schedule
        ii. Type(s) of digester (e.g. covered lagoon, plug flow, complete mix, etc.)
        iii. Method that raw material will be collected, stored, and delivered to the digesters
        iv. Environmental parameters that will be monitored and recorded to ensure proper digester operation, which may include but are not necessarily limited to:
            1. Operating temperature of digester (e.g. Ambient, Mesophilic, Thermophilic, etc.) and a description of equipment used to maintain the temperature of heated digesters
            2. pH,
            3. alkalinity, and
            4. waste characteristics, such as the amounts of
                a. volatile solids (VS),
                b. carbon to nitrogen (C/N) ratio,
                c. total solids (TS),
                d. nutrients,
                e. organic loading rate (OLR),
                f. ammonia, and
                g. VFAs
        v. Operational parameters that will be monitored and recorded to ensure proper digester operation, which may include but are not necessarily limited to:
            1. Solid retention time (SRT)
            2. Hydraulic Retention Time (HRT)
            3. Dimensions of the digester
            4. Digestion mode (single or multi-stage approach)
            5. Digester design (batch or continuous)

6. Digester mixing

3. Item 35 of AQM-1 indicates application forms AQM-4.1, AQM-4.2, & AQM-4.3 are attached, but I did not see the AQM-4.2 application form included in either of the draft application.
    a. AQM-4.2 appears to be the form which would be required for the proposed equipment (activated carbon & PSA systems) for the removal of VOCs, siloxanes, & H_2S.
4. Item C in the "Notice of Decision Letter for Conditional Use" from Sussex County states that "the proposed facility shall only accept, process and handle poultry litter and DAF. Item 7.1 of AQM-3.1 indicates that the raw material used will include "Organic waste (hatchery waste; chicken litter; liquid and solid cake DAF; fats, oils & grease; waste activated sludge)".
    a. I recommend including a statement in your process write-up, or wherever else you feel it fits best, describing how the material proposed for use in the digester complies with Item C in Sussex County's Conditional Use letter.
    b. For reference, an email you sent to me on May 3, 2021 indicated that "fats, oils & grease, and waste activated sludge are byproducts associated with DAF."
    c. Please also specify how hatchery waste complies with Sussex County's Conditional Use letter since it was not directly mentioned in Item C of the letter.
5. Item 3 on AQM-3.1 states that the application is for the "Operation of anaerobic digesters to produce renewable natural gas".
    a. How many digesters are proposed?
    b. Will all these digesters be constructed initially, or will they be constructed in phases? Some things to consider with regards to this question:
        i. If the digesters will be constructed in phases, there are at least a couple of options to move forward:
            1. Permit construction for all of the proposed digesters at once, so long as all of the proposed digesters are constructed within three (3) years of permit issuance (once we issue a construction permit, the permit is only valid for a maximum of 3 years). When the time comes, an amendment to the permit would be required to allow operation of the additional digesters.
            2. If all proposed digesters are not constructed within three (3) years of initial permit issuance, the additional digester(s) need to be permitted separately.
                a. If additional digesters are applied for at a later date, is the requested throughput of feedstock (250k TPY) feasible with the # of digesters proposed for initial construction?
    c. This information should be specified in the cover letter or wherever you decide to include your process narrative.
6. Item 11 on AQM-3.1 asks for you to describe the specifications and/or operating parameters for equipment or process. If these parameters are spelled out in the cover letter/process narrative (as I requested earlier in this document), then perhaps it would be best to reference that in this section instead.
7. Since AQM-3.1 describes emissions from the digesters and the control of emissions from this process, I would recommend checking the boxes in Items 12.9 & 12.10 as yes on both forms.

   a. You should also check the box for "Yes" on the associated Item # for any other equipment used to reduce emissions in the gas stream prior to treatment in the oxidizer or flare.
   b. For the H_2S and siloxane removal equipment as well as the PSA Vessels/Activated Carbon Polishing/membrane section of the process, the applicable box appears to be Item 12.7 – Adsorption Equipment.
8. Similarly, I would reference the oxidizer (AQM-4.1) and flare (AQM-4.3) as emission points in the stack information section of AQM-3.1. You can complete the stack specifications in the associated AQM-4 series form.
9. Items 10 and 19 on AQM-4.3 indicate a flame temperature of "250+°F". This seems very low, especially when compared with the temperature proposed in the flare application submitted last December.
   a. Please ensure this is accurate because the low temperature may have a negative impact on the modeling results (generally higher flame temperatures correlate to better dispersion).
10. For the "Auxiliary Fuel Information" section of AQM-4.3, I would suggest adding the information related to the fuel used for the pilot flame.
11. For the "Monitoring and Alarm Information" section of AQM-4.3, does BioEnergy know the setpoints for the various alarms described in Items 29.1.1 through 29.1.4?
12. On AQM-5, the # of "Individual Pieces of Process Equipment in Process" is listed as 2. Is this the number of proposed digesters?
13. On AQM-5, the @ of "Individual Control Devices in Process" is listed as 2. I would recommend including the previously referenced equipment for the removal of H_2S, siloxanes, & VOCs in this number.
14. Item 22 on AQM-5 asks whether the source is new or existing. While the note on the application form instructs you to refer to Question 11 on AQM-1, I believe this is misleading. While the facility is existing, the proposed source is new, which is the critical information for MNSR.
   a. Please check the box for "New" instead of "Existing".
   b. I have relayed this to management, and hope that the application form will be amended to correct this issue.
15. As for the email sent to me on December 3, 2021 with the description of the various control equipment (H_2S, VOCs, siloxane), the information provided was very helpful (and should be included in the process narrative) but application forms for the various adsorption systems should be completed to the extent possible and submitted along with the application forms for the flare & oxidizer.

ENGINEERING REPORT

BIOENERGY INNOVATION CENTER
SEAFORD, DELAWARE

ENGINEERING REPORT

January 12, 2022

Prepared for:

BioEnergy DevCo, LLC
50 State Circle
Annapolis, MD 21401

Prepared by:

Barton & Loguidice, DPC
116 Defense Highway Ste. 309
Annapolis, MD 21401

Project No. 12393.ED

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FIGURE
(in text)

Figure 1 Existing Site Aerial Photo

APPENDICES

Appendix A Proposed Facility Layout Drawing
Appendix B Mass and Energy Balance Reports
Appendix C Simplified Process Flow Diagram
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Appendix E Construction Safety

Appendix F Operations Safety Manual

Appendix G City of Seaford Wastewater Commitment Letter

Appendix H Wastewater Treatment Process Flow Diagram

Appendix I Wastewater Treatment System Mass Balance

1.0 INTRODUCTION

1.1. PURPOSE

This Engineering Report (the "Report") has been prepared pursuant to the requirements specified in Section 4.4.1.4 of Delaware's Regulations Governing Solid Waste ("DRGSW") for the Resource Recovery Facility ("RRF") operated by Bioenergy DevCo ("BDC") and operating as the BioEnergy Innovation Center ("BIC").

BDC is requesting a new permit to support the planned expansion of the RRF to include an anaerobic digester plant to facilitate resource recovery from poultry industry liquid and solid cake DAF waste, poultry litter and the bioreactor sludge from the on-site wastewater treatment plant.

Section 4.4.1.4 of DRGSW requires the completion of an Engineering Report that consists of the following 10 components:

1. Proposed layout drawings;
2. Mass & Energy balances;
3. Proposed design features;
4. Proposed installation methods & procedures;
5. Quality assurance plan;
6. Project Construction Schedule;
7. Proposed design capacity and facility life expectancy;
8. Hazardous Materials Safety Plan;
9. Future expansion analysis; and
10. Possible groundwater and surface water discharges.

These components are more specifically outlined in Sections 4.4.1.4.1 through Section 4.4.1.4.10 of DRGSW.

The Report has been produced under the oversight of and signed and sealed by Robert F. Hasemeier, P.E., a Professional Engineer registered in the state of Delaware.

2.0 PROJECT OVERVIEW

2.1. PROJECT DESCRIPTION

Bioenergy DevCo (BDC) is developing an organics processing facility referred to as the Bioenergy Innovation Center (BIC), which is located in Seaford, Delaware. The BIC (the Facility) will utilize Anaerobic Digestion (AD) technology to process organic feedstock into beneficial end products in addition to the capture of biogas. The Facility will primarily accept organic waste in the form of poultry litter and Dissolved Air Flotation (DAF) liquid and solid cake; fats, oils & grease; and waste activated sludge) ~~sludge, cake, and liquid as well as chicken poultry litter~~ as feedstocks.

The existing composting facility will be expanded in two phases to include four anaerobic digesters (two in each phase) and total capacity of up to an additional 250,000 tons per year of recycling capability. ~~The first phase is planned for completion by late-2021.~~ The second phase construction starts concurrently with the commissioning of the phase 1 digesters. ~~and is expected to be completed in Q2 of 2022.~~ The application for the Resource Recovery Facility permit is inclusive of both phases of the project.

The AD process will generate a solid digestate and biogas that can be further processed to produce marketable end-products as well as liquid digestate that will require pre-treatment on-site and final treatment off-site. The solid digestate will either be transported to the adjacent compost facility or marketed as a soil amendment/conditioner. The biogas will be upgraded and conditioned to pipeline grade renewable natural gas (RNG). The RNG will be pressurized and transported as Compressed Natural Gas (CNG) by an energy services provider~~Chesapeake Utilities Corporation (CUC)~~ for injection into the natural gas pipeline grid.

~~The~~ W~~w~~astewater generated by the ~~as part of the~~ AD process will be ~~pre-~~ treated on-site. Initially treated wastewater will be ~~(through biological treatment, ultrafiltration, and Reverse Osmosis)~~ hauled to ~~either a Sussex~~ the City of Seaford ~~County wastewater facility~~ for disposal ~~under the County's septage discharge program or to a municipal wastewater treatment plant~~. Ultimately, BDC will seek approval from Sussex County Council to form a sewer district and construct a pumping station and force main from the site directly to Seaford's wastewater system. BDC has a commitment from Seaford (Appendix G) to accept up to 60,000 gpd pretreated wastewater that meets Seaford's discharge standards. The Seaford commitment is subject to an executed service agreement with BDC. ~~the goal is a connection via force main to a municipal system.~~

3.0 ENGINEERING REPORT REQUIREMENTS

The following 10 report subsections follow the DRGSW Section 1301, Part 4.4.1.4 of the Administrative Code.

3.1. FACILITY LAYOUT

The BIC project site was formerly owned and operated by AgriSoil, LLC (Perdue) and functioned as an organics processing and micronutrient facility. Under the previous operating permit (originally issued to Seaford AgriSoil, LLC on December 2, 2016), the facility processed poultry industry hatchery waste, and liquid and solid cake dissolved air flotation (“DAF”) ("source separated") wastes. The composting permit was transferred to Bioenergy Development Group in February 2020, and BDC has been operating this facility since February 6, 2020.

The BIC project site is located at 28338 Enviro Way, Seaford, DE 19973 and encompasses approximately 225 acres consisting of several parcels located west off of Seaford Rd (US-13 Alternate Route), between Oneals Road (Rd 485) and approximately the intersection of Seaford Rd and Easter Ln. and west from Seaford Rd to near Rd 487. An aerial of the existing site obtained from Google Earth Pro is presented on the next page as Figure 1. In accordance with DRGSW, Section 1301, Part 4.4.1.4.1, the Proposed Facility Layout Drawing presenting the conceptual design of the facility is provided in Appendix A.

3.2. MASS AND ENERGY BALANCES AND PROCESS FLOW

In accordance with DRGSW, Part 4.4.1.4.2., mass and energy balances are included in Appendix B as provided by the process design engineer, BTS Biogas (BTS). A Simplified Process Flow Diagram is also provided in Appendix C.

Figure 1 – Existing Site Aerial Photo

3.3. PROPOSED DESIGN FEATURES

In accordance with DRGSW, Part 4.4.1.4.3., the facility's design features and processing equipment are detailed in this section. The facility includes a comprehensive AD System, which includes the following major components which are more completely described in the Section 3.3.2.1 to include design capacity, size and number of units:

- Feedstock Receiving
    - Solids Feedstock Tipping Floor in an enclosed building;
    - Solids Feedstock Receiving Feeders
    - Biomix Feed Pump
    - Liquids Feedstock Receiving Pad and Pump House
- Anaerobic Digestion System
    - Pretank/slurry tank
    - Digester Tanks
- Digestate Handling System
    - Polyelectrolyte Preparator (polymer feed system)
    - Centrifuge Solids Separation
    - Screw Press(as part of Phase 2 to be inserted upstream of centrifuge)

- Wastewater Pretreatment System
    - Solids Removal
    - Bioreactor
    - Ultrafiltration System
    - Reverse Osmosis
    - Nanofiltration
    - Superconcentration Reverse Osmosis
- Biogas Upgrading, Conditioning, and Control Equipment
    - Biogas Conditioning (H2S Scrubber and moisture removal)
    - Compression System
    - Flare and Thermal Oxidizer
- Odor Control Equipment
- ~~Process tank vent filters~~
    - Building Air Dilution Air Exhaust Fan System
- Truck Scales
    - Inbound truck scale, 70-ft
    - Outbound truck scale, 70-ft

3.3.1. Access Road and Traffic Flow

The access road to BIC will accommodate the traffic flow to the AD and organics facility and be of sufficient capacity to accommodate peak daily and hourly delivery volumes. Though not anticipated to be used often, the access road will be equipped with a Queue Area for trucks to queue during high delivery periods. The Queue Area will be located in the main entrance road leading to the facility. One (1) 70 foot, above ground inbound scale will be located after the Queue Area. All vehicle flow will proceed in a counter-clockwise direction around the facility after progressing over the inbound scale. One (1) 70 foot, above ground outbound scale will be located on the access road in the outbound direction. These scales will provide appropriate measures to monitor and track incoming waste receipts and outbound shipments from the facility. Incoming liquid wastes received at the facility will be metered. Both scales will be equipped with lightning protection to improve reliability.

3.3.2. Feedstock Receiving

The facility will receive poultry litter and DAF (liquid and solid cake; fats, oils & grease; and waste activated sludge) ~~industry hatchery waste, liquid and solid cake dissolved air flotation ("DAF"), chicken litter~~, and the

bioreactor sludge from the on-site wastewater treatment plant. The BIC facility is designed to receive and process up to 250,000 tons of organic wastes per year into marketable products or commodities that include biomethane gas (i.e., biogas), composted soil amendments, solids digestate soil amendments and blended soil amendments. The incoming feedstock types and quantities are presented in Table 1.

Table 1 – Feedstock Tonnage Assumptions for AD Process

Feedstock Source and Type	Short Ton (tpy)	Short Ton (tpd)[3]
Facility 1 Cake Average	11,542.44	31.71
Facility 1 DAF Sludge Primary Average	38,176.32	104.88
Facility 2 DAF Sludge Average	22,196.72	60.98
Facility 3 DAF Cake Average	79,908.92	219.53
Facility 4 Cake Average	17,755.92	48.78
Poultry Litter	29,924.44	82.21
SUBTOTAL[1]	**199,504.76**	**548.09**
Bioreactor Sludge	45,478.16	124.94
TOTAL[2]	**244,982.92**	**673.03**

[1]Accounts for all of the feedstock being delivered to the facility
[2]Accounts for total amount of material processed by the AD equipment. This total is greater than the tonnage of feedstock delivered to the facility because the bioreactor sludge is recycled through the process.
[3]Assumes 7 days per week/ 52 weeks per year operation. Actual daily values will be slightly higher per feedstock receiving operations

3.3.2.1 Solids Receiving Area

The solid DAF, chicken litter, or other similar solid organic materials will be transported to the facility in various sized transfer trailers up to a maximum of 53' in length. These trucks will enter through one of two roll up doors and tip in the Solids Receiving Area located on the south end of the building, which will accommodate a minimum of four (4) transfer trailers per hour. The trucks will tip and unload material into a receiving pit with a feeder. A screw auger conveyor will be located at the bottom of the feeder to transport the material to be pumped to the Pre-tanks. The screw auger will be sized to remove material quickly enough to avoid backups or overflow of the feeder. In the event some material does end up on the floor, a hose station will be located nearby to wash the material into the feeder. Preliminary design data for the solids receiving area is presented in Table 2.

Table 2 – Solids Receiving Design Data

Equipment	Quantity	Size / Rating	Capacity
Feeder 1 and 2 (DAF Waste)	2	2472 ft^3	30 ton/hr
Feeder 3 (Chicken Litter)	1	2825 ft^3	30 ton/hr
Bio-Mix Feeder Pumps	3	30 KW / 460 V	300 gpm

3.3.2.2 Liquids Receiving Area

The liquid unloading area, located at the back (west side) of the building, is designed to accommodate one truck unloading at a time. The liquid DAF and other similar liquid organic materials will be transported to the facility in large tanker trailer trucks. The driver will park the truck on a spill pad, which will contain any spillage that may occur during the unloading process. One truck will unload at a time. The spill pad can contain 2,304 gallons and will connect to a trench drain that will route back to a sump that will be connected to the wastewater treatment system in order to handle potential maximum spill volumes. The driver will connect a vacuum line via a quick connect fitting on the tanker vessel and pump the contents to the Pre-tanks. Preliminary design data for the liquids receiving area is presented in Table 3.

Table 3 – Liquids Receiving Design Data Area

Equipment	Quantity	Size / Rating	Capacity
Sump Pump	1		170 gpm
Flow Meter	1		
Liquid Unloading Station Pump	1	20 KW / 460 V	300 gpm

3.3.3. Anaerobic Digestion System

3.3.3.1 Pre-tanks

The project will include pre-tanks to provide mixing and stirring with mechanical agitators and provide for equalization allowing a constant flow rate and consistent quality of substrate to be fed to the digesters. The liquid DAF material will be pumped directly to the Pre-tanks.

The Solid DAF and processed poultry litter will be combined with liquid substrate that can be pumped from the pre-tanks to

create a pumpable slurry with a desired percentage of solids. The slurry will then be pumped to the digesters.

The pre-tanks are constructed using post-tensioned, pre-cast concrete panels which are sealed to prevent reactions with potential corrosives.

The pre-tanks are designed with almost 3 days of hydraulic retention time. The reduced retention time is kept short so as not to produce biogas. Any biogas produced is collected at the top of the tank with a line that connects to the common biogas lines from the anaerobic digesters and pulled to the biogas treatment system by way of a blower.

The pre-tanks preheat the substrate and provide some initial breakdown of complex organic molecules into sugars, amino acids, and fatty acids to aid the AD process within the digesters. Preliminary design data for the pre-tanks is presented in Table 4.

Table 4 – Pre-tanks Design Data

Quantity (Number)	Material (Type)	Foundation (Type)	Inside Diameter (FT)	Height (FT)	Volume Fermentation (FT^3)	Volume Total (FT^3)
3	Pre-Cast Post-Tension Concrete	Concrete Geo-Piers and Slab	46	33	50,571	54,349

3.3.3.2 Digester Tanks

The project includes four digesters that will operate in parallel to provide anaerobic digestion of the slurry and produce biogas. The digester tanks will be heated and mixed to facilitate the biological process. The digesters are expected to produce 2,304,000~~1,892,359~~ SCF~~scf~~ of biogas per day (1600 SCFM) which is expected to equate to 1,428,480~~106,796~~ SCF ~~scf~~ of methane produced per day based on continuous 24-hour operation, seven days per week. Biogas will be collected from the digesters and treated at the biogas conditioning system. Digestate from the digesters will be pumped to a Feed Tank for solids separation. Preliminary design data for the digester tanks is presented in Table 5.

Table 5 – Digester Design Data

Quantity (Number)	Material (Type)	Foundation (Type)	Operating Temperature (°F and °C)	Inside Diameter (FT)	Height (FT)	Volume Fermentation (FT^3)	Volume Total (FT^3)
4	Pre-Cast Post-Tension Concrete	Concrete Geo-Piers and Slab	108 / 42	92	39.5	244,096	265,919

The digestate is then pumped to centrifuges to provide solids separation prior to further treatment. A polyelectrolyte preparator will feed and blend polymer with the digestate upstream of the Centrifuges to facilitate solids separation. Solids from the centrifuges will be conveyed and discharged into a storage bunker and either marketed as a soil amendment product or transported to the adjacent compost facility for further processing. Preliminary design data for the solid digestate is presented in Table 6.

Table 6 – Solid Digestate Handling Design Data

Dewatering System Component	Units	Unit Capacity	Type	Material	Performance	Motor HP
Feed Tank Separation	1					
Sludge Feed Pump	1	150 gpm @ 30' TDH	Progressing Cavity	Cast Iron		10
Solids Macerator	1	150 gpm	Inline	Mild Steel		3
Decanter Centrifuge	3	110 gpm / 4,018 lbs/hr	Hydraulic Backdrive	Stainless Steel	3000 G	60 HP scroll; 15 HP backdrive
Flat Collector Conveyor	1	2,275 dry lbs/hr	Screw Conveyor	Stainless Steel		15
Inclined Discharge Conveyor	2	2,275 dry lbs/hr	Screw Conveyor	Stainless Steel		15

Dewatering System Component	Units	Unit Capacity	Type	Material	Performance	Motor HP
Polymer Dosing System	1	1 - 10 gph	Neat Blending/Dosing Skid	Stainless Steel Skid / PVC Pipe	0.25 - 1% Solution	Fractional
Sludge Flow Meter	1	4 - 20 mA	Magnetic	Stainless Steel with EPDM Liner	n/a	n/a
Storage Bunker	1					

The liquid fraction (centrate) exiting the centrifuges will be sent to a buffering or equalization tank to ensure constant feed to the wastewater pretreatment system. From there most of the liquid will be pumped to the wastewater treatment equipment and a portion of the liquid will be pumped back to the digesters. Preliminary design data for the liquid digestate is presented in Table 7.

Table 7 – Liquids Digestate Handling Design Data

Equipment	Units	Unit Capacity (GPD)	Plan Area (ft^2)	SWD (ft)	Collector Type	Collector Motor HP	Mixing System
Buffering / Equalization Tank	2	80,000		12	Equalization Tank	2	80,000

3.3.4. Biogas Upgrading & Conditioning System

BioEnergy DevCo will ~~sell raw~~ ~~biogas to CUC who is~~ be responsible for treating the biogas to generate Renewable Natural Gas (RNG) and sell the RNG to an energy services provider who will pressurize and transport it as Compressed Natural Gas (CNG) for injection into the natural gas pipeline grid. A utility flare will be available to combust~~burn off~~ the gas in the event of equipment maintenance or excess RNG.

The project basis of design and mass balance shows that the BIC will generate up to approximately 1,6~~3~~00 scfm of biogas with approximately 62~~0~~% methane when fully built-out and at full production. The raw

biogas from the digesters will be boosted in pressure by a blower and pass through a biogas conditioning system. The conditioned biogas will then be upgraded to RNG. The preliminary design data for the filtration component of the biogas conditioning system is presented in Table 8.

Table 8 – Biogas ~~Upgrading and~~ Conditioning System Design Data

~~Equipment~~	~~Quantity (Number)~~	~~Material (Type)~~	~~Piping~~	~~Operating Temperature (Degrees F)~~	~~Operating Pressure (in. W.C.)~~	~~Design Influent Flow (scfm)~~	~~Chiller Outlet Dew Point (Degrees F)~~
~~Blower, Biogas Booster~~	~~1~~		~~Stainless Steel~~	~~60 – 80~~	~~Inlet: 0-10 Outlet: 138~~	~~475 – 950~~	~~65~~
~~H_2S Media Vessel~~	~~1~~	~~FRP~~					
~~Activated Carbon Vessel~~	~~1~~	~~FRP~~					
~~Particulate Filter~~	~~1~~						
~~Dehydration Chiller HX~~	~~1~~						

Equipment	Quantity (Number)	Manufacturer	Bed Cross-Sectional Area~~Dimensions~~	Bed Depth ~~Collector Motor HP~~	Pressure Drop Across Bed~~Mixing System~~
~~H2S removal vessels~~	~~2~~	~~Biospark~~			
H2S removal vessels	2	Biospark	63.6 sq. ft.	36.5 ft.	33 – 63 in. WC
Siloxane removal vessels	2	-	59 sq. ft.	12 ft.	40 – 60 in. WC
PSA vessels	3	Global Welding Services	1,520 sq. in.	78 in.	28 in. WC
Polishing filters	2	Global Welding Services	38.5 sq. ft.	19.4 ft.	16 – 30 in. WC

The conditioning and polishing skid will include a biogas booster to increase the raw biogas pressure followed by pre-conditioner to remove hydrogen sulfide (H2S) and moisture from the gas. A polishing step using carbon filter skids with a catalytic high capacity media removes siloxanes and VOCs.

Each system is designed with lead-lag vessels with each vessel capable of processing the full production of biogas. This allows for changeout of media while continuing to operate at full production. The media is periodically replaced and removed for landfill disposal. The design of the media vessels is such that this should only be necessary two times a year.

A feed gas compressor will be used to increase the biogas temperature and pressure followed by a series of disposable particulate filters to remove moisture and bacteria from the gas prior to treatment with the membrane separation system.

The membrane separation system will be the final step of the biogas upgrade system and will separate the carbon dioxide (CO_2) and other gases from the biogas using a membrane filtration system resulting in a near pure (97 to 98.5%) methane (CH_4) stream of renewable natural gas (RNG). The tailgas, or waste gas stream, will be routed to a thermal oxidizer. The membrane filters are disposable and will need to be changed once every 3 years. The filters will be disposed of at an appropriately permitted landfill.

3.3.5. Wastewater Pretreatment System

The on-site ~~WWTP~~ wastewater treatment plant will be a Membrane Bioreactor System (MBR) that will include ~~an Equalization Tank ,~~ a Bioreactor (Anoxic and Aerobic Zones), followed by Ultrafiltration (UF), ~~and~~ Reverse Osmosis (RO), Nanofiltration and Superconcentration RO systems. Two treatment trains are required for the Phase 2 flows of approximately 60,000 gallons/day, initially one treatment train will be installed with the Phase 1 AD system. A process flow diagram (PFD) for the proposed treatment process is shown on Appendix H. A mass balance for the wastewater system is shown on Appendix I.

Preliminary Treatment, Filtration and Screening

AD discharge is directed into an ~~The E~~equalization t~~T~~ank prior to coarse solids removal step using disc press equipment. ~~will allow the flexibility to operate the Centrifuges for 12 hours per day. The Equalization Tank will include mixing to keep particulate matter in solution.~~Separated solids are sent to the compost operation. Expected wastewater influent characteristics (after disc press) are as follows:

Parameter	Units	Value
TS	%	<2.5
TSS	%	<0.3
TDS	%	<2.0
pH	mg/l	7.0 - 8.0
Temperature MIN	°C	30.0
Temperature MAX	°C	40.0
Alkalinity	mg/l	15,000 - 25,000
Total Kjeldahl Nitrogen	mg/l	<3,150
Ammoniacal Nitrogen	mg/l	<2,550
Parameter	Units	Value
Total Phosphorus	mg/l	<680
BOD	mg/l	3,200 - 8,000
COD	mg/l	4,900 - 10,500
Arsenic	mg/l	0.038
Cadmium	mg/l	0.004
Copper	mg/l	1.145
Cyanide	mg/l	424
Lead	mg/l	0.05-10.0
Mercury	mg/l	--
Zinc	mg/l	3.888
Molybdenum	mg/l	--
Selenium	mg/l	--
Silver	mg/l	--

Disc pressate ~~Centrate~~ ~~from the Equalization Tank~~ will be pumped sequentially through ~~a~~ Drum Filters and Microscreens located near the MBR tanks.~~-~~ T~~T~~he ~~purpose of the~~ Drum Filters ~~is to~~ protect the Microscreens which ~~and the purpose of the Microscreen is to~~ protect the downstream ~~UF~~ membrane systems~~s~~. Both the Drum Filters~~r~~ and Microscreens are relatively robust systems. Outages for emergency repairs to these units are expected to be minimal and not require durations that would upset the downstream biological processes. ~~, including recycle to the digestion process.~~ Solids captured by the Drum Filters and Microscreens will be collected in portable containers and will be recycled to the ~~anaerobic digesters.~~ AD system.

Bioreactor

~~The equalized centrate~~Screened wastewater will flow by gravity ~~from the Microscreen~~ ~~into the~~ to the Bioreactor Anoxic Z~~z~~ones. ~~of the Bioreactor.~~ The anoxic ~~zone~~ environment functions as a zone with depleted oxygen levels to allow for denitrification of effluent recycled from the Aeration Zones.~~nitrates that are recycled back from the end of the subsequent~~

aerated zones. -The Anoxic Zones are will include mixing and is designed to function as a ccomplete ly mixed reactors with no supplemental oxygen provided. -Anoxic Zone effluent will flow by gravity to two parallel [SH1] to the Aerobic Zones where diffused air and supplemental carbon (depicted as "nutrient" on the PFD) will be added to provide nitrification of ammonia nitrogen first to nitrites and then to nitrates. The diffused air will prosystem will provide oxygen and vide required aeration for the treatment process and also provide the mixing energy needed for the both Aeration Zones to function as completely mixed reactors. SludgeWaste solids from the bioreactor will be routed back to the digesters.AD system. A UF Feed Wet Well Tank will be provided toat the effluent end of the Bioreactor Tank to collect and mix effluent from both Aeration Zones prior to pumping to the UF systems.. Antifoam and Recirculation Pumps will recycle nitrates fully nitrified wastewater from the UF Feed Well Tank back to the Anoxic Zones influent for denitrification. An antifoaming agent will be fed to pump discharge to combat foaming within the Bioreactor. In addition, heat exchangers will be provided to cool recycled wastewater during warm months to optimize the denitrification process.

Membrane Treatment

The UF systems will provideprovide membrane filtration of the BBioreactor effluent to remove additional contaminants. UF system is a physical filtration system and will remove suspended solids. The UF membranes have a mean pore size of 30 nanometers, therefore any constituent with a size greater than 30 nm will be removed. Finally, the effluent from UF effluent will be pumped to the UF Permeate tank and from there into the RO Systems. The RO system is a multi-concentration, triple pass system that will remove dissolved solids including metal ions and aqueous salts. The RO system includes a 5 nanometer filter as well as semipermeable membranes.The RO systems will remove any remaining contaminants and provide effluent quality designed to meet Sussex County or municipal WWTP pre Seaford treatment permit requirements. -RO permeate will be pumped to a holding tank prior to being loaded on trucks and eventually allowed to be discharged to the new pumping station. Expected effluent quality is as follows:

Parameter	Units	Value
Flow	Gallons per day	
TS	%	<0.03
TSS	%	0.0
pH	mg/l	6.5 - 8.5
Temperature MIN	°C	--
Temperature MAX	°C	42.0
N-t	mg/l	<40.0
N-NH_3	mg/l	<15.0
Total Phosphorus	mg/l	<6.0
BOD	mg/l	<30.0
COD	mg/l	<100.0
Arsenic	mg/l	<0.1016
Cadmium	mg/l	<0.0141
Chromium	mg/l	<2.1751
Copper	mg/l	<0.0299
Cyanide	mg/l	<0.7272
Lead	mg/l	<0.1631
Mercury	mg/l	<0.0396
Nickel	mg/l	<0.7998
Zinc	mg/l	<0.5693
Molybdenum	mg/l	<0.2173
Selenium	mg/l	<0.078
Silver	mg/l	<0.0263

Some ~~of the~~ RO permeate will be pumped back into the plant to be used as service water for ~~-~~clean-in-place systems of other equipment. The RO systems will also produce ~~a stream on concentrate which will contain~~a concentrated effluent stream (RO concentrate) containing all the contaminants removed from ~~the~~ UF ~~Effluent.~~Permeate. This waste stream is directed into the NF system which uses membranes having pore sizes of 0.002 to 0.005 microns to remove smaller contaminants. NF permeate is fed to an additional RO super concentration process. NF concentrate (approximately 3,200 gallons per day) will be sent to the composting system to be used moisture control and because it contains concentrated minerals. RO super ~~The~~ concentrate (approximately 5,800 gallons per day) will be trucked off site to a facility that accepts industrial wastewater.

Supplemental Chemical Additions

An antifoaming agent will be injected into the Anoxic Zone recirculation lines to combat foaming within the Bioreactor. ~~to a location permitted for treatment or disposal of this liquid.~~ The UF, NF and RO s~~S~~ystems ~~will~~ all include a clean-in-place ~~system~~ capabilities to allow periodic cleaning with an acid, a base, sodium hypochlorite (UF), and an antiscalant (RO) ~~to maintain required treatment levels~~. Biocide and an anticorrosive will be injected into wastewater recycled through the heat exchanger systems.

Tank and Equipment Specifications

-The preliminary design data for the wastewater ~~pretreatment is presented in Table 9.~~ treatment equipment is provided in Appendix I.

~~Table 9 – Wastewater Pretreatment Equipment Design Data~~

~~Treatment System Component~~	~~Units~~	~~Unit Capacity~~	~~Type~~	~~Material~~	~~Plan Area (ft^2)~~	~~Motor HP~~
~~Influent Screen~~	~~1~~	~~50 gpm~~	~~Rotary Drum~~	~~Stainless Steel~~		
~~Feed Pump to Aeration~~	~~2~~	~~50 gpm @ 20' TDH~~	~~Submersible~~	~~Cast Iron~~		
~~Anoxic Reactor Tank~~	~~1~~	~~283,192 gal~~	~~Flat Bottom~~	~~Concrete~~	~~20' x 61'~~	
~~Oxic Reactor Tank~~	~~2~~	~~309,609 gal~~	~~Flat Bottom~~	~~Concrete~~	~~30' x 53'~~	
~~Level Transmitter~~	~~1~~	~~0 – 30 ft~~	~~Hydrostatic~~	~~Stainless Steel~~	~~n/a~~	~~n/a~~
~~DO Probe~~	~~1~~	~~0 – 30 ft~~	~~Immersion Duty~~	~~Stainless Steel~~	~~n/a~~	~~n/a~~
~~DO Transmitter~~	~~1~~	~~4 – 20 mA~~			~~n/a~~	~~n/a~~
~~Aeration Blowers~~	~~2~~	~~2,600 cfm @ 10 psi~~	~~Positive Displacement~~	~~Cast Iron~~		~~125~~
~~Aeration Diffusers~~	~~1~~	~~2,600 cfm @ 9 psi~~	~~Jet nozzle~~	~~FRP~~	~~775 ft2~~	
~~Aeration Mixing Pump~~	~~1~~	~~9,500 gpm @ 50' TDH~~	~~End Suction Centrifugal~~	~~Cast Iron~~		~~60~~
~~Automatic Strainer~~	~~1~~	~~200 gpm~~	~~Basket~~	~~Stainless Steel~~		~~Fractional~~
~~MBR Permeate Pump~~	~~2~~	~~100 gpm @ 100 psi~~	~~End Suction Centrifugal~~	~~Cast Iron~~		~~50~~
~~pH Sensor~~	~~1~~	~~0 – 14~~				
~~pH Transmitter~~	~~1~~	~~4 – 20 mA~~				
~~Ultrafilter~~	~~1~~	~~76,000 gpd~~	~~Tubular Ultrafilter~~	~~PVDF~~	~~1,500 ft2~~	~~60~~
~~UF Permeate Pump~~	~~2~~	~~100 gpm @ 100 psi~~	~~End Suction Centrifugal~~	~~Cast Iron~~		~~50~~
~~Air Scour Blowers~~	~~2~~	~~1,000 cfm @ 10 psi~~	~~Positive Displacement~~	~~Cast Iron~~		~~100~~
~~Reverse Osmosis Filter~~	~~1~~	~~76,000 gpd~~	~~Tubular Reverse Osmosis Filter~~	~~PVDF~~	~~1,500 ft2~~	~~60~~
~~RO Permeate pump~~	~~2~~	~~100 gpm @ 100 psi~~	~~End Suction Centrifugal~~	~~Cast Iron~~		~~50~~

3.3.6. Odor Control Equipment

All the solid feedstock will be received in an enclosed process building with an air ventilation system that will provide and maintain a negative air

pressure inside the building at all times, especially in and around the Solids Receiving Area (i.e., the tipping floor for solid organic waste). The air ventilation system will prevent odors from escaping outside the process building. As the solid feedstock will be received by trucks, quick acting rollup doors will be utilized to minimize the amount of time these areas of the building are open when trucks are being received, unloading, or when they are exiting the process building. The rollup doors will remain in the closed position at all other times.

The air ventilation system design has accounted for the removal of odors from the building and elimination through the sufficient dilution of odors prior to being released into the surrounding environment. Design requirements for equipment include a proven history of eliminating odors with examples of similar applications along with other attributes such as reliability, operational and maintenance requirements, critical spare parts, required space, and both CapEx and OpEx costs. Filters and dilution exhaust fans are proven technologies that are currently being considered for use. The facility equipment that will have process odor control is mainly the feed-tank separators prior to the solid separation of digestate downstream of the digesters. This equipment will have process filters to eliminate odors. Filters will be changed according to the maintenance requirements for correct functioning of the system. Changes will be done with the use of all required Personal Protective Equipment. Used filters will be disposed of at an appropriately permitted facility. Based on experience with other facilities, emissions from the Solids Receiving area are not expected to trigger regulatory thresholds for control equipment. If, during commissioning, it is determined that emissions require controls, BDC will seek permitting for appropriate equipment.

3.3.7. Mechanical/Electrical/Plumbing

The main portion of the facility will not require heating or cooling systems. Only worker areas or areas where equipment requires climate control (ex. MCC) have control systems. The rest of the area will be ventilated with the air handling system described above.

The facility has plumbing systems for worker comfort and process needs. Potable water systems are protected from contamination by reduced pressure zone (RPZ) backflow preventer.

The electrical system is serviced by a number of transformers on site with more than sufficient capacity for the facility. The facility will also incorporate an emergency standby generator sufficient to support critical loads during a grid outage.

3.3.8. Nuisance Dust and Vector Management

The facility will implement a vector control plan to eliminate and/or minimize the potential for vectors. This approach will include a regular washing and cleaning schedule for the Solid Receiving Area tipping floor and other process equipment as necessary. Inbound and outbound vehicles will also be required to tarp their loads while outside of the process building area (i.e. the rolldown tops being maintained in the "down" position) to minimize odors, which can also attract vectors. Regular cleaning and vehicle tarping will also prevent dust from accumulating.

The vector control plan will also include measures for contracting with a local pest management service to perform regular inspections and baiting of the facility. Bait stations will be checked for activity and rebaited as necessary. In addition, site landscaping will be regularly maintained to prevent overgrowth of vegetation, which could otherwise provide cover and nest sites for vectors.

3.4. PROPOSED INSTALLATION METHODS AND PROCEDURES

In accordance with DRGSW, Part 4.4.1.4.4., the BIC AD Project will be managed by Bioenergy DevCo, and constructed by a General Contractor Construction Manager utilizing multiple specialty trade subcontractors.

The existing building formerly used as a pelletizing plant will be used as the primary process support building containing feedstock receiving, solids separation, wastewater treatment, electrical distribution, control room and other support facilities for the AD plant. The liquid waste receiving area is located just outside the Process building between the Process Building and the anaerobic digesters with drive up access for offloading tanker trucks utilizing a liquid unloading station.

The anaerobic digesters and pretanks will be constructed of pre-cast, post tensioned concrete that is assembled on site, on a cast in place concrete foundation.

Most of the remaining equipment will come in pre-fabricated skids installed in containers that are installed and set on new cast in place concrete foundations. Equipment is interconnected both mechanically and electrically utilizing above ground and below ground piping, conduits, raceways and cable trays by the specialty subcontractors.

3.5. QUALITY ASSURANCE

In accordance with DRGSW, Part 4.4.1.4.5., a plan for third party quality assurance for the construction and installation of components of the facility that will be used in the processing, handling, and/or monitoring of solid waste is as follows:

In addition to the Quality Assurance/Quality Control Plan to be managed by the General Contractor and Subcontractors, Barton and Loguidice as the Engineer of Record, Bioenergy DevCo and 3rd Party QA consultant per DRGSW will provide additional inspections, oversight, and testing of the installation methods and practices utilized by the General Contractor and Subcontractors for all aspects of the project inclusive of the solid waste receiving and handling area.

Integrated Project Delivery (IPD) will be the project delivery method. IPD is a collaborative alliance of companies, people, systems, business structures, and practices that harnesses the talents and insights of all participants to optimize project results, increase value to the Owner, reduce waste, and maximize efficiency through all phases of design, fabrication, construction, and into operation.

The key participants will include Owner (BDC), the Process Engineer (BTS), the Engineer of Record (B&L), and the General Contractor (S&T), along with other partners, consultants, vendors, and subject matter experts that will be brought in from time-to-time during the execution of the Project.

3.6. CONSTRUCTION SCHEDULE

In accordance with DRGSW, Part 4.4.1.4.6., a project milestone schedule is included under Appendix C, which presents estimated timelines for permits and approvals; engineering and design; long lead procurements; construction; commissioning and startup; and commercial operation.

3.7. DESIGN CAPACITY AND LIFE EXPECTANCY

In accordance with DRGSW, Part 4.4.1.4.7, a proposed design capacity per day and life expectancy of the facility shall be provided. Assuming proper maintenance, the site structures (buildings, tanks, digesters, pump houses, etc.) and utility infrastructure have an estimated useful life of 20 years. Processing equipment, depending on type and use, are expected to be refurbished or replaced as required and have an estimated useful life of 5-20 years. Rolling stock (i.e., front end loaders) have an estimated useful life of 5-8 years. Essential spare parts will be maintained on-site or scheduled for replacement at required intervals. For additional information, refer to the BIC Facility Plan of Operation that has been provided to DNREC under separate cover for the Resource Facility permit.

3.8. HAZARDS AND SAFETY

In accordance with DRGSW, Part 4.4.1.4.8, a comprehensive Site Safety Management Plan that complies with OSHA, Federal, State and Local codes and requirements and industry standards will provide the specific controls for each aspect of construction and installation of the AD Project. A construction activities site specific safety plan is provided in Appendix E. A safety manual for the

operations of the facility is also provided in Appendix F. The requirements and safe practices will be enforced by BDC, the General Contractor and Subcontractors at all times. The General Contractor will have a full-time employee acting as the Site Safety Representative that is a trained professional and will monitor, train, evaluate, inspect, enforce and report on the Safety Management Plan for the site construction activities. As standard practice, any employee or worker on site has "STOP" authority to stop the work if an unsafe practice is observed.

Compliance with environmental regulations and permits for the Facility is regarded as an important requirement for all employees at all levels. Compliance requirements will be routinely discussed in employee meetings, posted in process or related areas for ease of reference and reported in Facility reports at least monthly. Compliance auditing will be conducted at least annually each year of operation and more frequently when required to correct deficiencies.

3.9. FACILITY EXPANSION

In accordance with DRGSW, Part 4.4.1.4.9, an analysis of the concept for an expansion of the facility was performed. The BIC facility is being designed and permitted for its full operational capacity up to 250,000 tons per year.

The BIC facility consists of approximately 225 acres with the AD and Composting facilities operations co-located on the site. Sufficient space is available to expand both operations as may be needed to support the needs of Bioenergy DevCo or in response to requirements deemed necessary by DNREC.

3.10. GROUNDWATER AND SURFACE WATER DISCHARGES

In accordance with DRGSW, Part 4.4.1.4.10, a review of the BIC facility's operations was performed to identify possible groundwater and surface water discharges. This review identified the potential for discharges resulting from wastewater and stormwater generated from the facility's operations as described below:

~~Wastewater~~

~~Up to approximately 37.5 million gallons per year of process wastewater will be generated directly by the anaerobic digestion process and supporting facilities. Process wastewater will be collected and refined using an on-site pretreatment system. BDC is evaluating options for disposal of effluent from the pretreatment process based on water balance and discharge limits. Initially treated effluent will be hauled to a municipal or Sussex County wastewater facility under the county septage discharge program with long-term plans to connect via a force main to a municipal system. The closest systems to the site are the Town of Blades, City of Seaford and Town of Laurel. Discussions with all potential discharge locations~~

~~have occurred but agreements have not been reached as of the preparation of this document.~~

~~The wastewater makeup from the pretreatment facility is being finalized but is expected to be consistent with the characteristics of domestic wastewater. The total discharge from the pretreatment facility is estimated to be 30,000 gallons per day when the plant is fully built out with the remaining amount recycled back into the anaerobic digestion process. Discussions with various officials indicate that these totals are well within manageable limits for the town.~~

~~Furthermore, all processed wastewater, including b~~Building~~s~~ and equipment drains will be collected and ~~treated through an in-house~~sent to the ~~-~~waste~~water~~ treatment facility. ~~for discharge to the treatment system.~~

Sanitary wastewater at the facility is currently treated and discharged to an on-site sanitary wastewater treatment system.

Stormwater

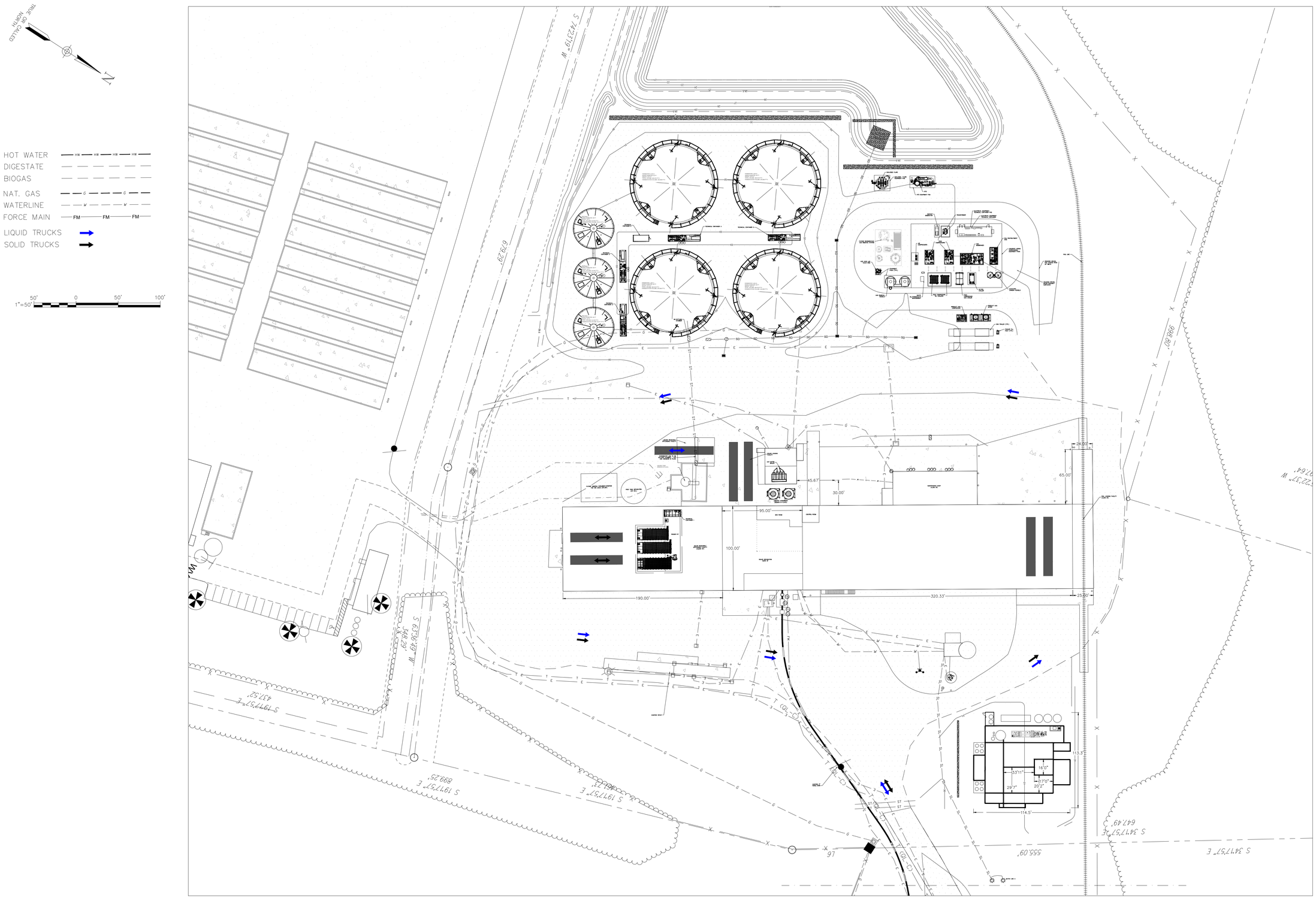
Surface Water Discharges – A NPDES general permit for industrial stormwater is in place for the facility and BDC has submitted a Notice of Intent to implement system enhancements. BDC has implemented plans previously developed by Perdue, through its consultant McCrone, and approved by DNREC to make modifications to the outlet structure of the stormwater facility that serves the composting operation. Aerators, per the approved plan, were installed in the stormwater pond to facilitate evaporation and enhance storage capacity with the goal of minimizing surface water discharges. The stormwater system has an outfall located on a prong of the Gum Branch tax ditch, a tributary of the Nanticoke River.

The stormwater facility that serves the former pelletizing plant will be redesigned and reconstructed to accommodate the construction of the proposed tank farm and process equipment associated with the anaerobic digester. The existing outfall from the stormwater pond will be utilized and will continue to discharge to Gum Branch tax ditch prong. The proposed stormwater management design will utilize one proposed wet extended detention pond facility and one existing wet extended detention pond facility to reduce peak runoff from the Site. A wet pond is proposed in lieu of infiltration and bioretention practices due to a high ground water table.

In accordance with the requirements of the Green Technology Best Management Practices (GTBMP) Design Manual, the wet pond facility was designed to provide 48 hours extended detention for the 1-year storm and to pass the 100-year storm. The wet pond facility was designed with a permanent pool depth of 5 feet.

APPENDIX A

PROPOSED FACILITY LAYOUT DRAWING



PLAN

SCALE: 1" = 50'

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REVISIONS

D	SITE UPDATES

BIOENERGY DEVCO – BIOENERGY INNOVATION CENTER
ANAEROBIC DIGESTION
AND BIOGAS IMPROVEMENTS

BIC CONCEPTUAL SITE PLAN

SEAFORD

SUSSEX COUNTY, DELAWARE

Barton & Loguidice

Date
MARCH 2021

Scale
AS SHOWN

Sheet Number
BIC-0000-C-1

File Number
2163.001.001

APPENDIX B

MASS AND ENERGY BALANCE REPORTS

5. Mass balance

18.05.2020

Solid input	t/d	t/a	DM [%]
Manure	74,6	27.223	68,0
Coferments	272,2	99.343	18,9
Total	346,8	126.566	29,4

Liquid input	t/d	t/a	DM [%]
Coferments	263,8	96.291	5,3
Water(recycle RO permeate)	10,0	3.650	0,1
Total	273,8	99.941	5,1

Biogas plant

856,6 t/d
312.647 t/a
14,2 DM [%]

Reduction of the volume

66 t/d
24.180 t/a

Production of methane

1.290 Nm³/h
30.962 Nm³/d

HRT: 31,6 [d]

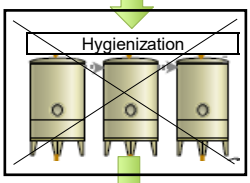
Digester net volume: 27.093 [m³]

Output biogas plant

791,3 t/d	9,3 N kg/t	2.686 N t/a
288.832 t/a	4,8 P kg/t	1.373 P t/a
8,9 DM [%]	3,1 K kg/t	902 K t/a

Recycle

237,0 t/d
86.505 t/a
2,6 DM [%]



N/A on this project

Input separation

791,3 t/d	9,3 N kg/t	2.686 N t/a
288.831,6 t/a	4,8 P kg/t	1.373 P t/a
8,9 DM [%]	3,1 K kg/t	902 K t/a

Separation

Solid fraction

102,6 t/d	14,3 N kg/t	537 N t/a
37.434 t/a	8,2 P kg/t	305 P t/a
23,0 DM [%]	3,7 K kg/t	140 K t/a

Liquid fraction

688,3 t/d	8,6 N kg/t	2.149 N t/a
251.235 t/a	4,2 P kg/t	1.068 P t/a
6,8 DM [%]	3,0 K kg/t	762 K t/a

Revision: 1907_002 Blades - BIC Project FS Rev.J (Phase 2 with only 30kt PL).xlsm

Polyelectrolyte solution	t/d	t/a	DM [%]
Polyelectrolyte	0,44	159,27	100
Water	86,84	31679,98	0,1
Total	87,27214	31839,25	0,50024

Input separation 2

775,5 t/d	5,8 N kg/t	1.908 N t/a
283.074 t/a	3,8 P kg/t	1.068 P t/a
6,1 DM [%]	2,7 K kg/t	762 K t/a

Separation 2

Solid fraction 2

133,3 t/d	12,1 N kg/t	590 N t/a
48.643 t/a	17,6 P kg/t	854 P t/a
23,0 DM [%]	3,5 K kg/t	168 K t/a

Liquid fraction 2

642,3 t/d	5,6 N kg/t	1.320 N t/a
234.431 t/a	0,9 P kg/t	214 P t/a
2,6 DM [%]	2,5 K kg/t	595 K t/a

Flow to onsite WWTP inlet

Input Nitrostripp

641,8 t/d	5,6 N kg/t	1.320 N t/a
234.431 t/a	4,2 P kg/t	214 P t/a
2,6 DM [%]	3,0 K kg/t	595 K t/a

Water	Sulphuric acid
24,6 t/d	7.479,7 kg/g
8982 t/a	2.729 t/a

N/A on this project

NITROstripp

Ammonium sulphate solution

32,13 t/d	819 N t/a
11.711 t/a	70,0 N kg/t

Output Nitrostripp

641,8 t/d	2,1 N kg/t	500 N t/a
234.431 t/a	4,2 P kg/t	214 P t/a
2,6 DM [%]	3,0 K kg/t	595 K t/a

Input bioreactor

406,3 t/d	COD
148.291 t/a	> 9.000 mg/L
2,6 DM [%]	<25.000 mg/L
2,0 DMs [%]	
0,7 DMv [%]	

Recycle from Bioreactor

113,8 t/d
41.522 t/a
0,5 DM [%]

Bioreattore Den/OX

Please refer to WWTP information for PFD/mass balance of effluent treatment

METAN economic

BTS TS energy GROUP

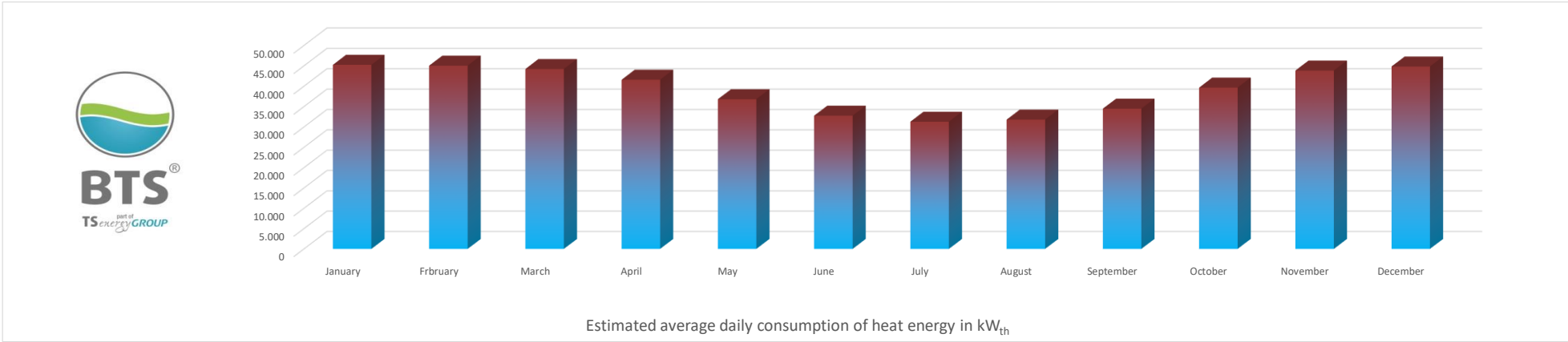
Calculation of the thermal own consumption of the biogas plant

The calculation for the estimated thermal consumation is based on the avarage temperatures recorded on the weather station of:

Blades (Delaware, USA)

	January	Frbruary	March	April	May	June	July	August	September	October	November	December	TOTAL year	Unit
Temperature in the fermenter/postfermenter	42	42	42	42	42	42	42	42	42	42	42	42	-	[°C]
Average ambient temperature	1,4	2,5	6,8	12,0	17,4	22,0	24,6	23,7	20,1	14,2	8,8	3,5	-	[°C]
Necessary thermal energy for the substrates in the input	667.524	602.925	667.524	596.438	499.878	388.641	370.853	381.495	428.960	569.316	645.991	667.524	6.487.067	[kWh_{th}]
Heat loss in the tanks	237.624	208.820	206.058	169.994	143.802	113.141	101.714	106.975	124.172	162.800	187.814	225.056	1.987.968	[kWh_{th}]
Produced process heat in the tanks	76.532	69.125	76.532	74.063	76.532	74.063	76.532	76.532	74.063	76.532	74.063	76.532	901.099	[kWh_{th}]
Other thermal energy sources	0	0	0	0	0	0	0	0	0	0	0	0	0	[kWh_{th}]
Additional process heat for hygienization and Nitrostripp	573.826	518.294	573.826	555.315	573.826	555.315	573.826	573.826	555.315	573.826	555.315	573.826	6.756.333	[kWh_{th}]
Estimated annual consumption of heat energy	**1.402.441**	**1.260.913**	**1.370.875**	**1.247.685**	**1.140.973**	**983.034**	**969.860**	**985.763**	**1.034.384**	**1.229.410**	**1.315.056**	**1.389.873**	**14.330.270**	**[kWh_{th}]**
Estimated average daily consumption of heat energy	**45.240**	**45.033**	**44.222**	**41.589**	**36.806**	**32.768**	**31.286**	**31.799**	**34.479**	**39.658**	**43.835**	**44.835**	**-**	**[kWh_{th}]**

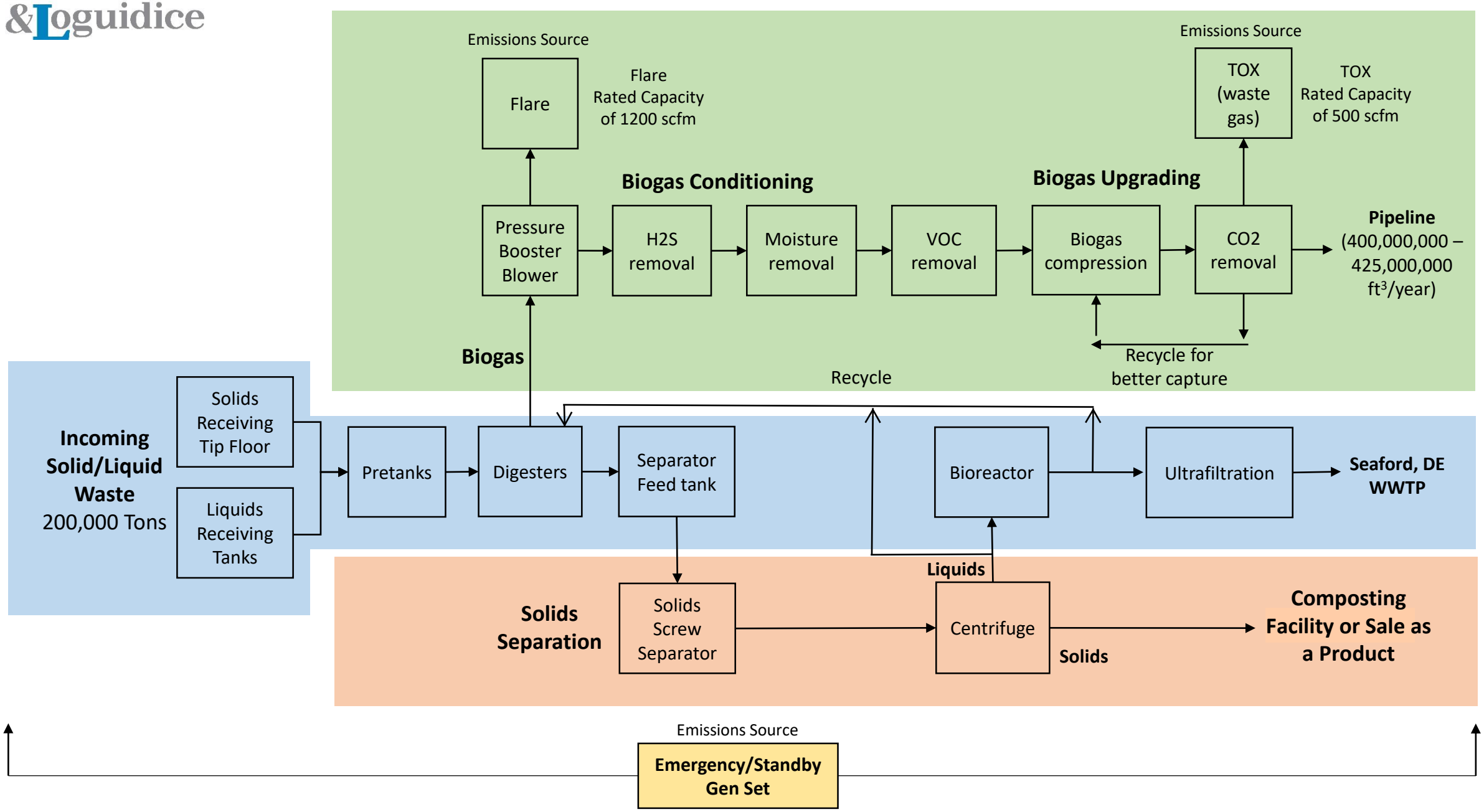
Max. thermal energy consumation	1.885	[kWh_{th}]
Average thermal energy consumation	1.636	[kWh_{th}]
Necessary installed thermal power of the CHP and/or Boiler (with 20 % safety margin)	2.262	[kWh_{th}]



APPENDIX C

SIMPLIFIED PROCESS FLOW DIAGRAM

Bioenergy Innovation Center – Process Flow Diagram



APPENDIX D

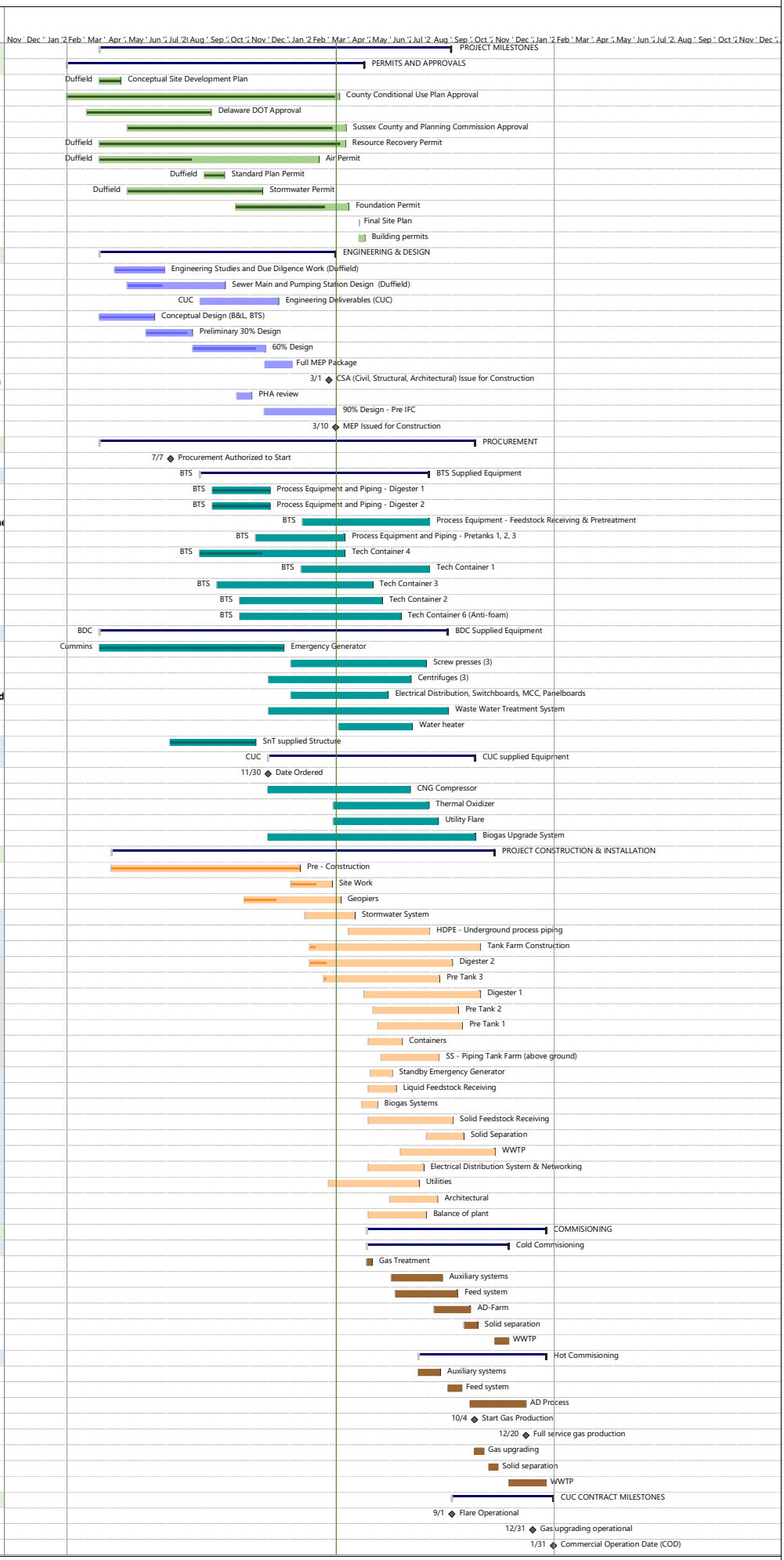
PROJECT MILESTONE SCHEDULE

BIOENERGY DEVCO

BIC SCHEDULE

March 12, 2021

ID	X	P	Task Name
1			**PROJECT MILESTONES**
26			**PERMITS AND APPROVALS**
27			**Conceptual Site Development Plan**
31			**County Conditional Use Plan Approval**
37			**Delaware DOT Approval**
49			**Sussex County and Planning Commission Approval**
65			**Resource Recovery Permit**
75			**Air Permit**
82			**Standard Plan Permit**
85			**Stormwater Permit**
94			**Foundation Permit**
98			Final Site Plan
99			**Building permits**
101			**ENGINEERING & DESIGN**
102			**Engineering Studies and Due Dilgence Work (Duffield)**
106			**Sewer Main and Pumping Station Design (Duffield)**
116			**Engineering Deliverables (CUC)**
126			**Conceptual Design (B&L, BTS)**
134			**Preliminary 30% Design**
144			**60% Design**
147			Full MEP Package
148			CSA (Civil, Structural, Architectural) Issue for Construction
149			**PHA review**
154			**90% Design - Pre IFC**
158			MEP Issued for Construction
159			**PROCUREMENT**
160			Procurement Authorized to Start
161			**BTS Supplied Equipment**
162			**Process Equipment and Piping - Digester 1**
167			**Process Equipment and Piping - Digester 2**
172			**Process Equipment - Feedstock Receiving & Pretreatme**
178			**Process Equipment and Piping - Pretanks 1, 2, 3**
183			**Tech Container 4**
188			**Tech Container 1**
193			**Tech Container 3**
198			**Tech Container 2**
203			**Tech Container 6 (Anti-foam)**
208			**BDC Supplied Equipment**
209			**Emergency Generator**
214			**Screw presses (3)**
219			**Centrifuges (3)**
224			**Electrical Distribution, Switchboards, MCC, Panelboard**
229			**Waste Water Treatment System**
234			**Water heater**
240			**SnT supplied Structure**
248			**CUC supplied Equipment**
249			Date Ordered
250			**CNG Compressor**
253			**Thermal Oxidizer**
256			**Utility Flare**
259			**Biogas Upgrade System**
262			**PROJECT CONSTRUCTION & INSTALLATION**
263	x		**Pre - Construction**
268	x		**Site Work**
273	x		**Geopiers**
276	x		**Stormwater System**
280	x		**HDPE - Underground process piping**
305			**Tank Farm Construction**
306	x		**Digester 2**
337			**Pre Tank 3**
369			**Digester 1**
400			**Pre Tank 2**
432			**Pre Tank 1**
464			**Containers**
480			**SS - Piping Tank Farm (above ground)**
488	x		**Standby Emergency Generator**
492	x		**Liquid Feedstock Receiving**
497	x		**Biogas Systems**
502	x		**Solid Feedstock Receiving**
519	x		**Solid Separation**
525			**WWTP**
529			**Electrical Distribution System & Networking**
551			**Utilities**
555			**Architectural**
568			**Balance of plant**
571			**COMMISIONING**
572			**Cold Commisioning**
573			**Gas Treatment**
575			**Auxiliary systems**
584			**Feed system**
588			**AD-Farm**
594			**Solid separation**
598			WWTP
599			**Hot Commisioning**
600			**Auxiliary systems**
605			Feed system
606			AD Process
607			Start Gas Production
608			Full service gas production
609			Gas upgrading
610			Solid separation
611			WWTP
612			**CUC CONTRACT MILESTONES**
613			Flare Operational
614			Gas upgrading operational
615			Commercial Operation Date (COD)



APPENDIX E

CONSTRUCTION SAFETY

SITE SPECIFIC SAFETY PLAN

Bioenergy Innovation Center - BIC

Project #20-0031

28338 Enviro Way Seaford, DE 19973

PURPOSE:
To establish uniform safety guidelines for contractors who perform services or work on construction sites of Stewart & Tate Construction. Additional information can be found in Stewart & Tate, Inc. Employee Safety Manual, attached herein,

SCOPE:
All subcontractors, suppliers or service employees contracted by Stewart & Tate Construction

GENERAL POLICY:
It is the policy of Stewart & Tate Construction to provide a safe and healthy environment for their employees, visitors, and outside contractors. In keeping with this commitment, we insist that employees of contractors doing work in the same environment as the employees of Stewart & Tate Construction be required to abide by the same Safety and Health Regulations. *See Exhibit E-1 for COVID-19 Safety Procedures.*

Subcontractors, suppliers, vendors, service companies, etc. will be expected to require their employees to follow the safety and health regulations of Stewart & Tate Construction, The Client, and statutory requirements while under the jurisdiction of said construction site or buildings.

Subcontractor and its lower-tier Subcontractors are responsible for the enforcement of their individual safety and health programs, regardless of Stewart & Tate Construction's Safety Department that oversees safety on the project site. Subcontractor shall ensure that these safety and health requirements are passed on to its Subcontractors.

Subcontractor is responsible for the implementation of all applicable governmental federal, state and local regulations as they apply to the scope of work and the project. Subcontractor is responsible for assuring that project supervisors and/or foremen are trained in safety procedures and that designated "Competent Persons" meet all training and experience requirements necessary to comply with OSHA directives.

CRANES AND RIGGING

Cranes

All crane and hoisting operations, including rigging, must be completed in accordance with 29 CFR 1926 Subpart CC and Subpart H.

- All lift service cranes shall have anti-two block devices and load moment indicators (LMI)

installed and functioning properly at all times during operations.

- All hoisting classified as a “Critical Lift” requires additional planning and must be reviewed by the project team. A critical lift is defined as a lift that exceeds 75% of the rated capacity of the crane, multiple crane picks and/or high-risk lifts. A minimum lift plan must include:
    - Completed Critical Lift form or equivalent;
    - Load analysis;
    - Lifting procedures;
    - Rigging analysis.
- A third party inspection is required for all cranes on an annual basis.
- Crane Checklist must be completed by a competent person on a daily basis and prior to operating a mobile crane at the project.
- The subcontractor in charge of the crane shall ensure that a crane lift plan is completed.
- The following are additional items regarding crane use, but not limited to:
    - The swing radius of the crane must be barricaded or otherwise guarded;
    - Only one person is to signal the crane operator at a time (hand signals, radio, hard line, etc.);
    - Subcontractor is responsible for submitting proof of training to Stewart & Tate for qualified rigger(s), signal person(s) and crane operator(s).

Rigging and material handling

- Each subcontractor is responsible for complying with rigging requirements set forth by OSHA, ASME and rigging manufacturers’. Rigging equipment should never be used beyond its rated capacity.
- Rigging shall be inspected prior to use and as necessary throughout the course of the day by the subcontractor’s Qualified Rigger. If any rigging is found to be damaged, it shall be removed from service immediately.

Drug and Alcohol Policy

Stewart & Tate Construction requires everyone to report to work in a condition that will allow them to be physically and mentally alert and enable them to perform their job safely. Stewart & Tate Construction prohibits the use, transfer, distribution, manufacture or possession of alcohol, controlled substances, unauthorized drugs, intoxicants, drug paraphernalia or any combination thereof on any work site, including private vehicles parked on work sites.

Electrical Safety

All cords and power tools must be plugged into a GFCI. All power tools must be double insulated or have a ground prong. All extension cords must have a grounding prong. Extension and power tool cords must be free of cuts and slices and shall not have any exposed wires.

Equipment and Vehicle Safety

All operators must be trained and certified to operate equipment. If it has a seatbelt, wear it! Riding on equipment or vehicles is only allowed where seats are provided with seatbelts. Always used three points of contact when getting in or out of equipment.

Excavations and Trenches

A competent person must inspect the excavation and surrounding areas on a daily basis for possible cave-ins, failure of protective systems, hazardous atmospheres, equipment, and other conditions. Employees shall not work in trench during excavation. Employees shall not work in trench 5 feet or more

in depth without adequate protection such as shoring, sloping, or benching. A ladder must be provided when a trench is 4 feet or more in depth and every 25 feet. Ladder must be 36" past landing surface.

Fall Protection

Fall protection shall be required and used 100% at all times in all areas where personnel may fall 6 feet or more to a lower level. Protection shall include one of the following: a guardrail system, a safety net, warning line systems, or personal fall arrest system. Except for roofing company personnel, where roofs with a width or length less than 50 feet, a monitor system or personal fall arrest system shall be used, or roofs over 50 feet, a warning line system shall be used unless personnel work outside the warning line, then they must be provided with a monitor or personal fall arrest system. When using a boom lift, you must be tied off. On any lift, you must remain on the platform of the lift. Do not climb or step on any rails. Fall protection during steel erection (see Steel Erection section).

Any defective items covered within the topics listed above shall be removed from site immediately.

Fire Protection

Fire extinguishers must be inspected monthly. Employees must have a fire extinguisher available near the area of hot work being conducted. When the welding, cutting or heating operation is such that normal fire prevention precautions are not sufficient, a fire watch shall be posted while the actual hot work is being conducted and for a 30 minute period afterward to ensure no possibility of fire exists.

Hand and Power Tools

All tools, whether personal or company owned, must be kept in good working order and safe condition. Power tools equipped with guards must only be used with the guards in place. Appropriate personal protective equipment must be used when using power tools. Any tools found to be defective must be removed from service immediately. At no time shall an employee intentionally by-pass a safety feature manufactured into a tool.

Hazard Communication

To ensure that information about the dangers of all hazardous chemicals and materials used throughout the jobsite is known by all affected employees, each contractor bringing chemicals on-site must be able to (upon request) provide the Job Superintendent with the appropriate hazard information on these substances, including the MSDS, the labels used and the precautionary measures to be taken in working with these chemicals. All containers must be labeled as to what they contain.

Housekeeping

It shall be the responsibility of Subcontractor to clean up after themselves daily to prevent unsafe conditions on the jobsite. Poor housekeeping presents fire hazards, slips, trips and falls, and other unsafe conditions. It also presents a negative image of your company to the passing public.

Injury Reporting and Unsafe Conditions

Any injury that requires medical attention must be reported to the job superintendent. If at any time you feel there is an unsafe condition, please report it to the superintendent so that it can be taken care of as soon as possible.

Inspections

Subcontractor shall prohibit the use of unsafe machinery, tools, materials, or equipment and shall conduct pre-job and as-required inspections in accordance with manufacturer's recommendations and

appropriate regulations. All equipment, tools, and appliances shall be used according to manufacturer specifications. Modifications or alternative uses must be approved by the manufacturer prior to planned use. Stewart & Tate Construction will perform periodic safety inspections of Subcontractor's work. Subcontractor shall take prompt action to correct all identified deficiencies as noted by Stewart & Tate Construction's Safety Department during these inspections. Such inspections and identification of deficiencies by Stewart & Tate Construction does not relieve Subcontractor from its responsibility to comply with all applicable safety regulations and rules.

Ladder Safety

Extension ladders must be extended 3 feet above the platform/floor/roof and must be secured in some way so that it cannot fall away from its point of contact. They must also have both feet attached. Step ladders shall be used only when the braces are in a locked position. Do not work off a step ladder that is leaning against a wall or point of contact. Step ladders are not meant to be straddled or to stand on the top two steps. Always use three points of contact when climbing up and down the ladder.

Any defective items covered within the topics listed above shall be removed from site immediately.

Lockout/Tagout

Only trained and authorized employees may perform lock and tag procedures. Never remove another persons lock or tag. Always communicate to the affected employees (employees working in surrounding area and/or the operator of the equipment locked/tagged) when locking/tagging out equipment and when restoring power to equipment.

Personal Protective Equipment

Subcontractor will provide, at its own expense, all required personal protective equipment for its employees and all required safety equipment and supplies as needed. Subcontractor is required to ensure that employees are wearing appropriate personal protective equipment as specified in applicable OSHA regulatory standards. In accordance with OSHA standards, all employees of Subcontractor shall be required to wear personal protective equipment during working hours and on the project premises including:

Hard Hats

Due to the dangers of head injuries on the jobsite, hardhats shall be worn at all times from start-up until finish or job completion.

Eye Protection

Due to continued changes throughout the jobsite, and the dangers of airborne debris, eye protection must be worn when working with or around flying debris (grinding, chipping, cutting, etc.), and splash hazards from harmful liquids. This includes safety glasses and or face shields and goggles.

Hearing Protection

Hearing protection is not mandatory, however, it is recommended when working with or around noises that exceed 85 decibels.

Clothing

The following minimum dress requirements have been established as a guideline for Subcontractor and its employees. It is the responsibility of Subcontractor to ensure that their employees conform to these guidelines acceptable to Stewart & Tate Construction:

A. All employees are required to wear construction-type safety boots that cover the ankle. Tennis or canvas shoes, sandals, shoes with open toes or heels, or shoes with narrow high heels are not allowed to be worn on the jobsite. Subcontractor will be responsible for assuring that required foot protection is worn in designated work areas.
B. Tank tops, net shirts, cut-off shirts, sleeveless shirts, and so forth, are not permitted to be worn. As a minimum, employees are required to wear a shirt or top that is comparable to a T-shirt. As a minimum, shirts must have a neck collar and a sleeve that covers the ball of the shoulder in the same manner as a T-shirt.
C. Pants must be full length. Cut-offs, shorts, and other such apparel are not permitted.
D. Clothing must not hang loose to the point where it may be caught in moving machinery, or snag onto dangerous objects.

Any defective items covered within the topics listed above shall be removed from site immediately

Personnel Lifts

Boom Lifts – You must be harnessed and tied off. You must stand on the platform. Do not climb on the rails or stand on anything other than the platform.
Scissors Lifts – All safety chains or gates must be in place while in use. You must stand on the platform. Do not climb on the rails or stand on anything other than the platform.

Scaffolding Safety

Scaffolding shall be erected, dismantled, and altered under the supervision of a competent person. They shall not be leveled with unstable objects such as buckets, barrels, concrete blocks, bricks, or small scrap pieces of wood. The scaffolding system shall have a safe means of access (ladder or stairs). Cross braces cannot be used as a ladder. Planks shall be cleated underneath to prevent sliding. A fall protection system is required at 10 feet or greater above the ground. The working platform must be fully decked. Mobile scaffolds must lock the wheels when occupied.

Respirable Crystalline Silica Safety

Crystalline Silica can be readily found on many job sites in rocks as well as many concrete and masonry products. Crystalline Silica can be released in the air when employees are performing such tasks as:

a. Chipping, hammering, drilling, crushing, or hauling rock.
b. Abrasive blasting.
c. Sawing, hammering, drilling, or sweeping concrete or masonry.

Unprotected respiratory exposure to crystalline silica may cause a lung disease called silicosis.

Because of the chronic (long term) nature of these hazards, detrimental health effects due to exposure would not be immediately noticed.

- Subcontractors are to comply with OSHA's Respirable Crystalline Silica 1926.1153.
- Subcontractors are responsible to submit Exposure Control Plans prior to conducting any work.
- The subcontractor's competent person on site will prevent exposures to these materials.

Steel Erection

Erectors who are on a walking/working surface with an unprotected edge more than 15 feet above a lower level must be protected by conventional fall protection system approved by OSHA. Perimeter safety cables must be installed at the final interior and exterior perimeters of multi-story structures as soon as the decking has been installed. Connectors and employees working in controlled decking zones must be protected from fall hazards by conventional fall protection when working on a surface with an unprotected edge more than two stories or 30 feet above a lower level; and have completed the connector training as required by OSHA. While working at heights over 15 and up to 30 feet, connectors must be provided with a complete personal fall arrest system or other allowable fall protection, and wear the equipment necessary for tying off.

Any defective items covered within the topics listed above shall be removed from site immediately

Steel Erection (continued)

A Controlled Decking Zone (CDZ) can be established as a substitute for fall protection where metal decking is initially being installed and forms the leading edge of a work area over 15 and up to 30 feet above a lower level. Leading-edge workers in a CDZ are required to be protected from fall hazards above 2 stories or 30 feet (whichever is less), and have completed CDZ training in accordance OSHA standards. Employees who are not engaged in leading-edge work and properly trained in the hazards involved are prohibited from entering the CDZ. The CDZ is required to be no more than 90 feet wide and 90 feet deep from any leading edge; not exceed 3,000 square feet of unsecured decking; and have designated and clearly marked boundaries with control lines or the equivalent. It must also have safety deck attachments placed from the leading edge back to the control line, and have at least two safety deck attachments for each metal decking panel. Lastly, final deck attachments and the installation of shear connectors are prohibited from being done in the CDZ.

Welding Safety

Health hazards from welding, cutting, and brazing operations include exposures to metal fumes and to ultraviolet (UV) radiation. Safety hazards from these operations include burns, eye damage, electrical shock, cuts, and crushed toes and fingers. These can be controlled with proper work practices and personal protective equipment such as welding helmets, gloves, jackets, etc. which is required by Stewart & Tate Construction. Cylinders must be stored and secured according to OSHA standard (stored upright, valve caps on, etc.). A hot work permit is required in operations involving heat, flame, or spark when the degree of a fire hazard is above normal due to the possible presence of flammable liquids, vapors, gases, and combustible materials. The permit shall be filled out prior to starting any hot work and then signed when the hot work is completed. When the welding, cutting or heating operation is such that normal fire prevention precautions are not sufficient, a fire watch shall be posted while the actual hot work is being conducted and for a 30 minute period afterward to ensure no possibility of fire exists. The fire watch must be aware of any anticipated fire hazards and how the fire fighting equipment operates. At no time shall the fire watch leave the area or work on something else in the area at the same time.

Any defective items covered within the topics listed above shall be removed from site immediately.

Subcontractor Enforcement Policy

Subcontractor is responsible for promptly correcting all violations of safety and health standards, potential hazards, and other such safety related problems within their area of responsibility. In the event an apparent violation is observed by Stewart & Tate Construction, Subcontractor will be notified.

If Stewart & Tate Construction notifies Subcontractor of any non-compliance with the provisions of Stewart & Tate Construction's Safety and Health Program, Client, or statutory requirements, Subcontractor shall take prompt action and make all reasonable efforts to correct the unsafe or unhealthy condition(s) or act(s). Satisfactory compliance shall be made within a reasonable, specified time. If Subcontractor refuses to correct unsafe/unhealthy conditions or acts; or fails to abide by the aforementioned safety requirements, Stewart & Tate Construction will initiate appropriate actions and may take one or more of the following:

A. Cease the operation or a portion thereof (particularly in the case of an imminent danger).
B. Correct the situation and back charge Subcontractor.
C. Stop or hold up payment for the work being performed.
D. Issue subcontract monetary penalties (See Attachment A)
E. Terminate the subcontract.

Safety is a priority at Stewart & Tate Construction and is everyone's responsibility. Your cooperation is greatly appreciated.

Andrew Yeager
Director of Safety
Stewart & Tate Construction

(ATTACHMENT A)

Safety Violation Monetary Enforcement Policy

The following steps shall be taken to ensure Subcontractors adhere to Stewart & Tate Construction's safety rules on each project.

1st Offense – Verbal Warning to Subcontractor

2nd Offense – $500.00 Penalty to Subcontractor

3rd Offense – $1,000.00 Penalty to Subcontractor

4th Offense – $2,000.00 Penalty to Subcontractor

5th Offense - Formal meeting with Subcontractor and Stewart & Tate Construction

Violations

Drug and Alcohol	Electrical Safety
Equipment and Vehicle Safety	Excavation and Trenching Safety
Fall Protection	Fire Protection
Hand and Power Tool Safety	Hazard Communication
Housekeeping	Ladder Safety
Lockout/Tagout	Personal Protective Equipment
Personnel Lifts	Scaffolding
Steel Erection	Welding, Cutting, & Brazing Safety

Stewart & Tate Construction
950 smile way
York, Pennsylvania 17404

Contractor Safety Violation Report

Safety Department

Date:				
Project Number: 19-0042 / Maryland food Center Authority				
Contractor Name: Dutchland, Inc.				
Employee Name:				
Violation				
	1st Offense - Verbal			4th Offense - $2,000
	2nd Offense - $500			5th Offense - Meeting
	3rd Offense - $1,000			OTHER
	Drug & Alcohol			**Electrical Safety**
	Equipment & Vehicle Safety			**Excavation & Trenching**
	Fall Protection			**Fire Protection**
	Hand & Power Tool			**Hazard Communication**
	Housekeeping			**Ladder Safety**
	Lockout / Tagout			**Personal Protective Equipment**
	Personnel Lifts			**Scaffolding Safety**
	Steel Erection			**Welding, Cutting, & Brazing**
Detailed Notes:				
Employee Signature:				

Stewart & Tate Construction
Safety
DEPARTMENT
(717) 771-3506

Stewart & Tate, Inc.
Employee Safety Manual

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Safety Statement

Safety is our first priority at Stewart and Tate Inc. There is no job, no task, and no risk worth jeopardizing the health of any employee. Our company has a responsibility and an obligation to every employee to provide a work environment that is, at all times, safe and healthy.

Our goal is to eliminate all job-related accidents and injuries. This goal can be accomplished with the care and cooperation of all of us, every day. We must all do our share to keep safe working conditions our number one priority. Each of you must accept the responsibility for conducting yourselves in the safest manner possible whenever you are at work.

First, you must know all safety rules for the job you are performing. Second, apply common sense in everything you do, even if it isn't covered in the Safety manual. Third, if it is not covered in the manual, bring it to someone's attention so that it can be addressed.

Your participation, support, care, and efforts will make Stewart & Tate, Inc. a safe and healthy place to work.

_____

Timothy R. Tate, P.E.
President

Safety Introduction and Training Program

All new employees will be trained on the safety manual along with related topics. Stewart & Tate, Inc. employees will receive proper OSHA and/or MSHA standards training. Employees will participate in monthly safety meetings and specific safety training. The Safety Manager will schedule, conduct, and keep track of all safety training records for employees. The company also has available, OSHA Construction Regulation manuals as well as other safety publications, videos, and DVD's.

The safety-training program is designed to assure that all employees are given information so that they can work in a safe, professional manner, as well as keeping their coworkers and customers safe.

Management conducts a yearly review of the Stewart & Tate, Inc. Safety program. The President of Stewart & Tate, Inc must approve all revisions and changes to the safety procedure.

At Stewart & Tate, Inc. Safety is first.

Disciplinary Policy

The purpose of this policy to provide all employees of S&T with a general standard of expected conduct for those employees whose behavior is deemed detrimental to the Company. The policy provides the framework in which to treat all employees in a fair and equitable manner.

To ensure orderly operations and provide the best possible work environment, S&T expects employees to follow rules of conduct that will protect the interests and safety of all employees and the organization.

It is not possible to list all the forms of behavior that are considered unacceptable in the work place. The following are examples of infractions of rules of conduct that may result in disciplinary action, up to and including termination of employment.

Unacceptable Conduct

Some examples of behavior that constitute unacceptable conduct, which may lead to disciplinary action up to and including termination of employment may include:

- Willful violation of safety or security rules.
- Gross negligence that endangers the life or safety or another person.
- Being intoxicated or under the influence of a controlled substance or illegal drugs while at work.
- Use, possession or sale of controlled substance drugs or intoxicants in any quantity while on Company property, work site, or customer location, except medications prescribed by a physician which do not impair performance.
- Unauthorized possession of firearms, weapons or explosives on Company property.
- Engaging in criminal conduct or acts of violence, making threats of violence toward anyone on Company property, work site, or customer location, or when representing S&T
- Fighting, horseplay, or provoking a fight on Company property, work site, or customer location, or negligent damage to property.
- Insubordination or refusing to obey instructions issued by a manager or Supervisor/Foreman.
- Reasonable stops in a loaded or unloaded vehicle must be authorized by S&T management. Abuse of this provision will result in the progressive disciplinary steps.
- Damage to truck/equipment or damage caused by trucks/equipment.
- Violation of safety, production, or other operating rules.
- Failure to report any accident immediately to a manager or supervisor/foreman.
- Rudeness to customers.
- Threatening, intimidating, coercing, or harassing fellow employees.

- Engaging in acts of sabotage willfully, or by gross negligence causing destruction or damage to Company property or the property of fellow employees, customers, suppliers, or visitors in any manner.
- Defacing Company property or a customer's product.
- Theft of Company assets, property, customer's product, or the property of fellow employees. The unauthorized possession or removal of any product, Company property, including documents from the premises (including dumpsters) without prior permission from management. The unauthorized use of Company equipment or property for personal reasons.
- Dishonesty and/or willful falsification or misrepresentation on your application for employment or other work records; lying about sick or personal leave; falsifying reason(s) for a leave of absence or other data requested by the Company; alteration of Company records or other Company documents.
- Providing confidential or proprietary information to competitors or other organizations or to unauthorized S&T employees; breach of confidentiality of personnel information.
- Malicious gossip and/or spreading rumors; engaging in behaviors designed to create discord and lack of harmony.
- Interfering with another employee on the job; willfully restricting output or encouraging others to do the same.
- Immoral or indecent conduct on Company property.
- Conducting a lottery or gambling on Company premises.
- Sleeping on the job.
- Alteration to any time-worked records or attendance documents; using another employee's time badge or records, or causing someone to alter your time card or records.
- Unsatisfactory or careless work; failure to meet production or quality standards as explained to you by your manager or Supervisor/Foreman; mistakes due to carelessness or failure to obtain necessary instructions.
- Performing work other than on Company's products or equipment during working hours without specific instructions from the manager or supervisor/foreman.
- Any act of sexual, racial, or other harassment; telling sexist or racial-type jokes; making racial or ethnic slurs.
- Leaving work before the end of a workday or not being ready to work at the start of the workday without the approval of your manager or supervisor/foreman.
- Loitering or loafing during work hours.
- Leaving your workstation or jobsite during work hours without the permission of your manager or supervisor/foreman.
- Smoking or the use of any tobacco product in restricted work areas, including all Company buildings, or at any non-designated times or areas established by the Company.
- Creating or contributing to unsanitary conditions.

- Posting, removing, or altering notices on any Company bulletin board on Company property without permission from a manager or Supervisor, or any violations of the Company's Solicitation Policy.
- Failure to report an absence at least one (1) hour prior to the start of the shift.
- Obscene or abusive language toward any employee or customer; indifference or rudeness toward a co-worker or customer and any disorderly/antagonistic conduct on Company premises.
- Any unsafe operation of any company vehicles or equipment.
- Failure to immediately report damage to, or of an accident involving Company equipment.
- Solicitation for any cause at any time on Company premises; distribution of any non-Company approved literature at any time, on Company premises.
- Failure to maintain a neat and clean appearance in terms of standards established by the Company; any departure from conventional modes of dress or appearance (including jewelry) or personal grooming; wearing improper or unsafe clothing (including jewelry and accessories).
- Failure to record your time worked.

Employment with S&T is an at-will relationship between S&T and the employee, and either party may terminate that relationship at any time, with or without cause, and with or without advance notice.

Accident / Injury Reporting Procedure

All employees of Stewart & Tate, Inc. must report accidents and injuries immediately to a Manager or Supervisor, regardless of severity. This is not only Company policy, but it is also an OSHA and/or MSHA requirement. All Managers or Supervisors/Foremen will complete Company accident forms and forward them to the Health & Safety Manager at the corporate office within 24-hours. All employees must follow the procedure listed below.

Work Related Injury/Illness

- Inform the Manager or Supervisors/Foremen.
- Determine if the injury/illness requires more than first aid treatment
- Contact the Health & Safety Manager at **(717) 771-3506 or (717) 324-2447** *prior* to proceeding to the occupational health center. The only exceptions to this are medical emergencies, which should receive immediate attention.
- The accident report must be completed by the Manager or Supervisors/foremen and the employee, and faxed to the Health & Safety Manager at (717) 718-2646 within 24-hours.
- All medical reports are to be faxed to the Health & Safety Manager immediately once received.
- It is the employee and Manager or Supervisor's/foreman's responsibility to inform the Health & Safety Manager of any restricted duty or Lost-Time immediately.
- Stewart & Tate, Inc. policy mandates a substance abuse screen for any employee involved in a work-related injury regardless of severity. The tests must be completed within 8 hours of the event. The results of the test must be faxed to the Health & Safety Manager immediately, once known.

Vehicle Accident

- If the accident is not on Stewart & Tate, Inc. property, contact local law enforcement. Company policy requires a police report, regardless of severity. Contact emergency medical services (EMS) personnel in the event of injury.
- Employees are to assume no responsibility for any accident. You are to exchange vehicle registration and insurance information only (see Accident Report).
- Contact the Manager, Supervisor/Foreman.
- Contact the Health & Safety Manager at **(717) 771-3506 or (717) 324-2447.**
- Obtain and document any witness information. This includes any names, addresses, and phone number(s).
- Complete the accident report within 24 hours and forward by fax to the Health & Safety Manager at (717) 718-2646.
- Stewart & Tate' Company policy mandates a substance abuse screen for any employee involved in a vehicle accident, regardless of fault. This test must be completed within 8 hours. The results of the test must be faxed to the Health & Safety Manager.

Failure to comply with this policy may result in disciplinary action up to and including termination of employment and may affect your ability to qualify for Worker's Compensation Insurance benefits.

~~(PENNSYLVANIA EMPLOYEES ONLY)~~
~~NOTICE: MEDICAL TREATMENT FOR YOUR WORK INJURY OR OCCUPATIONAL ILLNESS~~

~~Stewart & Tate, Inc. has selected a list of six (6) or more physicians and other health care providers who are available to treat your work-related injuries and illnesses during the first ninety (90) days of treatment. This list is posted on Company bulletin boards for you to view. Also, you may get a copy of this list from the Corporate Human Resources Department.~~

~~If you are injured at work or suffer an occupational illness, you have certain legal RIGHTS and DUTIES under Section 306(f.1)(1)(i) of the Pennsylvania Worker's Compensation Act regarding your medical treatment. These rights and duties are summarized below.~~

~~MEDICAL TREATMENT DURING THE FIRST NINETY (90) DAYS~~

• ~~You have the RIGHT to receive reasonable and necessary medical treatment for your work injury or occupational illness. Your employer must pay for the treatment, as long as the treatment is by one of the listed providers.~~ • ~~You have the RIGHT to choose which of the listed providers will treat you for your work injury or illness.~~ • ~~You have the RIGHT to switch among any of the listed providers when you receive treatment; and if a listed provider refers you to a provider not on your employer's list, you have the RIGHT to receive treatment from the referral provider.~~ • ~~You have the RIGHT to receive emergency medical treatment from any provider. However, non-emergency treatment must be given by a listed provider.~~ • ~~If a listed provider prescribes surgery for you, you have the RIGHT to receive a second opinion from any provider of your choice.~~	• ~~You have the DUTY to visit one of more of the listed providers for the first 90 days of treatment for your work injury or illness if you expect your employer to pay for the medical treatment you receive.~~ • ~~If you seek treatment for your work injury or illness from a provider who is not on the list, your employer may not have to pay for this medical treatment during this 90-day period. Therefore, you should talk to your employer before seeking treatment from a provider who is not on the list.~~ • ~~If that opinion is different from the opinion of the listed provider, you have the RIGHT to choose which course of treatment to follow. If you choose the treatment prescribed in the second opinion, you must receive the treatment from a listed provider for a period of 90 days after the date of your visit to the provider of the second opinion.~~
~~**IMPORTANT:** The requirements your employer must meet to have a valid list of at least 6 providers are shown on the reverse side of this form. If the list does not meet these requirements, it is no a valid list, and you have the right to seek medical treatment for your work injury or occupational illness from any health care provider of your choice.~~	

~~MEDICAL TREATMENT AFTER THE FIRST 90 DAYS~~

You have the RIGHT to receive treatment from any physician or other health care provider of your choice, whether or not they are listed by your employer. Your employer must pay for this treatment, as long as it is reasonable and necessary for your work injury or occupational illness and has been properly documented by the physician or other health care provider.	You have the DUTY to notify your employer if you receive treatment from a physician or other health care provider who is not listed by your employer. You must notify your employer within five days of the first visit to any provider who is not on your employer's list. The employer may not be required to pay for treatment received until you have given this notice.

~~Your signature on this form indicates that you have been informed of and you understand these rights and duties. **If you have questions, be sure to have your rights and duties explained to you before signing the form.**~~

~~I HAVE BEEN INFORMED OF MY MEDICAL TREATMENT RIGHTS AND DUTIES WITH REGARD TO WORK-RELATED INJURIES AND OCCUPATIONAL ILLNESSES. THIS NOTICE WAS PRESENTED TO ME AT (check one):~~

~~☐ Time of hire ☐ When I was injured ☐ Other~~

~~Employee:_____ Date: _____~~

~~Employer Representative:_____ Date: _____~~

NOTICE TO ALL EMPLOYEES

WORKER'S COMPENSATION MEDICAL TREATMENT EXPENSES

YOUR RIGHTS AND YOUR RESPONSIBILITIES

State laws require that if you are injured in a work-related accident, that you obtain treatment from one of the medical providers listed on the panel for your division which include the following:

Laurel ~~York~~ Area

Tidal Health Immediate Care, Laurel
30549 Sussex Highway
Laurel, DE 19956

~~**Industrial Resource Center – General TX**~~ ~~1769 3rd Ave York, PA 17403 849-5465~~ ~~520 Greenbriar Rd York, PA 17404~~ ~~(717) 764-1330~~	~~**Workfirst**~~ ~~2250 E Market St~~ ~~York, PA 17402~~ ~~(717) 851-1600~~	~~**The Center for Aesthetic & Reconstructive Surgery of York**~~ ~~Apple Hill Medical Center, Suite 292~~ ~~25 Monument Road~~ ~~York, PA 17403~~ ~~(717) 741-4746~~
~~**Emergency Hospital**~~ ~~Memorial Hospital~~ ~~S. Belmont St.~~ ~~York, PA~~ ~~(717) 849-5730~~	~~**Orthopedic and Spine Specialists**~~ ~~1855 Powder Mill Road~~ ~~York, PA 17402~~ ~~(717) 848-4800~~	~~**York ENT – Ear/Nose/Throat**~~ ~~924 E Colonial Ave.~~ ~~York, PA~~ ~~(717) 843-9089~~
~~**Emergency Hospital**~~ ~~York Hospital~~ ~~S. George St~~ ~~York, PA~~ ~~(717) 851-2345~~	~~**York Neurosurgical Assoc. -Neurosurgery**~~ ~~2319 S George St.~~ ~~York Pa~~ ~~(717) 747-9911~~	~~**Dermatology Associates**~~ ~~205 St. Charles Way~~ ~~York PA~~ ~~(717) 741-4666~~
~~**Optomology Associates of York**~~ ~~1945 Queenswood Dr.~~ ~~York, PA~~ ~~(717) 846-6900~~	~~**Bruce Sicilia, MD – Lower Back Specialist**~~ ~~1850 Normandie Dr.~~ ~~York, PA~~ ~~(717) 764-0840~~	

~~Hanover Area~~

~~**Hanover Ortho. Assoc. , Inc.-Bone & Joint**~~ ~~100 S. Penn St.~~ ~~Hanover, PA~~ ~~(717) 637-1977~~	~~**Dermatology Associates Burns/Dermatitis**~~ ~~525 McMosh St.~~ ~~Hanover, PA~~ ~~(717) 632-2711~~	

~~Harrisburg Area~~

~~**Community General Hospital**~~ ~~Emergency Treatment~~ ~~4300 Londonderry Rd.~~ ~~Harrisburg, PA~~ ~~(717) 657-7500~~	~~**Concentra Medical Center**~~ ~~Emergency & General Treatment~~ ~~4400 Lewis Dr.~~ ~~Harrisburg, PA~~ ~~(717) 558-6708~~	~~**Memorial Eye Institute** – Optomology~~ ~~4100 Linglestown, Rd.~~ ~~Harrisburg, PA~~ ~~(717) 657-2020~~

~~**Harrisburg Orthopedic Association**~~ ~~Bone & Joint Specialist~~ ~~2800 Green St.~~ ~~Harrisburg, PA~~ ~~(717) 234-5976~~	~~**Orthopedic Surgeons L.T.D.**~~ ~~Bone & Joint Specialist~~ ~~4700 Union Deposit Rd.~~ ~~Harrisburg, PA~~ ~~(717) 761-5530~~	

One of the above must be used for treatment for a period of ninety (90) days from the date of the first visit. ***If you obtain treatment from a provider not listed on the panel during that time period, the employer will not be responsible for the expense incurred.*** The expenses will be **your** obligation. (Please note that this panel may change from time-to-time and it is your responsibility to make note of such changes as they are posted on the Bulletin Board.)

After a ninety-day period expires, you may visit with a medical provider of your choice. However, you must notify the employer within five (5) days of the first visit that you are seeing a health care provider of your choice. *If you fail to notify the employer within five days, the employer will not be responsible for the medical expenses incurred* **until appropriate notice is given and the service is determined to be reasonable and/or necessary.**

Return to Work Policy

This policy will provide a guide for establishing the availability of modified duty work in the event of an injury/illness that permits a return to work with restrictions.

It is the policy of S&T to attempt to provide work for employees with restrictions due to work injuries. Decisions relating to the availability of work will be made by the managers and S&T's Health & Safety Manager, although every effort will be made to provide modified duty, we cannot guarantee work under the proposed restrictions will be available. Physical limitations will be defined by the treating health care provider and must be in writing, detailing those limitations. If needed, the Company will communicate a description of the proposed modified work activity to the health care provider in order to determine whether the job(s) is within the employee's prescribed limitations.

General Guidance on Modified Duty Work

Employees will be assigned tasks that are within the scope of the restrictions set forth by the treating health care provider.

All modified duty jobs must be monitored on a daily basis for compliance to restrictions, with documentation of any violation of those restrictions. Modified duty can be a regular 8 hour shift or a portion of that shift, which may or may not include overtime. An employee working in a modified duty capacity must follow the attendance policy and a health care provider's note is required to excuse them from work.

Back Injuries

The most common cause of back injuries is sprains and strains. Improper lifting is the largest single cause of back pain and injury. Next to the common cold, back injuries are a frequent cause of lost work time. A back injury may refer to vertebrae, discs, and ligaments and muscles.

Some common factors that may increase the risk of back injury include, but are not limited to, lifting heavy objects, especially from the floor or below the knees, repetitive bending and/or twisting, poor posture, and being overweight.

Most back injuries occur over time due to poor lifting techniques. Knowing and using proper lifting techniques can prevent back pain and injury. Some preventative measures to help reduce or eliminate the risk of back injury include, planning ahead, using mechanical lifting equipment when available, getting help to lift heavy or awkward shapes, getting as close to the load as possible and lifting with your legs, lifting straight up and smoothly, avoid fast jerking motions, do not twist or turn while lifting, and when putting the load down, bend at the knees.

Blasting and Explosives

Due to the complexity and dangers of handling and using explosives, you must be licensed by the state to perform or assist. Since we currently do not have any licensed blasters, all work is subcontracted. Under no circumstance is an employee of Stewart & Tate Inc. permitted to work with blasting or explosive devices. Failure to adhere to this policy could result in termination of employment.

Mobile Telephone and PDA Usage Policy

The purpose of this policy is to establish general operating rules for Company issued personal mobile phones and personal digital assistants (PDA's).

A "PDA" or personal digital assistant is an electronic device which can include some of the functionality of a computer, mobile phone, music player, and camera.

Mobile phone and PDA's have become indispensable tools in our business, making it possible to instantly communicate vital Company information, giving us immediate access to Company data, other employees, and providing immediate access to emergency agencies. However, like any other tool, mobile phones and PDA's can pose a hazard and must be used safely.

The use of personal mobile phones and PDA's at work is only authorized during designated break periods, when it does not affect the ability of the employee to do their job, and only in approved break areas. For safety reasons, we encourage you to follow these same rules when using these devices during work and personal time.

General Mobile Phone and PDA Usage Rules

- Read the owner's manual and follow the manufacturer's safety instructions. A working knowledge of the device's capabilities will allow for safer operation.
- Turn off the device while refueling and while near blasting areas, chemical fields, aircraft, or any other location or environment where the use of mobile phones/PDA's could be hazardous to you or others in the area.
- Comply with all device warnings and restrictions.
- Employees are prohibited from making any modifications or repairs to any Company-issued devices without the approval of the Company.
- Adhere to all local, State, and Federal rules and regulations relating to the use of mobile phones and PDA's while driving.
- Do not use your mobile phone or PDA if it is prohibited by law, regulation, or other ordinance in a particular area.

Use of Mobile Phones and PDA's in Vehicles

- The driver's primary responsibility is the safe operation of the vehicle. It is recommended that you pull off the road to use these devices. In order to simplify dialing mobile phones, program as many numbers into the speed dial or voice-dial feature as possible.
- All mobile phone conversations conducted while driving a Company vehicle should be done with a "hands-free" device. Many locations throughout the country prohibit using mobile phone and PDA's without a hands-free device. All mobile phone and PDA manufacturers offer a hands-free device. Even while using one of these devices

while driving, the possibility of distraction is great. Therefore, you should make each call as brief as possible.

Construction Equipment Mobile Phone/PDA Rules

- The equipment operator's primary responsibility is the safe operation of the equipment. Do not dial or operate other functions of a mobile phone or PDA while the equipment is in operation. To safely operate these devices, the equipment operator will move their equipment to a safe, level area and secure the parking brake prior to operating the mobile phone or PDA. The only time you may dial a phone while operating equipment is to report an emergency that requires immediate attention, such as an accident or dangerous situation. Do this exercising extreme care and do not prolong the call.
- If you should receive an incoming message of any kind while operating equipment, allow the call (in the event of a phone call) to default to voice-mail. These and other PDA messages can be retrieved/viewed at a time when it is safe to do so.

Use of Mobile Phones and PDA's on Job Sites

- Before attempting to use a mobile phone or PDA on a job site, be aware of hazards and activities taking place in the area. If necessary, move to a safe area before using the device.
- While on a job site, restrict the use of your mobile phone or PDA to those areas designated by the customer. Turn your device off before entering any posted or restricted environment.

Adherence to this policy will ensure continued effective communications and safety for all of our employees. Any questions regarding the use of mobile phones or PDA's should be directed to the manager or S&T's Health & Safety Manager.

Mobile Phones/PDAs in Relation to Other Policies

The use of mobile phones or PDAs in violation of any other S&T policy, including but not limited to, the anti-discrimination and anti-harassment polices, is strictly prohibited.

Concrete Work

The following safety guidelines shall be followed:

1. Since uncured concrete contains curing agents and additives that may cause skin irritation, prolonged contact should be prevented. Rubber boots must be worn while standing in uncured concrete along with the proper gloves. Eye protection is required when exposed to splashing concrete.
2. All protruding reinforcing steel, onto and into which employees could fall, shall be guarded to eliminate the hazard of impalement.
3. Employers shall take measures to prevent unrolled wire mesh from recoiling. Such measures may include, but are not limited to, securing each end of the roll or turning over the roll.
4. No employee shall be permitted to apply a cement, sand, and water mixture through a pneumatic hose unless the employee is wearing protective head and face equipment.
5. Riding concrete buckets. No employee shall be permitted to ride concrete buckets
6. No employee shall be permitted to work under concrete buckets while buckets are being elevated or lowered into position.
7. Concrete buckets equipped with hydraulic or pneumatic gates shall have positive safety latches or similar safety devices installed to prevent premature or accidental dumping.
8. Power concrete trowels: Powered and rotating type concrete troweling machines that are manually guided shall be equipped with a control switch that will automatically shut off the power whenever the hands of the operator are removed from the equipment handles
9. Concrete buggies: Concrete buggy handles shall not extend beyond the wheels on either side of the buggy
10. Bull float handles used where they might contact energized electrical conductors, shall be constructed of a nonconductive material or insulated with a nonconductive sheath.
11. Formwork shall be erected, supported, braced, and maintained so that it will be capable of supporting any loads imposed on it. All shoring, forms, and timber must be inspected prior to use. Always have preparations made in the event of kick-outs or form slippage.
12. When drilling or using a jack hammer, the proper eye and face protection such as goggles or a face shield is required. Protect surrounding areas with screens or partitions if needed
13. Masonry saw shall be guarded with a semicircular enclosure over the blade. A face shield and hearing protection should be worn while operating a masonry saw.
14. If there is a need to construct mason walls, contact the safety Manager for details.

Confined Space Entry Program

Purpose
The purpose of this program is to inform interested persons, including employees, that Stewart and Tate, Inc. is complying with the OSHA Confined Space Standard, Title 29 Code of Federal Regulations 1910.146. We have determined that this workplace needs written procedures for the evaluation of confined spaces, and where permit-required spaces are identified, we have developed and implemented a permit-required confined space entry program. This program applies to all work operations at Stewart and Tate, Inc. where employees must enter a permit-required confined space as part of their job duties.

Under this program, we identify permit-required spaces for Stewart and Tate, Inc. and provide training for our employees according to their responsibilities in the permit space. These employees receive instructions for safe entry into our specific type of confined spaces, including testing and monitoring, appropriate personal protective equipment, rescue procedures, and attendant responsibilities.

This program is designed to ensure that safe work practices are utilized during all activities regarding the permit space to prevent personal injuries and illnesses that could occur.

What is a confined space? A confined space may include, but is not limited to the following; Air and gas ducts, air receivers, bin/hoppers, caissons, condensers, furnaces, machine pits, manholes, pipes, sewers, silos, stacks, storage tanks, sumps, tunnels, turbines, vats, vaults, and all trenches more than 4 feet in depth.

A confined space is:

1. Limited openings for entry and exit
2. The area is not intended for continuous work. A permit required confined space has one or more of the following characteristics;
    a.) Contains or has the potential to contain a hazardous atmosphere.
    b.) Has an internal configuration such that an entrant can become trapped or asphyxiated.
    c.) Contains less than 19.5% oxygen
    d.) The area is not protected against the entry of water, gas, sand, gravel, chemicals, or any other substance which could possibly trap, suffocate, or harm a person.

Safe Permit Space Entry Procedures
Only trained and qualified personnel shall analyze a confined space and determine if it is safe to enter or work within.

Contact the Safety Manager for permits and related documents.

Pre-Entry Evaluation
To ensure the safety and health of our employees, before allowing authorized workers to enter a permit space, we evaluate conditions in that space to determine if the conditions are safe for

entry. Any employee, who enters the space, or that employee's authorized representative, has the opportunity to observe the pre-entry and any subsequent testing. The authorized entrant or that employee's representative also has the option of requesting a reevaluation of the space if they feel that the evaluation was not adequate.

Our company follows the procedures to evaluate each permit space before entry according to 1910.146(c)(5)(ii)(C). This includes testing the internal atmosphere with a calibrated direct-reading instrument for oxygen content, flammable gases and vapors, and potential toxic air contaminants. We also periodically test the atmosphere of the space to ensure that the continuous ventilation is preventing the accumulation of a hazardous atmosphere.

Certification
According to 1910.146(c)(5)(ii)(H), our company verifies that the space is safe for entry and that the pre-entry measures required by 1910.146(c)(5)(ii) have been taken, through a written certification that contains the date, location of the space, and signature of the person providing the certification. At our company, Safety Director, foreman, and project managers is responsible for verifying these procedures. The certification is made before entry and is available to each employee entering the space.

According to 1910.146(c)(5)(iii), our company documents the basis for determining that all hazards in a permit space have been eliminated, through a certification that contains the date, location of the space, and signature of the person making the determination. At our company, Safety Director, foreman, and project managers is responsible for documenting this information. The certification is available to each employee entering the space.

Equipment
To ensure the safety and health of our employees, Stewart and Tate, Inc. provides appropriate equipment to all employees who work in or near our permit spaces. According to 1910.146(k)(3)(i), each authorized entrant will use a chest or full body harness, with a retrieval line attached at the center of the entrant's back near shoulder level, above the entrant's head, or at another point which Stewart and Tate, Inc. can establish presents a profile small enough for the successful removal of the entrant. Wristlets may be used instead of the chest or full body harness if Stewart and Tate, Inc. can demonstrate that the use of a chest or full body harness is infeasible or creates a greater hazard and that the use of wristlets is the safest and most effective alternative.

Duties: Authorized Entrants
Those persons who have completed the training and are authorized to enter permit required spaces (authorized entrants) are assigned specific duties and responsibilities, which they must perform when they work in the permit space.

Their duties and responsibilities include:

1. Knowing the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure
2. Properly using equipment as required by paragraph (d)(4) of this section
3. Communicating with the attendant as necessary to enable the attendant to monitor entrant

status and to enable the attendant to alert entrants of the need to evacuate the space as required

4. Alerting the attendant whenever: (i) The entrant recognizes any warning sign or symptom of exposure to a dangerous situation, or (ii) The entrant detects a prohibited condition
5. Exiting from the permit space as quickly as possible whenever: (i) An order to evacuate is given by the attendant or the entry supervisor; (ii) The entrant recognizes any warning sign or symptom of exposure to a dangerous situation, (iii) The entrant detects a prohibited condition, or (iv) An evacuation alarm is activated.

Duties: Attendants

Those persons who have completed the training and have been designated as permit space attendants are assigned specific duties and responsibilities, which they must perform in, permit space job duties.

Their duties and responsibilities include:

1. Knowing the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure
2. Properly using equipment as required by paragraph (d)(4) of this section
3. Communicating with the attendant as necessary to enable the attendant to monitor entrant status and to enable the attendant to alert entrants of the need to evacuate the space as required
4. Alerting the attendant whenever: (i) The entrant recognizes any warning sign or symptom of exposure to a dangerous situation, or (ii) The entrant detects a prohibited condition
5. Exiting from the permit space as quickly as possible whenever: (i) An order to evacuate is given by the attendant or the entry supervisor; (ii) The entrant recognizes any warning sign or symptom of exposure to a dangerous situation, (iii) The entrant detects a prohibited condition, or (iv) An evacuation alarm is activated.

Duties: Entry Supervisors

Those persons who have completed the training and have been designated as permit space entry supervisors are assigned specific duties and responsibilities, which they must perform in, permit space job duties. Their duties and responsibilities include:

1. Knowing the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure
2. Properly using equipment as required by paragraph (d)(4) of this section
3. Communicating with the attendant as necessary to enable the attendant to monitor entrant status and to enable the attendant to alert entrants of the need to evacuate the space as required
4. Alerting the attendant whenever: (i) The entrant recognizes any warning sign or symptom of exposure to a dangerous situation, or (ii) The entrant detects a prohibited condition
5. Exiting from the permit space as quickly as possible whenever: (i) An order to evacuate is given by the attendant or the entry supervisor; (ii) The entrant recognizes any warning sign or symptom of exposure to a dangerous situation, (iii) The entrant detects a prohibited condition, or (iv) An evacuation alarm is activated.

Training Program
Every employee at Stewart and Tate, Inc. who faces the risk of confined space entry is provided with training so that each designated employee acquires the understanding, knowledge and skills necessary for the safe performance of the duties assigned to them. The Safety Director conducts our permit-required confined space training. All training related materials, documents, and signed certificates are kept in the Safety Director's office.

Upon successful completion of The Stewart and Tate, Inc. permit-required confined space training program, each participant receives a certificate which they sign verifying that they understand the material presented, and that they will follow all company policies and procedures regarding permit space entry.

Every 3 years or if a job warrants update training.

Post-operations Procedures
Upon completion of work in a permit space, we follow these procedures to close off the space and cancel the permit: Foreman assures that confined space work has been properly finished and permits have been cancelled.

Review-Procedures
To ensure that all employees participating in entry operations are protected from permit space hazards, Stewart and Tate, Inc. reviews the Permit-Required Confined Space Entry Program on a regular basis. Stewart and Tate, Inc. performs a single annual review covering all entries performed during a 12-month period. If no entry is performed during a 12-month period, no review will be performed.

Enforcement
Constant awareness of and respect for permit-required confined space entry hazards, and compliance with all safety rules are considered conditions of employment. Supervisors and individuals in the Safety and Personnel Department reserve the right to issue disciplinary warnings to employees, up to and including termination, for failure to follow the guidelines of this permit entry program.

Crane Safety

General safety:

1. **Only authorized personnel are permitted to operate a crane.**
2. All rated load capacities; recommended operating speeds, special hazard warnings, or instruction must be clearly posted on all cranes. Instructions or warnings shall be visible to the operator while he is at his control station.
3. The operator must know the weight of the load, the pick and set radius of the load to be picked, and if the load is in the structural or tipping portion of the load chart.
4. Load lines should be able to support at a minimum, at least (7) seven times the maximum intended load.
5. Proper hand signals, (appendix A) from one (1) person at a time, shall be used to signal the operator. The operator shall not hoist the load if he is unclear of the signal or if more than one (1) person is giving signals.
6. The crane shall be set level on a firm foundation with all outriggers extended
7. Unless overhead electrical lines have been de-energized or insulated by the utility company, operation near these lines is as follows:
    a.) 50 KV or less – minimum clearance is 10 feet
    b.) Over 50 KV – 10 feet plus one half inch for each 1 KV over 50 KV.
    c.) A person shall be assigned to observe clearance of the crane and give warning if the desired clearance is not maintained.
    d.) Always assume that all overhead lines are live.
8. If for some reason you come into contact with overhead lines, remain in the cab. No one on the ground should be in contact with the crane when working near overhead lines.
9. Hooks on overhaul ball assemblies, lower load blocks, or other attachment assemblies shall be of a type that can be closed and locked, eliminating the hook throat opening. A positive acting device shall be used which prevents contact between the load block or overhaul ball and the boom tip (anti-two-blocking device), or a system shall be used which deactivates the hoisting action before damage occurs in the event of a two-blocking situation.
10. Accessible areas within the swing radius of the counterweight must be barricaded. Loads shall not be swung or suspended over any people. Watch for defective rigging equipment or improper rigging techniques. The operator must remain alert at all times and shall never leave the cab while a load is suspended.

Suspended personnel platforms

Because of the hazards and strict standards for using suspended personnel platforms, under no circumstances shall anyone be hoisted or lifted in any type of platform.

Inspections

Aside from the formal (certified and kept on file) annual crane inspection, each crane will be inspected daily by the operator prior to use. All defects or repairs must be repaired or replaced before operation may resume.

For details on rigging, see Rigging Safety policy

Demolition

Demolition poses specific hazards due to sudden changes in structures and work areas. This section reviews the special concerns. It is an addition to the other safety and health procedures which are recommended or mandatory according to policy.

Preparation survey

A survey of the structure is to be made prior to the start of demolition. As a minimum, the survey will determine the following conditions:

1. Survey is to be completed by a competent person.
2. Floors, walls, and framing are to be checked to determine if an unplanned collapse may occur.
3. Bracing or shoring is required if a fire, storm, or explosion has damaged the structure.
4. All utilities have been shut off and a formal notification made to all affected utilities.
5. Temporary power or water, if needed, should not be installed near the demolition area.
6. All flammable liquids, gasses, and hazardous chemicals removed or purged from the structure.
7. All glass, which may pose hazards to workers, is to be removed or covered.

Special concerns during demolition work:

1. Where a hazard exists to employees falling through wall openings, the opening shall be protected to a height of approximately 42 inches
2. When debris is dropped through holes in the floor without the use of chutes, the area onto which the material is dropped shall be completely enclosed with barricades not less than 42 inches high and not less than 6 feet back from the projected edge of the opening above. Signs, warning of the hazard of falling materials, shall be posted at each level
3. When a chute is used, all sides shall be enclosed and discharge gates closed when not in use.
4. Discharge openings where workers dump debris, must have a guardrail 42” from the floor
5. Floor openings must be covered when not in use. Coverings must be attached and able to support intended load weights
6. Worker entrances to demolition areas must be protected from overhead hazards by sidewalk sheds or canopies. This protection must extend at least 8 feet from the building and be 1 foot wider on each side that the building entrance. Minimum load sustaining capacity is 150 pounds per square foot
7. Only those stairways, passageways, and ladders, designated as means of access to the structure of a building, shall be used. Other access ways shall be closed at all times
8. Exterior wall demolition must begin and be completed on the top floor before proceeding downward to each subsequent level
9. Stairways must be covered at least 2 stories below the floor being demolished
10. Any wall sections more than 1 story high must be supported laterally
11. Load bearing walls must be braced if unable to support designed loads
12. If flooring planks are required to serve as worker floors or walkways, they must be at least 2”x 10”. Openings between planks shall not exceed 16”

Substance Abuse Policy

SUBSTANCE ABUSE STRICTLY PROHIBITED

It is the policy of S&T to maintain a working environment free from the effects of drug and alcohol abuse. S&T has a vital interest in ensuring safe, healthy and efficient working conditions for all employees and S&T has established, as a condition of employment and continued employment, a policy directed at eliminating drug and alcohol abuse in the workplace. To the extent this policy is invoked, all testing will be at the Company's expense. Any employee testing positive under this policy will be subject to disciplinary action, up to and including termination. If termination is the outcome, employee will not be eligible for re-hire for ninety-two (92) days.

Pre-Employment Drug Testing: Job offers to candidates shall be contingent upon candidates successfully passing a drug and alcohol test. A positive result will automatically result in the withdrawal of the offer for employment.

Random Testing: Random drug and alcohol testing will be conducted on a periodic basis.

Reasonable Suspicion Testing: Reasonable suspicion testing will occur when management/supervision has reasonable suspicion based on a belief that an employee is using or has used drugs and/or alcohol in violation of the Company's policy. Such evidence may consist of, but is not limited to:

- Direct observation while at work of drug or alcohol use, or of the physical symptoms or manifestations of being under the influence of a drug or alcohol
- Abnormal conduct or erratic behavior while at work or a significant deterioration in work performance
- A report of drug or alcohol use
- Information that an employee has caused, contributed to, or been involved in an accident or other incident while at work
- Belief that an employee has used, possessed, sold, solicited or transferred drugs or alcohol while working or while on the Company's premises
- A pattern of absenteeism or tardiness from work

Motor Vehicle Accident and/or Incident Testing: An employee involved in an accident shall be sent for a drug and alcohol test. Failure to comply or failure to provide specimens, attempts to contaminate specimens or otherwise interfere with Company policies may be grounds for immediate termination of employment.

Prohibition Against Unlawful Presence of Controlled Substances in the Workplace: The unlawful manufacture, distribution, dispensation, possession, or use of a controlled substance on Company premises, in Company or personal vehicles or while engaged in Company activities is strictly prohibited.

Prohibition Against the Unauthorized Presence of Alcoholic Beverages: The unauthorized or unlawful manufacture, distribution, dispensation, possession or consumption of alcoholic beverages on Company premises, in Company vehicles or while engaged in Company activities is strictly prohibited.

Prohibition Against Working or Reporting to Work "Under the Influence": No employee shall work, report to work, or be present on Company premises, in Company vehicles or engaged in Company activities while under the influence of illegal drugs or alcohol.

An employee under the influence of a legal drug has an obligation to inquire and determine whether the legal drug he or she is taking may or will affect his or her ability to safely and efficiently perform his or her job duties. If the employee is using a legal drug at the direction of a physician, dentist or other licensed practitioner, the employee must obtain a written statement of any work restrictions. This statement must be submitted to the employee's Supervisor/Foreman prior to commencing work under the influence of any legal drug.

CDL DRIVERS

In addition to the policy outlined herein, all employees or contractors who are CDL drivers must comply with the Federal Motor Carrier Safety Regulations ("FMCSR") Part 40, 382-383, Title 49 of the Code of Federal Regulations. Further information on these requirements maybe obtained from the HR Department.

QUESTIONS

Any questions concerning the above policy or any part of the drug and alcohol testing program should be directed to your supervisor/foreman or the HR Department at (717) 848-2831. A copy of the Department of Transportation Title 49 CFR drug and alcohol rules is available in the HR Department.

Electrical Safety

Purpose

The purpose of this program is to:

1. Demonstrate compliance with OSHA electrical safety requirements necessary for the practical safeguarding of employees involved in construction work, found in Subpart K of 29 CFR 1926; and
2. Establish specific written procedures to protect the health and safety of all employees.

Electricity has been recognized as a serious workplace hazard, exposing employees to such dangers as electric shock, fires, and explosions. You must ensure that electrical equipment is free from recognized hazards that are likely to cause death or serious physical harm. This program addresses basic electrical safety. **Treat electricity with respect!**

General Requirements:

1. The use of a GFCI is mandatory.
2. Only approved equipment can be used on a job site and must be designed to handle the intended load.
3. All work on electrical equipment is to be done only by qualified workers.
4. Employees should not work near any part of electric power circuits in the course of work unless protected against shock by de-energizing the circuit, grounding it or by guarding it effectively by insulation or other means, using appropriate protective equipment, and using good judgment.
5. A ground fault circuit interrupter (GFCI) shall be used on all 120 volt single phase 15 and 20 ampere receptacle outlets, which are not a part of the permanent wiring of the building or structure and in use by employees.
6. Circuit protective devices shall be used to automatically limit or shut off current in the event of ground-fault, overload, or short circuit.
7. All equipment/tools shall be checked daily for damage or defects.
8. All live parts of electrical equipment operating at 50 volts or more must be guarded to avoid accidental contact.
9. Entrance to rooms and other locations containing exposed live parts must be marked with conspicuous warning signs forbidding unqualified persons to enter.
10. Grounding is required to protect employees from electrical shock, safeguard against fire, and protect against damage to electrical equipment.
11. Personnel shall use appropriate protective equipment such as insulated non-conductive gloves and shoes to protect body parts needing protection while work is being done.
12. Before work begins it must be determined where any part of an exposed or concealed energized power line is located
13. Employees must be advised of locations of lines, hazards involved and protective measures to be taken.
14. Electrical clearances:
    a.) 50 kv or below = 10 feet minimum
    b.) 50 kv or above10 feet plus 4 inches for each 1 kv over 50 kv
15. Observe all posted warning signs

16. Only authorized personnel shall repair electric tools.
17. Maintain and use electrical equipment according to the manufacturer's specifications.
18. Only use three-prong plugs, double insulated tools, and safety switches, and keep guards in place.
19. Never use worn or frayed extension cords.
20. Protect circuits form sharp edges.
21. Bulbs attached to light strings must be protected with a guard.

Training

Training is provided to ensure that employees are familiar with the requirements of this plan. This training is provided every three years or as needed. The Safety Director is responsible for conducting training.

Excavation, Trenching, and Shoring Safety

General Requirements:

This policy applies to all open excavations made in the earth's surface. Excavations are defined to include trenches. All surface encumbrances (signs, telephone poles, etc.) shall be removed or supported, as necessary, to safeguard employees.

Underground Installations: The location of all utility installations shall be determined prior to excavation and:

1. Must be identified and marked by Miss Utility of Delmarva ~~PA One-Call or MD Miss Utility~~, prior to opening anexcavation.
    i. Delaware 1-800-282-8555 ~~PENNSYLVANIA ONE CALL TEL # 1-800-242-1776~~
    ii. ~~MARYLAND MISS UTILITY TEL # 1-800-257-7777~~
    iii. NATIONAL # 811
    iv. Requirements:
        1. Notify all facility owners through the one call system.
        2. ONE CALL - Notification required no less than 3 days, (complete working days) or more than 10 working days prior to work.
        3. MISS UTILITY - Notification required no less than 48 hours or more than 10 working days prior to work.
        4. Provide specific information that identifies the exact site.
        5. Provide protection and preserve facility markings. If compromised, re-notify the system.
        6. Protect exposed utility from damage.
        7. Use prudent techniques to expose lines (hand digging requirements) within 18 inches on either side of marker.
        8. Maintain one call location report number on site during the operation. Submit it to the project manager upon completion of project.
        9. Photograph layout of markings including stationary objects for future reference.

APWA UNIFORM COLOR CODE
WHITE - Proposed Excavation
PINK - Temporary Survey Markings
RED - Electric Power Lines, Cables, Conduit and Lighting Cables
YELLOW - Gas, Oil, Steam, Petroleum or Gaseous Materials
ORANGE - Communication, Alarm or Signal Lines, Cables or Conduit
BLUE - Potable Water
PURPLE - Reclaimed Water, Irrigation and Slurry Lines
GREEN - Sewers and Drain Lines

2. While the excavation is open, underground installations shall be protected, supported or removed as necessary to safeguard employees.

Access and Egress:

1. Structural ramps as a means of access or egress from excavations shall be designed by a competent person.
2. Ramps must have connected cross members.
3. Cleats shall be used to prevent slipping.
4. Trenches deeper than 4 feet require ladders, ramps, or stairways at least every 25 feet of lateral travel for employees.
5. Head protection is required in trenches deeper than 4 feet.

Vehicular Traffic:

1. Workers exposed to vehicular traffic shall be protected by the use of highly visible reflectorized vests and any necessary traffic control patterns as determined by MUTCD.
2. Training is required in accordance with the MUTCD.

Falling Loads:

1. No one is permitted under loads handled by lifting or digging equipment.
2. Employees must also stay clear of any loading or unloading of equipment.

Water Accumulation:

1. Employees may not work in excavations where water accumulates unless protection systems are used.
2. Must be inspected daily prior to entrance

Adjacent Structure Stability:

1. Where stability of structures is affected by excavation, shoring or bracing must be used.
2. A registered professional engineer must determine if hazards to workers or to structures exist if excavating below the footer or base.
3. Sidewalks must be supported if undermined.

Loose Rock or Soil:

1. All loose rock and soil shall be kept off the face of excavation walls or employees must be protected by installing barriers.
2. Spoils piles must be kept back at least 2 feet from the edge of the excavation.

Inspections:

1. A competent person shall make a daily inspection of all excavation areas prior to entry.
2. Inspections must be made after every rainstorm or other weather hazard when employees will enter the excavation.
3. The competent person shall have the authority to remove exposed employees until the hazardous condition is controlled.
4. Hazardous atmospheres where applicable with confined space monitors.

Fall Protection:

1. Excavations not readily seen because of plant growth or other barriers shall be barricaded.
2. All excavations not back-filled at the end of the shift must be barricaded.

Protective Systems

All employees in excavations must be protected from cave-ins by one of the following methods except when:

1. The excavation is made entirely in stable rock, or
2. The excavation is less than 4 feet deep and a competent person determined that there is no indication of a potential cave-in.
3. The use of proper protective systems is mandatory on all excavations over 4 feet unless a site specific safety meeting has been held on the project site with the foreman/superintendent and a representative of the safety department to review all aspects of the planned excavation as it relates to OSHA trench protective system standards. The occurrence of the meeting must be documented in writing.

Disciplinary Action for Protective Systems

First offense **-** 3 day suspension will be the minimum disciplinary action for violation of the protective system policy. First offense could also result in termination depending upon the severity of the offense.

Second offense in a 12 month period – Termination of employment.

Types of Protective Systems:

1. Sloping or Benching:
   a.) Sloped excavations must be sloped back at an angle not steeper than one and one half horizontal to one vertical (34 degree angle of repose), or
   b.) Excavations can be sloped or benched in accordance with Appendix P after a soil classification by a competent person.
   c.) No employee is permitted to work above another on a slope or bench unless reviewed by a competent person.

2. Shielding (trench box):
   a.) Shield systems shall be built and used in accordance with the manufacturer's certification. The certification must be on site while a shield is being used.
   b.) Shields may be placed up to 2 feet from the bottom of the trench as long as there is no indication of soil loss from below the shield
   c.) When a combination sloping-shielding system is being used, the excavation must be sloped back to at least 18 inches below the top of the shield.
   d.) Employees are not permitted in shields when they are being installed, adjusted or removed.
   e.) Shields shall be installed in a manner to prevent lateral movement in the event of a cave-in.

3. Shoring (hydraulic or timbers):
   a.) Designs of support systems, shield systems, and other protective systems shall be selected and constructed by the employer or his designee and shall be in accordance with the requirements of designs using appendices A, C and D of 29 CFR 1926 Subpart P.
   b.) Designs for timber shoring in trenches shall be determined in accordance with the conditions and requirements set forth in appendices A and C to subpart P.
   c.) Designs for aluminum hydraulic shoring shall use the Manufacture's tabulated data, but if manufacturer's tabulated data cannot be utilized, designs shall be in accordance with appendix D.

4. Design by a Registered Professional Engineer:
   a.) Any other protective system, or any sloping or benching system in an excavation over 20 feet deep shall be designed by a registered P.E.
   b.) The engineered design must be available on site.

Soil Classifications

Requirement: Each soil and rock deposit shall be classified by a competent person as Stable Rock, Type A, Type B, or Type C. The soil classification is based on the results of at least one visual and at least one manual analysis conducted by a competent person. Details of the acceptable visual and manual analyses are to be found in Appendix A of 29 CFR 1926, Subpart P. NOTE: Soil classification is not necessary if the excavation will be sloped to an angle of one and one-half horizontal to one vertical.

Type A: is cohesive with an unconfined compressive strength of 1.5 tons per square foot (tsf). Type A soils include clay, silty clay, sandy clay, clay loam, and sometimes-silty clay loam and sandy clay loam. Exemptions; if it is fissured; subject to vibration from traffic, pile driving, or similar effects; previously disturbed; or part of a sloped, layered system where the slope is four horizontal to one vertical or greater.

Type B: is cohesive soil with an unconfined compressive strength greater than .5 tsf but less than 1.5 tsf. Type B soils include granular cohesion less soils like angular gravel, silt, silt loam, sandy loam, and sometimes silty clay loam and sandy clay loam; Exemptions; previously disturbed soils that are not Type C; fissured soils and soils subject to vibration that would otherwise be classified as Type A; dry rock that is not stable; and material that is part of a sloped, layered system where the layers dip on a slope less steep than four horizontal to one vertical.

Type C: is cohesive soil with an unconfined compressive strength of .5 tsf or less. Type C soils include granular soils such as gravel, sand, and loamy sand; Exemptions; submerged soil; soil from which water is freely seeping; submerged rock that is not stable; or material in a sloped, layered system where the layers dip into the excavation at a slope of four horizontal to one vertical or steeper.

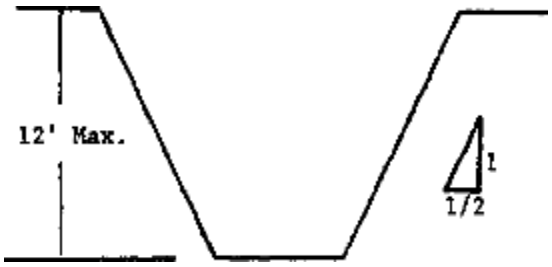
Layered Systems: In a layered system, the system shall be classified in accordance with its weakest layer. However, each layer may be classified individually where a more stable layer lies under a less stable layer. Ex: Type C over Type B

Maximum Allowable Slopes Based On Soil Classifications:

1. Stable Rock – Vertical (90 degrees)
2. Type A – 3/4H to 1V (53 degrees)
3. Type B – 1H to 1V (45 degrees)
4. Type C – 1-1/2H to 1V (34 degrees)

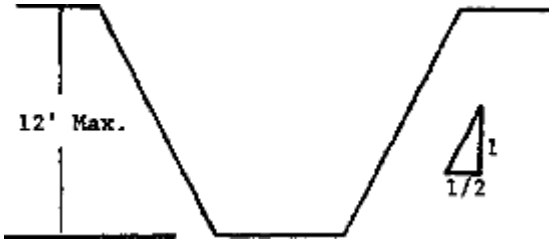
<u>Excavations made in Type A soil</u>.
All simple slope excavation 20 feet or less in depth shall have a maximum allowable slope of 3/4:1.

SIMPLE SLOPE – GENERAL



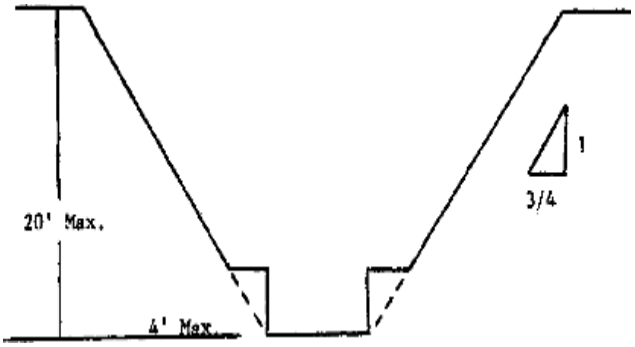
Exception: Simple slope excavations which are open 24 hours or less (short term) and which are 12 feet or less in depth shall have a maximum allowable slope of 1/2:1.

SIMPLE SLOPE - SHORT TERM

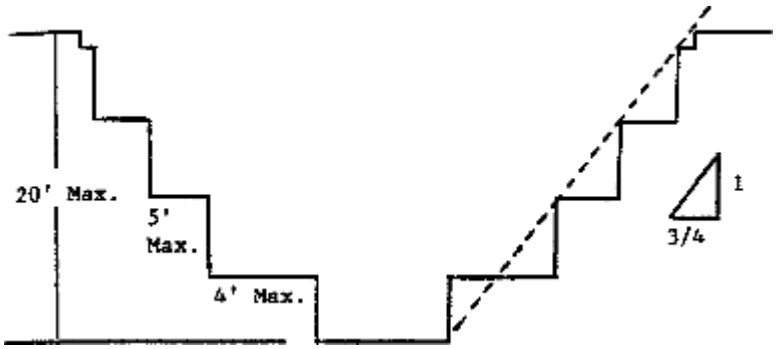


All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 3/4 to 1 and maximum bench dimensions as follows:

SIMPLE BENCH

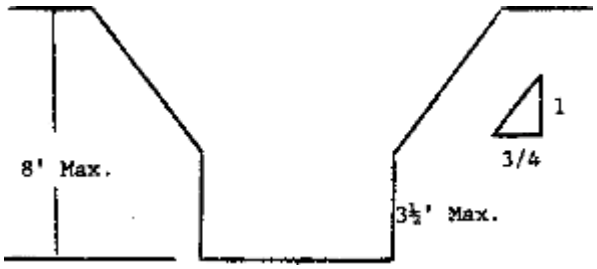


MULTIPLE BENCHES



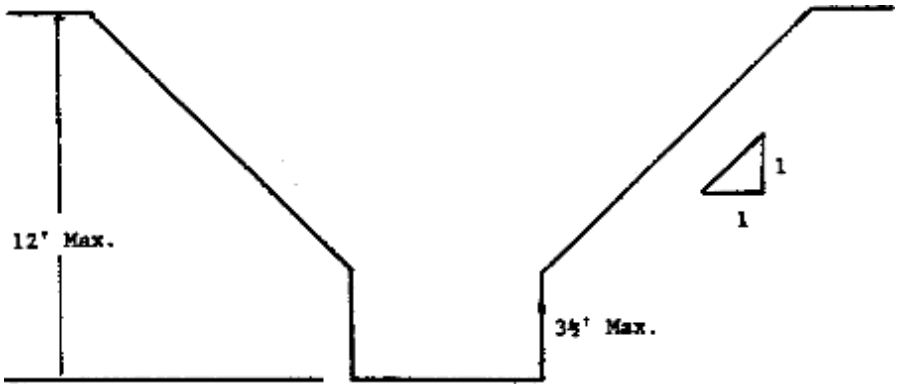
All excavations 8 feet or less in depth which have unsupported vertically sided lower portions shall have a maximum vertical side of 3 1/2 feet.

UNSUPPORTED VERTICALLY SIDED LOWER PORTION
MAXIMUM 8 FEET IN DEPTH



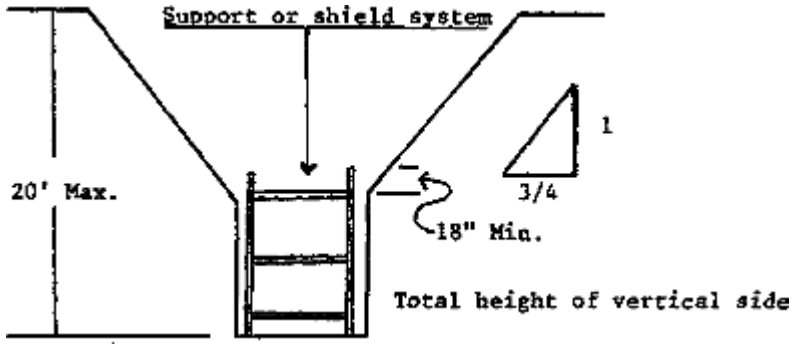
All excavations more than 8 feet but not more than 12 feet in depth with unsupported vertically sided lower portions shall have a maximum allowable slope of 1:1 and a maximum vertical side of 3 1/2 feet.

UNSUPPORTED VERTICALLY SIDED LOWER PORTION
MAXIMUM 12 FEET IN DEPTH



All excavations 20 feet or less in depth which have vertically sided lower portions that are supported or shielded shall have a maximum allowable slope of 3/4:1. The support or shield system must extend at least 18 inches above the top of the vertical side.

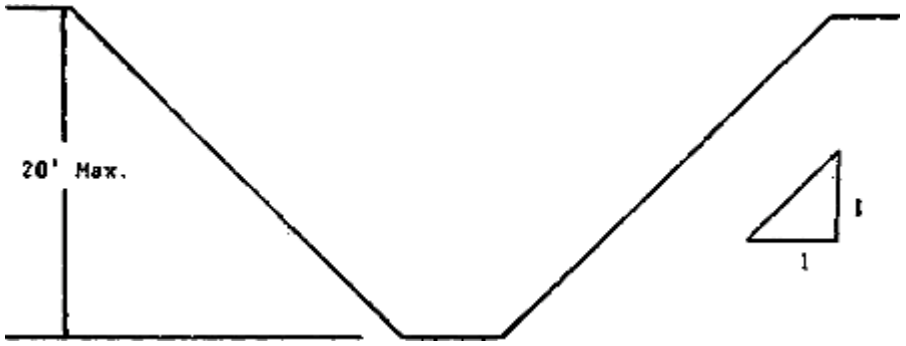
SUPPORTED OR SHIELDED VERTICALLY SIDED LOWER PORTION



Excavations Made in Type B Soil

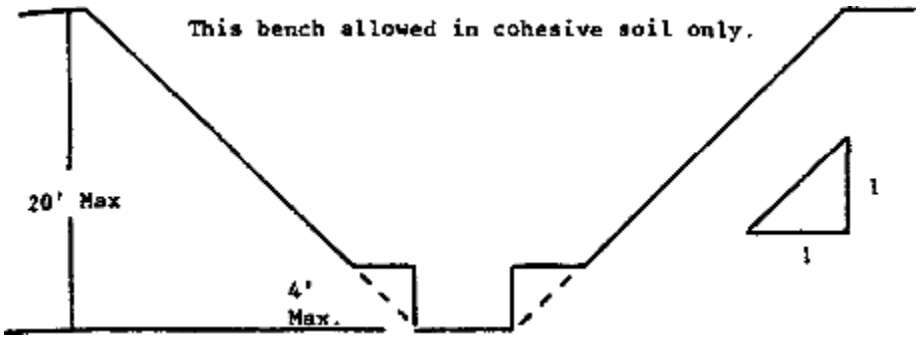
All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1.

SIMPLE SLOPE

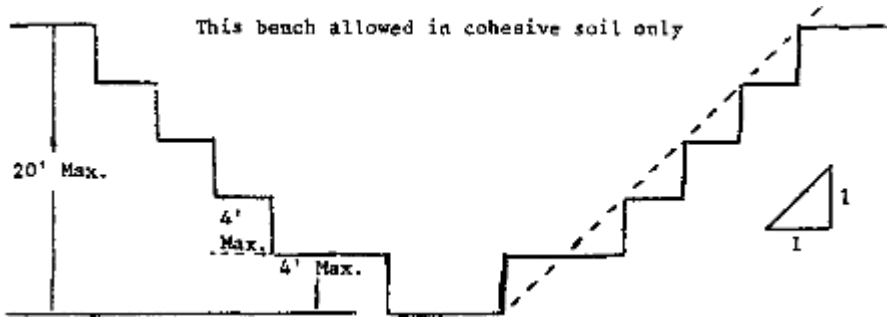


All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1 and maximum bench dimensions as follows:

SINGLE BENCH

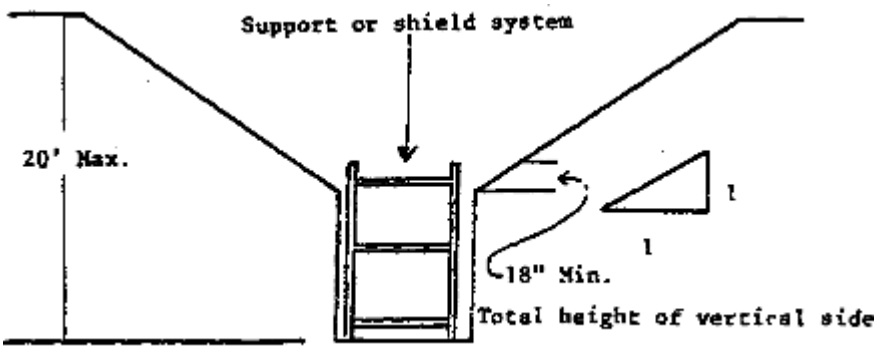


MULTIPLE BENCHES



All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1:1.

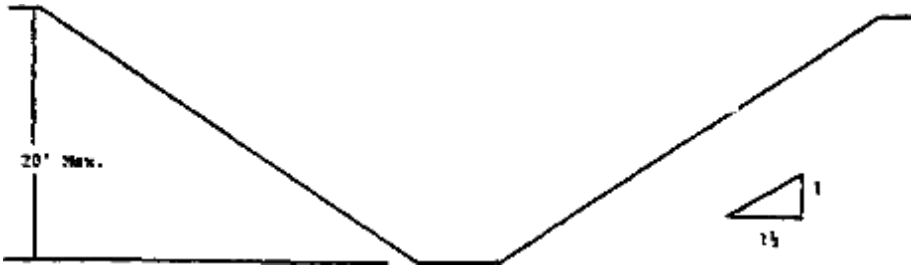
VERTICALLY SIDED LOWER PORTION



<u>Excavations Made in Type C Soil</u>

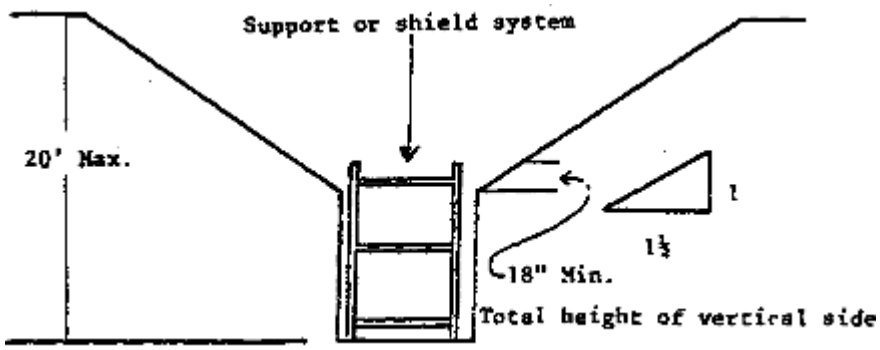
All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1 1/2:1.

SIMPLE SLOPE



All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1 1/2:1.

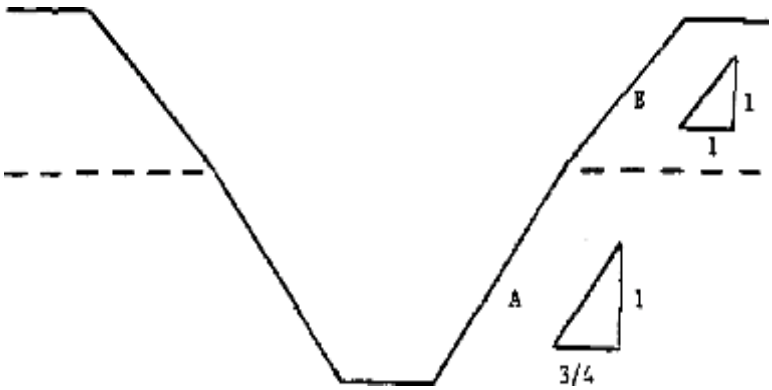
VERTICAL SIDED LOWER PORTION



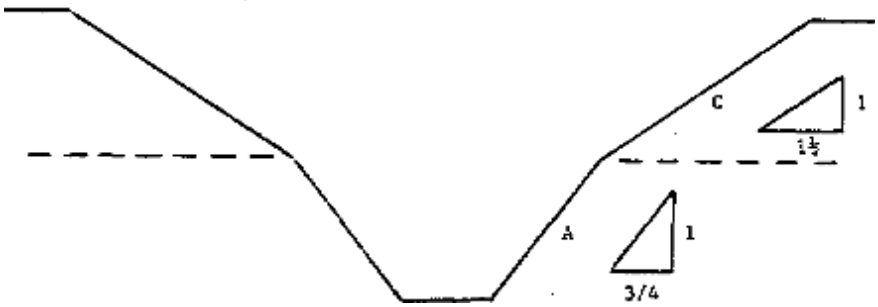
<u>Excavations Made in Layered Soils</u>

All excavations 20 feet or less in depth made in layered soils shall have a maximum allowable slope for each layer as set forth below.

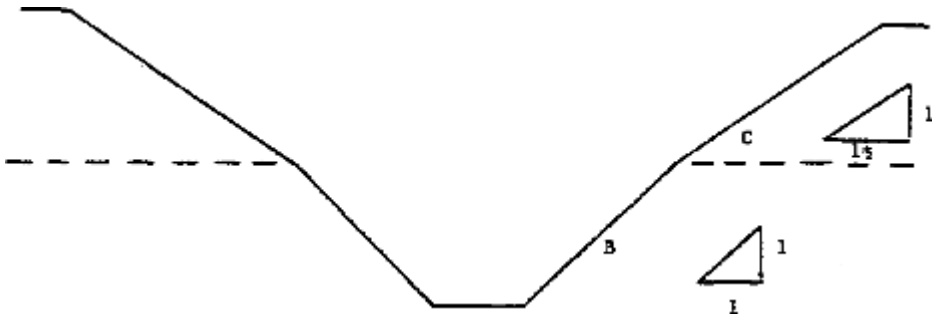
B OVER A



C OVER A



C OVER B



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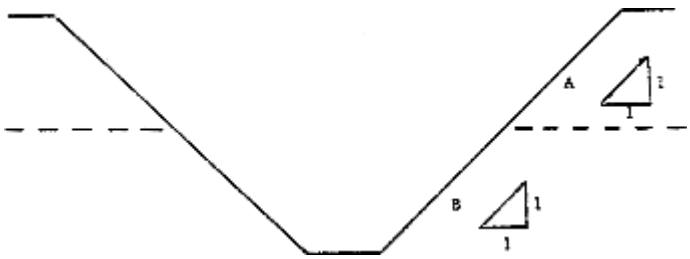

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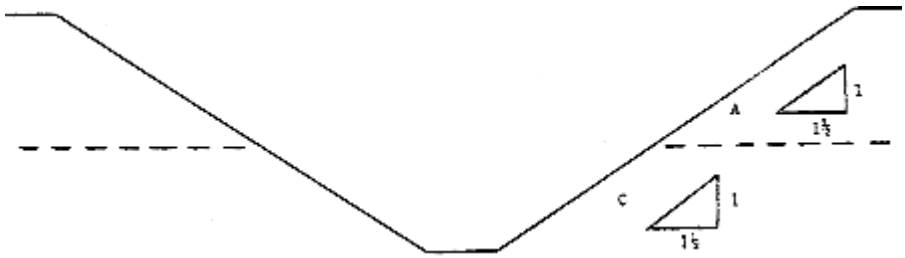

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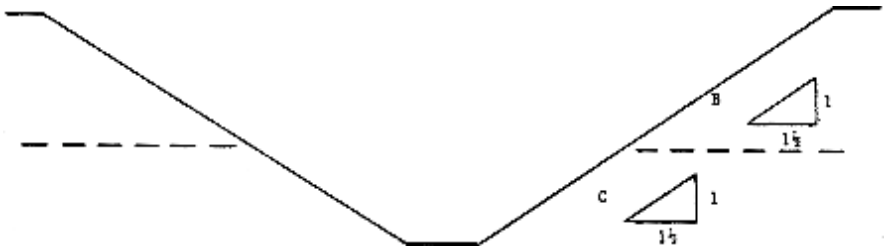


Fall Protection

This policy sets forth those workplaces, conditions, operations, and circumstances for which fall protection shall be provided except as follows:

1. Requirements relating to fall protection for employees working on scaffolds are provided in the Scaffold policy in this manual.
2. Fall protection requirements for employees performing steel erection work are provided in the Steel erection policy of this manual.
3. Requirements relating to fall protection for employees working on stairways and ladders are provided in the Ladders and Stairs policy of this manual.
4. Requirements relating to fall protection for employees working in residential construction are covered by the Residential Construction standard.

General requirements: Fall protection

Fall protection shall be required in all areas were personnel may fall 6 feet or more to a lower level and all holes with a minimum dimension of 2" or more.

The following guidelines shall be followed:

1. Personnel will be provided with and use 100 % fall protection at all times.
2. All walking/working surfaces, including ramps, with unprotected sides or edges which are 6 or more feet above a lower level shall be protected from falling by one of the following, covers, a guardrail system, a safety net, warning line systems or personal fall arrest system.
3. Employees engaged in construction of leading edges shall be protected by one of the following, a guardrail system, a safety net, or personal fall arrest system.
4. Employees engaged in work around hoist areas should be provided protection by one of the following, a guardrail system, a chain gate, or personal fall arrest system. In areas where the guardrail system or the gate system is removed, a personal fall arrest system shall be used
5. Employees working around holes in walking/working surfaces (including skylights) shall be protected with one of the following, a guardrail system, cover, or personal fall arrest system. A cover must withstand twice the intended load weight of the equipment that may pass over it. It must be secured in place and marked with fluorescent paint stating "HOLE."
6. Personnel working on the face of form work or reinforcing steel shall be protected with one of the following, a safety net, a positioning device, personal fall arrest system, or a platform with a guardrail system.
7. Each employee at the edge of an excavation 6 feet (1.8 m) or more in depth shall be protected from falling by guardrail systems, fences, or barricades when the excavations are not readily seen because of plant growth or other visual barrier.
8. Each employee at the edge of a well, pit, shaft, and similar excavation 6 feet (1.8 m) or more in depth shall be protected from falling by guardrail systems, fences, barricades, or covers.

9. Employees working at, above, or near wall openings with an outside bottom edge greater than 6 feet and an inside lower edge less than 39 inches shall be protected with one of the following, a guardrail system, a safety net, or personal fall arrest system.
10. Personnel working less than 6 feet above dangerous equipment shall be protected with one of the following, a guardrail system, or equipment guards.
11. Personnel working more than 6 feet above dangerous equipment shall be protected with one of the following, a guardrail system, personal fall arrest system or a safety net .
12. Personnel performing overhand bricklaying shall be protected with one of the following: a guardrail system, a safety net, personal fall arrest system or a controlled access zone.
13. Each employee reaching more than 10 inches (25 cm) below the level of the walking/working surface on which they are working shall be protected from falling by a guardrail system, safety net system, or personal fall arrest system.
14. Employees working on all low and steep sloped roofs shall be protected with a guardrail system, a safety net system or personal fall arrest system.
15. Personnel working on flat roofs shall be protected with a warning line system, guardrails with toe boards, or safety harnesses.
16. Personnel erecting concrete wall panels, columns, beams, floors, roof tees or related operations shall be protected with a guardrail system, safety net, or personal fall arrest system.
17. Personnel working on any walking/working surface not addressed shall be protected with a guardrail system, safety net or personal fall arrest system.

Protection from Falling Objects

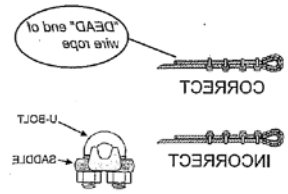
General Requirements:

1. Erect toe boards, screens, or guardrail systems to prevent objects from falling from higher levels; or,
2. Erect a canopy structure and keep potential fall objects far enough from the edge of the higher level so that those objects would not go over the edge if they were accidentally displaced; or,
3. Barricade the area to which objects could fall, prohibit employees from entering the barricaded area, and keep objects that may fall far enough away from the edge of a higher level so that those objects would not go over the edge if they were accidentally displaced.
4. Toe boards, when used as falling object protection, shall be erected along the edge of the overhead walking/working surface for a distance sufficient to protect employees below.
5. Toe boards shall be capable of withstanding, without failure, a force of at least 50 pounds applied in any downward or outward direction at any point along the toe board.
6. Toe boards shall be a minimum of 3 1/2 inches in vertical height from their top edge to the level of the walking/working surface. They shall have not more than 1/4 inch clearance above the walking/working surface. They shall be solid or have openings not over 1 inch in greatest dimension.

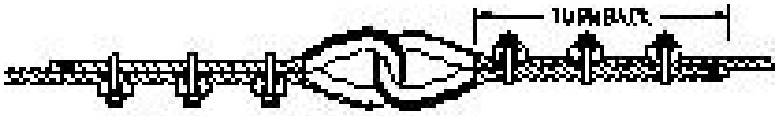
Fall Protection Systems

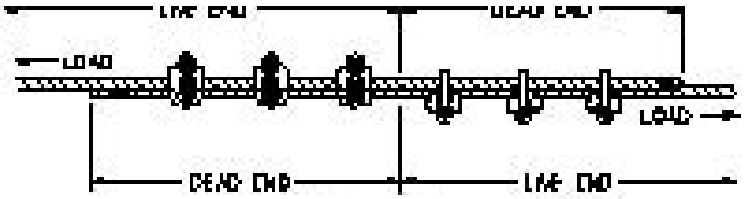
<u>Guardrail Systems</u>:

1. Top edge height of top rails, or equivalent guardrail system members, shall be 42 inches (1.1 m) plus or minus 3 inches (8 cm) above the walking/working level.
2. Midrails, when used, shall be installed at a height midway between the top edge of the guardrail system and the walking/working level.
3. Guardrail systems shall be capable of withstanding, without failure, a force of at least 200 pounds applied within 2 inches of the top edge, in any outward or downward direction, at any point along the top edge. When the 200 pound test load is applied in a downward direction, the top edge of the guardrail shall not deflect to a height less than 39 inches above the walking/working level.
4. If wire rope is used as a guardrail system, see below for rigging specifications. (Note: A 3/8" wire rope must be used a minimum)



acing	Torque in Foot-lbs (unlubed bolts)
3/4"	-
-1/8"	-
-1/2"	15
-7/8"	30
-1/4"	45
-5/8"	65
3"	65
-3/8"	95
-3/4"	95
-1/2"	130





Personal Fall Arrest Systems:

1. Personal fall arrest systems and their use shall comply with the provisions set forth below. Body belts are not acceptable as part of a personal fall arrest system, they are used as a positioning device only.
2. Personal fall arrest systems shall consist of a full body harness, lanyard, and an approved anchorage point.
3. Connectors shall be drop forged, pressed or formed steel, or made of equivalent materials and shall have a corrosion-resistant finish, and all surfaces and edges shall be smooth to prevent damage to interfacing parts of the system.
4. Dee-rings and snap hooks shall have a minimum tensile strength of 5,000 pounds.
5. Unless the snap hook is a locking type and designed for the following connections, snap hooks shall not be engaged: directly to webbing, rope or wire rope; to each other; to a D-ring to which another snap hook or other connector is attached; to a horizontal lifeline.
6. Horizontal lifelines shall be designed, installed, and used, under the supervision of a qualified person, as part of a complete personal fall arrest system, which maintains a safety factor of at least two.
7. Lanyards and vertical lifelines shall have a minimum breaking strength of 5,000 pounds. Each employee shall be attached to a separate lifeline. Lifelines shall be protected against being cut or abraded.
8. Self-retracting lifelines and lanyards which automatically limit free fall distance to 2 feet or less shall be capable of sustaining a minimum tensile load of 3,000 pounds.
9. Ropes and straps (webbing) used in lanyards, lifelines, and strength components of body belts and body harnesses shall be made from synthetic fibers.
10. Anchorages used for attachment of personal fall arrest equipment shall be independent of any anchorage being used to support or suspend platforms and capable of supporting at least 5,000 pounds per employee attached.
11. Personal fall arrest systems, when stopping a fall, shall be rigged such that an employee can neither free fall more than 6 feet nor contact any lower level.
12. The attachment point of the body belt shall be located in the center of the wearer's back.
13. The attachment point of the body harness shall be located in the center of the wearer's back near shoulder level, or above the wearer's head.
14. Personal fall arrest systems shall be inspected prior to each use for wear, damage and other deterioration, and defective components shall be removed from service.

Warning Line Systems:

1. The warning line shall be erected around all sides of the roof work area. When mechanical equipment is not being used, the warning line shall be erected not less than 6 feet from the roof edge.
2. Warning lines shall consist of ropes, wires, or chains, and supporting stanchions erected as follows: The rope, wire, or chain shall be flagged at not more than 6-foot intervals with high-visibility material. No employee shall be allowed in the area between a roof edge and a warning line unless the employee is performing roofing work in that area.

Controlled Access Zones:

1. When control lines are used, they shall be erected not less than 6 feet (1.8 m) nor more than 25 feet (7.7 m) from the unprotected or leading edge, except when erecting precast concrete members.
2. The control line shall extend along the entire length of the unprotected or leading edge and shall be approximately parallel to the unprotected or leading edge.
3. The control line shall be connected on each side to a guardrail system or wall.
4. Control lines shall consist of ropes, wires, tapes, or equivalent materials, and supporting stanchions as follows: Each line shall be flagged or otherwise clearly marked at not more than 6-foot (1.8 m) intervals with high-visibility material.
5. Each line shall be rigged and supported in such a way that its lowest point (including sag) is not less than 39 inches (1 m) from the walking/working surface.

Safety Monitoring Systems:

The employer shall designate a competent person to monitor the safety of other employees and the employer shall ensure that the safety monitor complies with the following requirements:

1. The safety monitor shall be competent to recognize fall hazards;
2. The safety monitor shall warn the employee when it appears that the employee is unaware of a fall hazard or is acting in an unsafe manner;
3. The safety monitor shall be on the same walking/working surface and within visual sighting distance of the employee being monitored;
4. The safety monitor shall be close enough to communicate orally with the employee; and
5. Shall not have other responsibilities which could take the monitor's attention from the monitoring function.

Fire Protection

General Requirements:

1. Access to all available firefighting equipment (fire extinguishers) shall be maintained at all times. Fire extinguishers shall be conspicuously located and should be available at any job site where fire hazards occur, such as welding sites, use of flammable or combustible materials, and dry conditions.
2. All fire extinguishers shall be inspected once a month and maintained in operating condition. This includes checking the nozzle for obstructions, ease of accessibility, and fullness (charge). Defective equipment shall be immediately replaced.
3. A fire extinguisher, rated not less than 2A, shall be provided for each 3,000 square feet of the protected building area, or major fraction thereof. Travel distance from any point of the protected area to the nearest fire extinguisher shall not exceed 100 feet. One or more fire extinguishers, rated not less than 2A, shall be provided on each floor. In multistory buildings, at least one fire extinguisher shall be located adjacent to stairway.
4. A fire extinguisher, rated not less than 10B, shall be provided within 50 feet of wherever more than 5 gallons of flammable or combustible liquids or 5 pounds of flammable gas are being used on the jobsite.
5. At least one portable fire extinguisher, having a rating of not less than 20-B units, shall be located outside of, but not more than 10 feet from, the door opening into any room used for storage of more than 60 gallons of flammable or combustible liquids.
6. At least one portable fire extinguisher having a rating of not less than 20-B units shall be located not less than 25 feet, nor more than 75 feet, from any flammable liquid storage area located outside.
7. At least one portable fire extinguisher having a rating of not less than 20-B:C units shall be provided on all tank trucks or other vehicles used for transporting and/or dispensing flammable or combustible liquids.
8. A fire extinguisher shall be installed in every company vehicle.
9. A fire extinguisher shall be installed in every office trailer.

Fire Prevention

1. Housekeeping is an important part of fire prevention. Keeping combustible and flammable materials in closed containers or proper disposal units will prevent the spread of fire if an ignition source should occur.
2. No smoking is permitted when using combustible materials, including fueling operations. Signs shall be conspicuously placed prohibiting smoking and open flames.
3. Flammable and combustible liquids must be stored in approved containers or in the manufacturer supplied containers. Each container must be clearly labeled for its contents and hazard.
4. No more than 25 gallons of flammable or combustible liquids can be stored in a building unless in a safety storage cabinet or approved storage tank. Not more than 60 gallons of flammable or 120 gallons of combustible liquids shall be stored in any one storage cabinet.
5. Portable tanks shall not be nearer than 20 feet from any building. Storage areas shall be kept free of weeds, debris, and other combustible material not necessary to the storage.

6. Flammable liquids may be used only where there are no open flames or other sources of ignition within 50 feet of the operation, unless conditions warrant greater clearance.
7. Internal combustion engine powered equipment shall be so located that the exhausts are well away from combustible materials.
8. Combustible materials shall be piled with due regard to the stability of piles and in no case higher than 20 feet.
9. Clearance shall be maintained around lights and heating units to prevent ignition of combustible materials.

First Aid

If injuries are determined to be beyond on-site first aid treatment, transport the injured person to a medical facility and notify the Safety Manager. If the injury is so severe that immediate medical attention is required, call 911. An injury report will need to be completed and turned in within 24 hours after the injury.

First Aid Kits

A standard size first aid kit shall be located at every job and easily accessible. The contents of the first aid kit shall be placed in a weatherproof container with individual sealed packages for each type of item, and shall be checked by the employer before being sent out on each job, after every use, and at least monthly. Items that were used or items that have expired shall be replaced as soon as possible. Each foreman truck shall also have a first aid kit in it at all times if a permanent fixed cabinet is not kept within the job trailer. It is the superintendent's / foreman's responsibility to upkeep their first aid kit.

Forklifts and Material-Moving Equipment

General Requirements:

1. Only trained and certified employees are permitted to operate a forklift and they must possess a certification card.
2. Always pre-plan a move to assure that the vehicle, lifting devices, and travel area is capable of supporting the job.
3. Moving equipment should have an audible signal, which will warn personnel of your approach, either by a horn or other type of alarm.
4. A pre-start inspection is required before using any forklift or lifting vehicle.
5. An unattended lift truck must be turned off and the load lowered to ground level when the operator is more than 25 feet away. This applies even if the lift truck is in plain view.
6. Riders are never permitted on a lift truck unless a seat is included in the confines of the cage.
7. All warning lights, horns, parking brake and disconnect switches must be operating.
8. Sufficient counterbalance must be included to support the intended load.
9. Always back down a steep slope to avoid losing the load or control of the lift truck.
10. Always travel backwards when a wide or high load obstructs your view.
11. If using a forklift to lift personnel, this must be done in a man lift cage which fits squarely on the forks and is also secured to the truck with safety chains. The cage must have railings and a lockable gate.
12. When hoisting material, do not hoist with the forks. Slings or chains must be secured to frame to prevent sliding off of the forks.
13. Solid wheel trucks are not intended for outdoor or rough terrain use.
14. Follow plant forklift rules when you are using equipment in a customer's facility.
15. All employees will adhere to the following OSHA Forklift Rules:

Forklift Driver Training Rules

1. Only trained and licensed operators shall operate a forklift.
2. Check your forklift using the Operator's Daily Checklist before you begin your duties. Periodically check the braking system. This is for your safety and is a condition of your employment as an operator.
3. Forklifts shall not be driven up to anyone standing in front of any fixed object.
4. No person shall be allowed to stand or pass under the elevated portion of any forklift whether loaded or empty.
5. Keep all parts of your body inside the running lines of the forklift. Never put arms or legs between the uprights of the mast.
6. When dismounting your forklift:
   a.) Lower the forks to the ground
   b.) Place all controls in neutral
   c.) Shut off the motor
   d.) Set the parking brake
7. A safe distance shall be maintained from the edge of ramps or platforms while on an elevated dock, platform, or freight car door. Forklifts shall not be used for opening and closing of freight car doors.

8. Brakes shall be set and wheel blocks shall be in place to prevent movement of trucks, trailers, or railroad cars while loading or unloading.
    a.) Additional safety equipment normally used for loading of rail cars must be in place along with proper signage.
    b.) Fixed jacks are necessary to support a semi-trailer during loading or unloading when the trailer is not coupled to a tractor.
    c.) The flooring of trucks, trailers, and rail cars shall be checked for breaks and weakness before they are driven upon.
9. Be sure dock boards and bridge plates are properly secured before driving over them. Drive over these devices carefully and never exceed their rated capacity.
10. An overhead guard shall be used as protection against falling objects. The overhead guard is intended to give protection from small packages, boxes, bagged material, etc., but is not intended to withstand the impact of the falling capacity of the entire load. With approval, an overhead guard may be removed, on a temporary basis, for special loading conditions.
11. A load backrest extension shall be used, when necessary, to minimize the possibility of the load or part of it from falling backward.
12. Spinner knobs shall not be attached to steering wheels of forklifts not originally equipped with such.
13. No rear-end loading or unloading of flatbed trucks is permitted without the Safety Department's approval.
14. All traffic regulations shall be observed, including plant speed limits and stop signs. A safe distance shall be maintained (three forklift lengths) from the forklift ahead. Forklifts shall be kept under control at all times.
15. Stunt driving and horseplay are strictly forbidden.
16. Forklifts traveling in the same direction shall not pass at intersections, blind spots, or other dangerous locations.
17. Drivers must slow down and sound horns at cross isles and other locations when vision is obstructed.
18. If the load being carried obstructs forward view, the driver shall be required to travel with the load trailing. (Exceptions to this must have the approval of the Safety Department.)
19. Drivers shall look in the direction of travel and keep a clear view.
20. Grades shall be ascended and descended slowly.
21. When ascending or descending grades, loaded forklifts shall be driven with load upgrade
22. On all grades, the load and forks shall be tilted back if applicable, and raised only as far as necessary to clear the road surface.
23. Under all travel conditions, the forklift shall be operated at a safe speed that will permit it to be brought to a stop in a safe manner.
24. Slow down for wet or slippery floors.
25. Backup alarms or horn must be used every time a forklift backs up.

26. Railroad tracks shall be crossed diagonally whenever possible. Parking closer than eight feet from the center of the railroad tracks is prohibited.
27. Smoking, eating, and drinking are prohibited while operating a forklift.
28. No one shall be permitted to ride on forklifts with the operator unless using an approved platform.

29. Do not lift anyone on forklift except with approved platform.
30. Running over loose objects on the roadway surface shall be avoided. This applies to cords, cables, etc.
31. While negotiating turns, speed shall be reduced while turning the steering wheel in a smooth, sweeping motion.
32. Only stable or safely arranged loads shall be handled.
33. Only loads within the rated capacity of the forklift shall be handled. Exceptions to this rule need the approval of the Safety Department.
34. Forks shall be placed under the load as far as possible. The mast must then be tilted back to stabilize the load.
35. Extreme care shall be used when tilting the load forward or backward, particularly when high-tiering. Tilting forward with the forks elevated shall be prohibited except to pick up a load. An elevated load shall not be tilted forward except when the load is in a deposit position over a rack or stack. When stacking or tiering, only enough backward tilt to stabilize the load shall be used.
36. Emergency exits, fire extinguishes, and electrical panels shall not be blocked.
37. Turn off the engine before filling fuel tanks. Spilled fuel should be cleaned up or allowed to evaporate before restarting the engine. When changing the fuel tank of an LP powered forklift, be sure the valve is closed before removing the fuel line. No smoking during refueling
38. Fuel system leaks must be repaired before operating the forklift.
39. Keep open flames away from batteries and fuel tanks. Use a flashlight or dipstick to check battery fluid and gasoline tank levels.
40. Smoking shall be prohibited while charging batteries and repairing of forklifts.
41. Battery covers shall be left open when charging battery powered forklifts.
42. If at any time a forklift is found to be in need of repair, defective, or in any way unsafe, the forklift shall be taken out of service until it has been restored to safe operating condition. If a condition like this exists, notify your supervisor immediately. It will then be his determination as to whether or not the forklift can be safely operated.
43. Forklifts with an inoperable horn must be taken out of service until repaired.
44. Masts on forklifts may only be lowered from beside the forklift when forks are less than two (2) feet above the ground and <u>not</u> loaded.
45. Be sure you know the correct way to connect the battery to the charger. If this is not done properly, it can damage both pieces of equipment.
46. Seat belts must be used while operating a forklift.

Hand & Power Tools

General Requirements:

1. All hand and power tools, whether personal or supplied by Stewart and Tate, must be kept in good, safe condition.
2. Hand and power tools equipped with guards must only be used with the guards in place.
3. Appropriate PPE must be worn when using power tools.
4. Any tools that are found to be defective or unsafe shall be taken out of service immediately.
5. GFCI's must be used at all times

Hand Tools

1. Chisels, punches, and wedges must be replaced if cracked or if the head is mushroomed.
2. Hammers, axes, shovel, and picks must be repaired or replaced if handles are splintered or broken.
3. Handles must be tightly wedged onto a tool.
4. Wrenches shall be replaced if jaws are sprung.
5. Files and rasps should have handles.

Power Tools

1. Electrical tools must be either double-insulated indicated by the "double box" symbol or be properly grounded.
2. Electric Tools shall not be lowered, hoisted, or unplugged by their cords.
3. Electrical cords should be replaced if cracked, broken, or spliced.
4. Electrical tools shall be unplugged from the power source before attempting to service, adjust, remove, or replace any moving parts.
5. GFCI's are required at all times during construction with electrical connections of 15-20 amps.
6. Grinders, saws, and pulleys must have guards in place during operation.
7. Circular saws must have guards above and below the base shoe.
8. Fuel powered tools must be shut down during refueling or tool replacement.

Abrasive Wheel Equipment

1. Grinders must be supplied with sufficient power supply to maintain safe operating speeds.
2. Work rests must be within 1/8" of the wheel.
3. Top tongue must be within 1/4" of the wheel.
4. The maximum RPM of the abrasive wheel cannot exceed the RPM rating of the tool.
5. New wheels must be inspected and tested prior to installation. Spindle nuts and anchors must be reinstalled.
6. Above 75% of the wheel diameter must be guarded and angle of exposure should be less than 90 degrees.
7. Guarding is not required if the entire wheel is within the work being cut or ground

Pneumatic Tools

1. Air operated tools must be positively secured to the air supply.
2. Percussion air tools, such as jackhammers, must have a retainer clip holding bits in place.
3. Air hoses may not be used to hoist tools.
4. Air drivers, such as nailers must be locked such that the tool must be on surface to operate.
5. Compressed air shall not be used for cleaning unless it is less than 30 psi.

Powder-Actuated Tools

1. Only licensed operators may use powder actuated tools.
2. Tools must be locked and stored when not in use.
3. Tools must be unloaded until ready for use.
4. Each tool must have a double-action control for activation. Tool must be in contact with area and a positive action switch must be applied for operation.
5. Use of approved personal protective equipment is mandatory.
6. In the event of a misfire follow these steps:
    a.) Wait 30 seconds then try firing again.
    b.) If it still does not fire, wait an additional 30 seconds before carefully removing the cartridge.

Hazard Communication

The Hazardous Communication Policy was established to ensure that information about the dangers of all hazardous chemicals used by Stewart & Tate, Inc is known by all affected employees. Under this program, you will be informed of the contents of the OSHA Hazard Communication standard, the hazardous properties of chemicals with which you work, safe handling procedures and measures to take to protect yourself from these chemicals.

This program applies to all work operations in our company where you may be exposed to hazardous chemicals under normal working conditions or during an emergency situation. All work units of this company will participate in the Hazard Communication Program. Copies of the Hazard Communication Program are available in the corporate office and jobsites for review by any interested employee. Manager of Health & Safety is the program coordinator, with overall responsibility for the program, including reviewing and updating this plan as necessary.

Container Labeling: Superintendents/Foremen/Warehouse Personnel will verify that all containers received for use will be clearly labeled as to the contents, note the appropriate hazard warning, and list the manufacturer's name and address. Superintendents/Foremen/Warehouse Personnel will ensure that all secondary containers are labeled with either an extra copy of the original manufacturer's label or with labels marked with the identity and the appropriate hazard warning. For help with labeling, see the Manager of Health & Safety. On individual stationary process containers, we are using DOT Placards rather than a label to convey the required information. We are using the following in house labeling system: Labeling maker and permanent marker. The Manager of Health & Safety will review the company labeling procedures annually and will update labels as required. Before beginning work in areas where unlabeled pipes carry chemicals, contact immediate supervisor.

Material Safety Data Sheets (MSDSs): The Manager of Health & Safety is responsible for establishing and monitoring the company MSDS program. He/she will ensure that procedures are developed to obtain the necessary MSDSs and will review incoming MSDSs for new or significant health and safety information. He/she will see that any new information is communicated to affected employees.

The procedure below will be followed when an MSDS is not received at the time of initial shipment: Contact 3 E Company

Copies of MSDSs for all hazardous chemicals to which employees are exposed or are potentially exposed can be accessed by calling 3E Company. MSDSs will be readily available to all employees during each work shift. If an MSDS is not available, contact the Manager of Health & Safety. MSDSs will be readily available to employees in each work area using the following format: via Phone by calling the 3E Company at (800)-451-8346. When revised MSDSs are received, the following procedures will be followed to replace old MSDSs: the 3E Company will update MSDS.

Employee Training and Information: The Manager of Health & Safety is responsible for the Hazard Communication Program and will ensure that all program elements are carried out.

Everyone who works with or is potentially exposed to hazardous chemicals will receive initial training on the hazard communication standard and this plan before starting work. Each new employee will attend a health and safety orientation that includes the following information and training:

- An overview of the OSHA hazard communication standard
- The hazardous chemicals present at his/her work area
- The physical and health risks of the hazardous chemicals
- Symptoms of overexposure
- How to determine the presence or release of hazardous chemicals in the work area
- How to reduce or prevent exposure to hazardous chemicals through use of control procedures, work practices and personal protective equipment
- Steps the company has taken to reduce or prevent exposure to hazardous chemicals
- Procedures to follow if employees are overexposed to hazardous chemicals
- How to read labels and MSDSs to obtain hazard information
- Location of the MSDS file and written Hazard Communication Program

Prior to introducing a new chemical hazard into any section of this company, each employee in that section will be given information and training as outlined above for the new chemical hazard. The employee's immediate supervisor will conduct the training where applicable.

Hazardous Non-routine Tasks: Periodically employees are required to perform non-routine tasks that are hazardous. Example of non-routine tasks: confined space entry

Prior to starting work on such projects, each affected employee will be given information by the supervisor/foreman about the hazardous chemicals he or she may encounter during such activity. This information will include specific chemical hazards, protective and safety measures the employee should use, and steps the company is taking to reduce the hazards, including ventilation, respirators, the presence of another employee (buddy systems), and emergency procedures.

1. Informing Other Employers/Contractors: It is the responsibility of the site supervisor to provide other employers and contractors with information about hazardous chemicals that their employees may be exposed to on a job site and suggested precautions for employees. It is the responsibility of the site supervisor to obtain information about hazardous chemicals used by other employers to which employees of this company may be exposed. Other employers and contractors will be provided with MSDSs for hazardous chemicals generated by this company's operations in the following manner: The Manager of Health & Safety will provide training on how to utilize the 3E Company Program. In addition to providing a copy of an MSDS to other employers, other employers will be informed of necessary precautionary measures to protect employees exposed to operations performed by this company. Also, other employers will be informed of the hazard labels used by the company. If symbolic or numerical labeling systems are used, the other employees will be provided with information to understand the labels used for hazardous chemicals for which their employees may have exposure.
2. List of Hazardous Chemicals: A general list of all known hazardous chemicals used by our employees is attached to this plan. This list includes the name of the chemical, the manufacturer, the work area in which the chemical is used, dates of use, and quantity used.

Further information on each chemical may be obtained from the MSDSs, located in via Phone by calling the 3E Company at (800)-451-8346.

When new chemicals are received: this list is updated (including date the chemicals were introduced) within 30 days. To ensure any new chemical is added in a timely manner, the following procedures shall be followed: 3E Company maintains all MSDS records. The hazardous chemical inventory is compiled and maintained by the 3E Company (800) 451-8346.
Chemicals in Unlabeled Pipes: Work activities are sometimes performed by employees in areas where chemicals are transferred through unlabeled pipes. Prior to starting work in these areas, the employee shall contact Superintendents/Foremen for information regarding:

- The chemical in the pipes
- Potential hazards
- Required safety precautions.

Program Availability: A copy of this program will be made available, upon request, to employees and their representatives.

Chemical Information List

Company Name: _____

Business Address: _____

Workplace Address:
(if different than business)
_____

Contact Person: _____

Phone #: 717-771-3506

Title: Manager of Health & Safety

Date of Preparation or Revision: _____

Common Name	Chemical Name	Work Area	Date added to list
Anti-freeze	Ethylene glycol, Diethylene glycol, Potassium 2-ethylhexanoate		
Asphalt	Asphalt (hot liquid), Crystalline silica (quartz), other particulates		
Diesel Fuel	1,2,3 TRIMETHYLBENZENE, 1,2,4-TRIMETHYLBENZENE, 1,3,5 TRIMETHYLBENZENE, AROMATIC HYDROCARBONS, BENZENE, M-XYLENE, Naphthenes, Nonane, Octane, O-xylene, P-xylene, Toluene		
Diesel Fuel Treatment	Stoddard solvent, 1,3,5 Trimethylbenzene, Xylene, 1,2,4 Trimethylbenzene		
Fuel treatment	Stoddard solvent, Naphtha petroleum, Methyl hexyl alcohol		
Gasoline	Gasoline, Butane, Pentane, n-Hexane, Hexan, Benzene, N-heptane, Ethylbenzene, Xylene, Cyclohexane, Trimethylbenzene, Methyl-t-butyl ether, Toluene, Ethyl-t-butyl ether, t-amyl-methyl-ether, Ethanol		
Grease - Tube			
Oil - Hydraulic	Lubricant Base oil (petroleum) VARIOUS, Additives PROPRIETARY, Zinc compound PROPRIETARY		
Oil - Motor	Lubricant Base oil (petroleum) VARIOUS, Additives PROPRIETARY, Zinc compound PROPRIETARY		
Paint - Marking	Hydrocarbon Propellant, Hexane, Aliphatic Petroleum Distillates		
Penetrating oil	Aliphatic Petroleum Distillates, Petroleum Base Oil, LVP Hydrocarbon Fluid, Carbon Dioxide		
Pipe Compound (soap)	Magnesium Oxide fume, Graphite, Magnesium Chloride, Calcium Carbonate, Starch Gum		
PVC Cement	Methyl Ethyl Ketone, Tetrahydrofuran, Acetone, PVC Resin, Cyclohexanone		
PVC Cleaner / primer	Acetone, Methyl Ethyl Ketone, Tetrahydrofuran, Cyclohexanone		
Starter fluid	Carbon dioxide, Mixed isomeric heptanes, Oxybisethane		
Teflon Dope			
Transmission Fluid	Lubricant Base oil (petroleum) VARIOUS, Additives PROPRIETARY		
Two-Cycle Oil	Hydrotreated distillates, Petroleum, Solvent-refined heavy paraffinic, Solvent REFINED RESIDUUM		
WD-40	Aliphatic Petroleum Distillates, Petroleum Base Oil, LVP Hydrocarbon Fluid, Carbon Dioxide		

Heavy Equipment

General Requirements:

These rules apply to the following types of earthmoving equipment: scrapers, loaders, crawler or wheel tractors, bulldozers, off-highway trucks, graders, agricultural and industrial tractors, and similar equipment. **Only qualified individuals shall operate any machinery or equipment.**

Use of cell phones or headphones of any kind is prohibited while equipment is moving or operating.

Under no circumstances, shall anyone ride, hang, or work from a bucket or similar equipment, including hanging on the steps or ladder of machinery while in operation.

Operating equipment on public roads shall be for the purposes of business use only and not for personal reasons.

Horseplay with any equipment will not be tolerated and could result in immediate termination.

Seatbelts

1. Seat belts shall be provided on all equipment covered above. Or,
2. Seat belts are not required for equipment which is designed only for standup operation.
3. Seat belts are not required for equipment which does not have roll-over protective structure (ROPS) or adequate canopy protection.
4. Equipment is designed to carry as many passengers as there are seatbelts.

Daily Inspections

1. All machinery and equipment shall be inspected prior to use to ensure safe operation.
2. Any defects or malfunctions that would prevent the equipment from being operated in a safe manner shall be taken out of service immediately.

Brakes

1. All earthmoving equipment mentioned in this 1926.602(a) shall have a service braking system capable of stopping and holding the equipment fully loaded, as specified in Society of Automotive Engineers SAE-J237, Loader Dozer-1971, J236, Graders-1971, and J319b, Scrapers-1971.
2. All parked equipment shall have the parking brake set.
3. Equipment parked on an incline shall have the wheels chocked and the parking brake set.

Rollover protective structures (ROPS)

1. This section applies to the following types of material handling equipment: To all rubber-tired, self-propelled scrapers, rubber-tired front-end loaders, rubber-tired dozers, wheel-type agricultural and industrial tractors, crawler tractors, crawler-type loaders, and motor graders, with or without attachments, that are used in construction work.
2. Material handling machinery described above and manufactured on or after September 1, 1972, shall be equipped with rollover protective structures.

Audible Alarms

1. All bidirectional equipment shall be equipped with a horn, distinguishable from the surrounding noise level, which shall be operated as needed when the machine is moving in either direction.
2. No employer shall permit earthmoving or compacting equipment which has an obstructed view to the rear to be used in reverse gear unless the equipment has in operation a reverse signal alarm distinguishable from the surrounding noise level or an employee signals that it is safe to do so.

Access and Egress from Equipment

1. Climb into and out of equipment by steps or ladders provided on the machine.
2. Do not jump out of equipment when exiting
3. Accessing or exiting equipment while it is moving is strictly prohibited.
4. Always use three points of contact.

Access Roadways and Grades

1. No construction equipment or vehicles shall be moved upon access roadway or grade unless the access roadway or grade is constructed and maintained to accommodate the movement of the equipment and vehicles in a safe manner.
2. Every emergency access ramp and berm used by an employer shall be constructed to restrain and control runaway vehicles.

Hot Work

Purpose
To provide safe procedures and guidance for welding, cutting, grinding and any other activity that result in sparks, fire, molten slag, or hot material, that has the potential to cause personal injury, fire, or explosions.

Hot Work Permit
A permit is required in operations involving heat, flame, or spark when the degree of a fire hazard is above normal due to the possible presence of flammable liquids, vapors, gases, and combustible materials. The permit shall be started prior to starting any hot work and then signed when the hot work is completed.

Arc Welding and Cutting

1. Any current carrying parts passing through the portion of the holder, which is held in hand, and the outer surfaces of the jaws of the holder, shall be fully insulated against the maximum voltage encountered to ground.
2. All welding cables and connectors shall be of the flexible type and fully insulated and capable of handling the maximum current requirements of the work in progress.
3. Welding leads must be free of repair or splice within 10 feet of the stinger.
4. A ground return cable shall have a safe current carrying capacity equal to or exceeding the specified maximum output of the welding machine it is servicing.
5. Pipelines containing gases or flammable liquids, or electrical conduits, shall not be used as a ground return.
6. When electrode holders are left unattended, the electrodes shall be removed and the holder shall be placed as to prevent accidental contact with employees or conducting objects.
7. Hot electrode holders shall be kept away from water.
8. When the welder will be away from the electrode holder for any amount of time, such as breaks, or when the machine is to be moved, the power must be turned off.
9. Whenever possible, all welding or cutting operations shall be shielded to protect employees and other persons in the area from the flash of the arc.
10. When possible, welding or cutting should be done in a designated area free of combustible materials. If the object to be cut or welded cannot be moved, all combustibles shall be relocated to at least 35 feet from the work site and actions must be taken to contain the release of hot slag, sparks, and flames.
11. Suitable fire extinguishing equipment shall be immediately available and ready for use instantly.
12. When the welding, cutting or heating operation is such that normal fire prevention precautions are not sufficient, a fire watch shall be posted while the actual hot work is being conducted and for a 30 minute period afterward to ensure that no possibility of fire exists.
13. The fire watch must be aware of any anticipated fire hazards and how the fire fighting equipment operates.
14. At no time shall the fire watch leave the area or work on something else in the area at the same time.

15. Prior to applying heat to any drum, container, or hollow structure, a vent or opening shall be provided to allow the release of any built-up pressure during the hot work operation.
16. Ventilation shall be provided whenever hot work is conducted within a confined space.
17. Hot work in any enclosed space involving the following metals shall be performed with general mechanical or local exhaust ventilation:
    a.) Zinc bearing base or filler metals or metals coated with zinc bearing materials.
    b.) Cadmium bearing filler metals
    c.) Chromium bearing metals or metals coated with chromium bearing materials.
18. Hot work in any enclosed space involving the following metals shall be performed with local exhaust ventilation or employees shall be protected by air supplying respirators:
    a.) Metals containing lead or metals coated with lead bearing materials.
    b.) Cadmium bearing or cadmium coated base metals.
    c.) Metals coated with mercury bearing metals.
    d.) Beryllium containing base or filler metals because of its high toxicity, hot work operations should be performed with both local exhaust ventilation and air supplied respiratory protection
19. Employees performing such operations in the open air shall be protected by air purifying respirators with appropriate filters. Other employees or persons exposed to the same hazards shall be given the same protection.

Gas Welding and Cutting

1. The following rules apply to transporting, moving, and storing compressed gas cylinders regardless of their contents or whether they are full or empty.
2. Valve protection caps shall be in place and secured when cylinders are not in use.
3. Cylinders shall be moved by tilting them and rolling them on their bottom edges. They shall not be intentionally dropped, struck, or permitted to strike each other.
4. When cylinders are transported by a powered vehicle, they shall be secured in an upright position.
5. Unless cylinders are firmly secured on a cart specifically designed for carrying cylinders, regulators shall be removed and valve protection caps replaced before cylinders can be moved.
6. A suitable cylinder truck, chain, or other means shall be used to prevent cylinders from falling over during use.
7. When work is finished, when cylinders are empty, or when cylinders are moved at any time, the cylinder valve shall be closed.
8. Compressed gas cylinders shall be secured in an upright position at all times.
9. Oxygen cylinders in storage shall be separated from fuel-gas cylinders or combustable materials a minimum distance of 20 feet or by a noncombustible barrier at least 5 feet high with a fire resistance rating of at least 30 minutes.
10. Inside of buildings, cylinders shall be stored in well ventilated, well protected locations at least 20 feet from highly combustible materials. Assigned storage areas shall be located away from elevators and stairways. Storage areas shall also be located where cylinders will not be knocked over, damaged by passing or falling objects or tampered with by unauthorized personnel.

Housekeeping Program

Good housekeeping is a necessary requirement for maintaining safety at construction sites. Clean and tidy work sites hold fewer hazards for all employees. Accidents and injuries are avoided and productivity improved where good housekeeping is a daily occurrence.

Good housekeeping is possibly the most visible evidence of management and employee concern for safety and health that a company displays on a day-to-day basis. Orderliness in our workplace contributes to a safe working environment by minimizing obstacles and potential safety and health threats such as:

1. Prevents accidents – slips, trips, and falls
2. Prevents fire
3. Saves time
4. Increases production
5. Gives our workers the freedom to move
6. Gives our workers pride
7. Protects our products and equipment
8. Reduces our waste

Housekeeping Procedures

Office Trailers and Company Vehicles

1. Shall be maintained in a clean orderly fashion to promote company image

Storage and Scrap Areas

1. During the course of construction, alteration, or repairs, form and scrap lumber with protruding nails, and all other debris, must be kept cleared from work areas, passageways, and stairs, in and around buildings or other structures.
2. Combustible scrap and debris must be removed at regular intervals during the course of construction.
3. Garbage and other waste must be disposed of at frequent and regular intervals.

Open Yard Storage Housekeeping Procedures

1. Combustible materials must be piled with due regard to the stability of piles and in no case higher than 20 feet.
2. Driveways between and around combustible storage piles must be at least 15 feet wide and maintained free from accumulation of rubbish, equipment, or other articles or materials. Driveways must be so spaced that a maximum grid system unit of 50 feet by 150 feet is produced.
3. The entire storage site must be kept free from accumulation of unnecessary combustible materials. Weeds and grass must be kept down and a regular procedure provided for the periodic cleanup of the entire area.
4. When there is a danger of an underground fire, that land must not be used for combustible or flammable storage.
5. Method of piling must be solid wherever possible and in orderly and regular piles. No combustible material may be stored outdoors within 10 feet of a building or structure.

Indoor Storage Housekeeping Measures

1. Storage may not obstruct, or adversely affect, means of exit.
2. All materials must be stored, handled, and piled with due regard to their fire characteristics.
3. No compatible materials, which may create a fire hazard, must be segregated by a barrier having a fire resistance of at least 1 hour.
4. Material must be piled to minimize the spread of fire internally and to permit convenient access for firefighting. Stable piling shall be maintained at all times. Aisle space shall be maintained to safely accommodate the widest vehicle that may be used within the building for firefighting purposes.
5. Clearance of at least 36 inches must be maintained between the top level of the stored material and the sprinkler deflectors.
6. Clearance must be maintained around lights and heating units to prevent ignition of combustible materials.
7. A clearance of 24 inches must be maintained around the path of travel of fire doors unless a barricade is provided, in which case no clearance is needed. Material must not be stored within 36 inches of a fire door opening.

   Note: Flammable and combustible substance storage is not allowed in office areas UNLESS it is required for maintenance and operation of building and operation of equipment.

Aisles, Walkways, and Floor

1. Provide sufficient safe clearances and access to any and all work stations and work areas, fire aisles, fire extinguishers, fire blankets, electrical disconnects, safety showers, other emergency aids, doors, and access to stairways.
2. Clearly mark to distinguish walkways from areas not for pedestrian traffic.
3. Keep aisles and walkways free of physical obstructions that would prevent access, including path-blocking objects, liquid or solid spills, and other obstructions.
4. Keep aisles at least 3 feet wide where necessary for reasons of access to doors, windows, or standpipe connections.
5. Keep stairs clean, dry, and free of waste, well lit, and provided with adequate hand rails and treads that are in good condition.
6. Keep floors clean; dry (dry as possible); slip-resistant; and free of waste, unnecessary material, oil and grease, protruding nails, splinters, holes, or loose boards.
7. Provide an adequate number of waste receptacles at accessible locations throughout all work areas.

Ladder and Stairwell Safety

This policy applies to all stairways and ladders used in construction, alteration repair (including painting and decorating), and demolition workplaces, and also sets forth, in specified circumstances, when ladders and stairways are required to be provided.

General Requirements:

1. A stairway or ladder shall be provided at all personnel points of access where there is a break in elevation of 19 inches (48 cm) or more, and no ramp, runway, sloped embankment, or personnel hoist is provided
2. Two or more separate ladders shall be provided when ladders are the only mean of access or exit from a working area for 25 or more employees.

Stairways

1. Stairways that are not a permanent part of the structure on which construction work is being performed shall have landings every 12 feet or less of vertical rise.
2. Riser height and tread depth shall be uniform within each flight of stairs, including any foundation structure used as one or more treads of the stairs. Variations in riser height or tread depth shall not be over 1/4-inch in any stairway system.
3. Except during stairway construction, foot traffic is prohibited on stairways with pan stairs where the treads and/or landings are to be filled in with concrete or other material at a later date, unless the stairs are temporarily fitted with wood or other solid material at least to the top edge of each pan
4. Stairways having four or more risers or rising more than 30 inches, whichever is less shall be equipped with at least one handrail.
5. Stair rails shall be not less than 36 inches from the upper surface of the stairrail system to the surface of the tread, in line with the face of the riser at the forward edge of the tread.
6. Midrails, when used, shall be located at a height midway between the top edge of the stairrail system and the stairway steps.
7. Unprotected sides and edges of stairway landings shall be provided with guardrail systems.

Ladders

1. When portable ladders are used for access to an upper landing surface, the ladder side rails shall extend at least 3 feet above the upper landing surface to which the ladder is used to gain access;
2. Ladders shall be maintained free of oil, grease, and other slipping hazards.
3. Ladders shall not be loaded beyond the maximum intended load for which they were built, nor beyond their manufacturer's rated capacity
4. When ascending or descending a ladder, the user shall face the ladder.
5. Each employee shall use at least one hand to grasp the ladder when progressing up and/or down the ladder.
6. An employee shall not carry any object or load that could cause the employee to lose balance and fall.

7. Portable ladders with structural defects, such as, but not limited to, broken or missing rungs, cleats, or steps, broken or split rails, corroded components, or other faulty or defective components, shall either be immediately marked in a manner that readily identifies them as defective, or be tagged with "Do Not Use" and shall be withdrawn from service until repaired. Employees finding ladders with any of these conditions must report them to Small Tools Manager, Shop Manager, and/or Safety Director. Improvised repairs may not be made.
8. Ladders shall not be moved, shifted, or extended while occupied.
9. The top platform or top step of a stepladder shall not be used as a step. Good rule of thumb – your knees should never be above the top platform.
10. Cross-bracing on the rear section of stepladders shall not be used for climbing unless the ladders are designed and provided with steps for climbing on both front and rear sections.
11. Ladders shall be inspected by a competent person for visible defects on a periodic basis and after any occurrence that could affect their safe use. Ladders will be maintained in good usable condition at all times.
12. Frayed or badly worn rope will be replaced.
13. Portable rung and cleat ladders will be used at such a pitch that the horizontal distance from the top support to the foot of the ladder is one-quarter of the working length of the ladder (the length along the ladder between the foot and the top support).
14. The ladder will be so placed as to prevent slipping, or it will be lashed, or held in position. The ladder base section must be placed with a secure footing.
15. The top of the ladder must be placed with the two rails supported, unless equipped with a single support attachment.

Ladders will not be:
Placed on boxes, barrels, scaffolds (unless authorized by company safety professional), or other unstable bases to obtain additional height. In addition, they may not be tied or fastened together to provide longer sections.

Lock-out / Tag-out Procedures

Purpose

This procedure establishes the minimum requirements for controlling hazardous energy whenever maintenance or repair is done on machinery at construction sites. It is used to ensure that the machine or equipment is stopped, isolated from all potentially hazardous energy sources and locked out before employees perform any servicing or maintenance where the unexpected energization or start-up of the machine or equipment or release of stored energy could cause injury.

Authorized and Affected Employees

Authorized employee: Is a person who locks out or tags out machines or equipment in order to perform servicing or maintenance on that machine or equipment. An affected employee becomes an authorized employee when that employee's duties include performing servicing or maintenance covered under this section.

Affected Employee: An employee whose job requires him/her to operate or use a machine or equipment on which servicing or maintenance is being performed under lockout or tagout, or whose job requires him/her to work in an area in which such servicing or maintenance is being performed.

Machinery and Equipment

All machinery and equipment that is energized by one of the following sources falls under the Control of Hazardous Energy Standard and shall be locked or tagged out when servicing: hydraulic, pneumatic, electrical, or mechanical.

Lockout is the preferred method of isolating machines or equipment from energy sources. Tagout is to be performed instead of lockout only when there is no way to lockout a machine.

Lockout/Tagout Procedures

1. Notify all affected employees that a lockout or tagout system is going to be utilized and the reason why. The authorized employee shall know the type and magnitude of energy that the machine or equipment utilizes and shall understand the hazards thereof.
2. If the machine or equipment is operating, shut it down by the normal stopping procedure. This is usually done by depressing stop button, open toggle switch, etc. In addition, ensure that all stored energy is dissipated or properly restrained.
3. Operate the switch, valve, or other energy isolating device(s) so that the equipment is isolated from its energy source(s). Stored energy such as the springs, elevated machine members, rotating flywheels, hydraulic systems, and air, gas, steam, or water pressure, etc. must be dissipated or restrained. Combinations of these energy sources and any stored energy will require specific procedures.
4. Lockout, block out and/or tagout device application:
    a.) Locks, blocks and tags shall be affixed to each energy-isolating device only by an “authorized” employee.
    b.) Locks and tags shall be singularly identified.
    c.) Locks shall be affixed in a manner that will hold the energy-isolating device in a safe or off position.

d.) Tags, when used, shall be affixed in a manner that will clearly indicate that the operation or movement of the energy isolating device from the "safe" or "off" position is prohibited.
e.) Tags that cannot be affixed directly to the energy isolating device shall be located as close as safely possible to the device, in a position that will be immediately obvious to anyone attempting to operate the device.
f.) All potentially hazardous stored or residual energy shall be relieved, disconnected, restrained or otherwise rendered safe. If there is a possibility of re-accumulation of stored energy to a hazardous level, verification of isolation shall continue until the possibility of accumulation no longer exists. Stored energy may require blocks, blinds, flanges, etc. in order to appropriately control stored energy.
g.) After ensuring that no personnel are exposed, as a check on having disconnected the energy sources, operate the push button or other normal operating controls to make certain the equipment will not operate
h.) The equipment is now locked out or tagged out.

Testing or Positioning of Machines, Equipment, or Components thereof

In situations which lockout, blockout, or tagout devices must be temporarily removed from the energy isolating device and the machine or equipment energized to test or position the machine, equipment or component thereof, the following sequence of actions shall be followed:

Clear the machine or equipment of tools and materials.

1. Remove employees from the machine or equipment area.
2. Remove the lockout or tagout devices.
3. Energize and proceed with testing or positioning.
4. De-energize all systems and reapply energy control measures in accordance with the requirements set forth in this instruction.

Restoring Machines or Equipment to Normal Production Operations

After the servicing and/or maintenance is complete and equipment is ready for normal production operations, check the area around the machines or equipment to ensure that no one is exposed.

After all tools have been removed from the machine or equipment, guards have been reinstalled and employees are in the clear, remove all lockout or tagout devices. Operate the energy isolating devices to restore energy to the machine or equipment.

Company Vehicles

At the discretion of the President of S&T, Company-owned vehicles may be issued to selected employees for business purposes and for limited/reasonable personal use.

Driver Responsibilities

Employees assigned a Company-owned vehicle are responsible for driving their vehicle in a safe and courteous manner. Employees must know and abide by all driving laws and regulations in areas where they operate the vehicles. Employees must maintain a valid driver's license for the state in which they are a resident. If an employee's driver's license is suspended, restricted, or revoked for any reason, it is *mandatory* that the employee notify S&T's Health & Safety Manager immediately.

Safety Guidelines

1. All vehicles are to be inspected daily for visual defects/malfunctions that are likely to affect the safe operation of the vehicle.
2. Parking brakes must be set when a vehicle is parked.
3. If rear view is obstructed, the vehicle must have a backup alarm.
4. No modifications to motor vehicles are permitted unless approved by the manufacturer.
5. Mud flaps must be attached to tractors and trailers when moving on roadways.
6. Loose materials, tools, supplies, and cargo must be secured to avoid loosing the material or having it fall from the bed.
7. Report any vehicle defects to maintenance so it can be repaired promptly.

It is mandatory that the driver and all occupants of a Company-owned vehicle use seat belts at all times, *without exception*. It is the employee's responsibility to ensure that all occupants fasten their seatbelts prior to riding in any Company vehicle. All malfunctioning seat belts must be repaired as soon as possible and must not be used until appropriate repairs are made.

All employees are expected to drive defensively during business and personal travel and to obey all applicable traffic laws and regulations. Driving under the influence of drugs or alcohol, including prescription drugs that may impair the operator's driving ability is strictly forbidden.

All traffic violations received while operating a Company-owned vehicle must be reported to the Health & Safety Manager immediately. Fines associated with traffic violations will be paid by the employee and are not the responsibility of S&T. Any employee who is charged with three (3) moving violations and/or a combination of three (3) moving violations/accidents within a three (3) year period may be prohibited from operating a Company-owned vehicle. Also, an employee found guilty of a violation associated with alcohol and/or drug use will be prohibited from driving a Company-owned vehicle.

Company-owned vehicles should not be used to transport dangerous materials such as flammables, illegal substances, or other hazardous items. Further, unless originally outfitted

with a dealer-installed towing hitch, no Company vehicle will be used for towing unless written permission is received to install a hitch. Only trailers owned by the company may be pulled by a company vehicle, unless prior approval has been given by Health & Safety Manager or executive management.

Employees will adhere to the Company Mobile Telephone and PDA Usage Policy while operating a Company-owned vehicle.

Should you be involved in an accident while driving a Company-owned vehicle, refer to the Company's Accident/Injury Reporting Procedure for the proper procedures to follow.

Questions regarding this policy should be directed to the Safety Department.

OSHA Inspections

This section contains general information about the inspection process from different regulatory agencies governing worker safety. Employees should be aware of the inspection procedures of these agencies. Work performed in Pennsylvania is governed by the federal Occupational Safety and Health Administration (OSHA). Work performed in Maryland is governed by the Maryland Occupational Safety and Health Administration (MOSH). Work performed on mine properties is governed by the Mine Safety and Health Administration (MSHA).

Due to frequently occurring OSHA / MOSH inspections on construction projects, several key points need to be identified to ensure proper steps are taken prior to and during an inspection.

Inspections

What triggers an inspection?
OSHA can initiate an inspection for various reasons. Inspections are conducted according to the following priority schedule which are:

1. Imminent Danger – OSHA's highest priority
    a) Imminent danger is a situation that is likely to cause death or serious injury.
    b) If a compliance officer witnesses any situation they consider to imminent danger to workers, they have the right to initiate an inspection
2. Fatalities or Catastrophes – Second priority
    a.) A catastrophe is a work-related incidents resulting in the death of an employee or in-patient hospitalization of three (3) or more employees.
    b.) The employer must orally report such incidents in person or by phone to OSHA within 8 hours of the incident.
3. Employee complaints
    a.) OSHA responds to every complaint they receive.
    b.) Serious allegations may result in on site inspections.
4. Referrals from other agencies
5. Follow up inspections

Focused Inspection Program
OSHA's focused inspection program was created to focus on the major hazards in the construction industry. The program allows for limited scope inspections for employers with a strong safety and health program.
The program focuses on the 4 main hazards in construction:

1. Fall Hazards
2. Caught in/between hazards
3. Struck by hazards
4. Electrical hazards

A focused inspection is usually much quicker than a comprehensive inspection. To qualify for a focused inspection we as employer must do two things. First, we must have evidence of a safety and health program that complies with all of OSHA's General Safety and Health requirements and each project must have a competent person who conducts frequent and regular inspections of the job site.

Inspection Procedures

Opening Conference: An inspector will show up on a job site unannounced. Before the actual inspection begins, the inspector will hold an opening conference. Call the Safety Manager as soon as the inspector is on site.

The inspector should introduce him/herself and show identification. If one is not offered, ask for a business card. The inspector should state the reason for the inspection. If they do not, ask them for a reason. Also ask if the inspection will be a comprehensive or focused inspection. If it is not a focused inspection ask why it will not be. The opening conference sets the tone for the actual inspection, so be courteous and professional.

Actual inspection: A Superintendent or foreman should accompany the inspector during the walk around inspection. The inspector may do any of the following;

1. Inspect the work area and equipment for unsafe conditions mainly looking for fall hazards, electrical hazards, struck by, and caught in between hazards.
2. Ask questions of workers pertaining to safety and job knowledge.
3. Take pictures or videos.

Closing conference: This will be held after the actual inspection is complete. The inspector may choose to do this separately with each contractor or as a group. The inspector will notify you of your rights and responsibilities after an OSHA inspection and any citations they will propose. Citations will be sent in the mail in the days or weeks following the inspection. At that point the safety department can appeal the citation to have them reduced or withdrawn.

Employee Behavior during an Inspection:

1. All employees shall be cooperative with the inspector. All statements should be factual and accurate. Do not volunteer information or recommend areas that should be inspected.
2. Any records such as accident or training shall be shown upon request, but no copies will be provided without approval from the Safety Department.
3. The inspector shall be accompanied by the foreman at all times.
4. During the inspection, detailed notes should be taken pertaining to areas of concern.
5. The inspector has the right to take pictures and measurements, thus the foreman should do the same to document any items that are in question. Also, document the names of any workers the inspector interviews.
6. All hazards shall be corrected immediately. Corrections done while the inspector is on site and documented by the inspector by either picture or note can possibly reduce the citation.
7. Any corrective action that was taken care of immediately shall be documented.
8. Do not argue, shout, ignore, or disrespect the inspector even if you don’t agree with him.
9. Pay attention and stay positive.

Personal Protective Equipment (PPE)

PPE Specific Information

Eye and Face Protection – Safety glasses, goggles and face shields
It is the policy of the company that as a condition of employment, whether full time, part time, or temporary, all employees working in designated work areas and/or job assignments are required to wear ANSI approved safety glasses, goggles/face shields to help prevent eye and face injuries, including but not limited to those resulting from flying particles, molten metal, liquid chemicals, acids or caustic liquids, chemical gases or vapors, or light radiation, for example.

Employees are required to wear eye protection while working around machines, equipment, power tools and operations that present the potential for injury. All employees required to wear safety glasses and/or goggles/face shields must routinely inspect and properly care for their goggles/face shields.

Stewart and Tate, Inc. will provide the necessary eye and face protection at no cost to employees with the exception of prescription safety glasses. Partial reimbursement is offered to employees who purchase prescription safety glasses.

S&T will reimburse the employee up to $120.00 per pair of prescription safety glasses biennially; said amount may be adjusted on an annual basis by the Company at its discretion. The manager will be responsible for determining eligibility.

Employees must purchase ANSI approved safety frames and lenses with side shields. The employee will present a purchase receipt from the optician to the Manager. That purchase receipt will be forwarded to the HR Department, along with the reimbursement form signed by an authorized manager. Reimbursement will be added to the employee's paycheck.

Foot Protection-Safety Shoes
It is the policy of the company that as a condition of employment, whether full time, part time, or temporary, all employees are required to wear steel toe, composite toe, and/or metatarsal safety shoes with leather over the ankle to help prevent foot injuries, ankle injuries, slips, and falls. The safety shoes must meet ANSI Standards (Z41.1-1967).

Boots with soles not firmly attached to the leather, worn out to the point that there are visible holes in the sole or the leather is ripped to the point that any part of your foot is exposed, is not permissible. Failure to comply will result in disciplinary action. The company does not provide reimbursement for safety footwear.

Hand Protection -- Gloves
It is the policy of the company that as a condition of employment, whether full time, part time, or temporary, all employees working in designated work areas and/or job assignments are required to wear gloves to help prevent hand injuries. This shall include, but not limited to, cuts, punctures, burns, and electrical or chemical hazards.

All employees who work in designated work areas and/or job assignments that have the potential

for injury are responsible for wearing company provided gloves to comply with this policy. Failure to comply will result in disciplinary action.
All employees required to wear protective gloves must routinely inspect and properly care for their assigned gloves (if the gloves are not disposable).

Head Protection -- Hard hats
It is the policy of the company that as a condition of employment, whether full time, part time, or temporary, all employees working on construction jobsites shall wear hard hats at all times. Employees seated inside vehicles or in fully enclosed mobile equipment (i.e. windows and doors) are not required to wear a hard hat, but must have it in the cab with them at all times to be donned upon exit. Hardhats shall meet the specifications contained in ANSI, Z89.1-1969.
Bump caps are not acceptable alternatives for hard hats.
Hard hats are to be worn in compliance with manufacturer recommendations and cannot be modified in any way. This includes wearing hardhats backwards when not approved by the manufacturer.
Baseball style caps may not be worn under hard hats at any time.
All employees who work on construction jobsites are responsible for wearing company provided hard hats to comply with this policy. All employees required to wear hard hats must routinely inspect and properly care for their hard hats and shall be worn in accordance with the manufacturer's recommendations. Hard hats must be removed from service after 5 years of initial use**.**

Hearing Protection
It is the policy of the company that as a condition of employment, whether full time, part time, or temporary, all employees working in designated work areas and/or job assignments where there is excessive noise levels or duration of exposures to those specified in the table below, Permissible Noise Exposures, hearing protection devices shall be provided and used.

PERMISSIBLE NOISE EXPOSURES

Duration per day, hours	Sound level dBA slow response
8	90
6	92
4	95
3	97
2	100
1 1/2	102
1	105
1/2	110
1/4 or less	115

When employees are subjected to sound levels exceeding those listed in the table above, feasible administrative or engineering controls shall be utilized. If such controls fail to reduce sound

levels within the levels of the table, personal protective equipment shall be provided and used to reduce sound levels within the levels of the table. Plain cotton is not acceptable hearing protection.

Clothing – Outerwear
All employees are required to wear full length pants and shirts that cover at least the top of the shoulder. Note: Some customers require that shirts have at least a 3inch sleeve.
Clothing that is excessively loose, baggy, ragged, or torn is not permitted.
Note: Some customers do not allow hooded garments.

Respiratory Protection - See Respiratory Protection policy.

Cleaning and Maintenance
It is important that all PPE be kept clean and properly maintained by the employee to whom it is assigned. Cleaning is particularly important for eye and face protection where dirty or fogged lenses could impair vision. PPE is to be inspected, cleaned, and maintained by employees at regular intervals as part of their normal job duties so that the PPE provides the best protection. If a piece of PPE is in need of repair or replacement it is the responsibility of the employee to bring it to the immediate attention of his or her supervisor, the dispatcher, or the Safety Manager. It is against work rules to use PPE that is in disrepair or not able to perform its intended function.

Note: Some customer's policies are stricter regarding PPE. Make sure you know the customers rules prior to arriving at the job site.

Personnel Lifts

AERIAL OR ARTICULATING BOOM

Aerial lifts come in a variety of sizes and help to make a difficult job easier. Lifts used improperly and recklessly could result in serious injuries or costly damages. Since lifts are normally used around other workers, safety precautions must be taken.

When operating these units the following should be observed:

1. The operator must be trained and authorized to operate the unit.
2. The operator is responsible for the safe operation of the unit.
3. Inspect the unit prior to each use.
4. Know the lift you are using and never exceed its capacity.
5. **Head protection is required** by all personnel on the lift and those working below it.
6. Look around and make sure you have proper clearances.
7. Keep aware of power lines and take into consideration swaying and rocking.
8. Be aware of obstacles in your path.
9. Retract outriggers before moving.
10. Take precautions to avoid tipping, operate a lift on solid surfaces.
11. The use of a full body harness is required before operating a lift and proper anchorage, (not outside the lift) is required.
12. A **full body harness is required** even when the unit is being moved from one position to another.
13. **Never climb on safety rails**.
14. Keep platforms clear of ice, snow, and other slippery conditions.
15. Keep the platform free of debris, unused tools, and materials.
16. **Never stand on anything inside the lift**; this will put you above the protected safety rails.
17. Never push or pull the lift with any other type of equipment or machinery.
18. Shut off all power before performing any type of maintenance work (lockout/tagout).
19. Always use three points of contact when climbing on or off the unit.

SCISSOR LIFTS

Any lift that stays within the width of the wheel-base is considered a scissor lift.

Here are the regulations for this type of lift:

1. The operator must be trained and authorized to operate the unit.
2. The operator is responsible for the safe operation of the unit.
3. Inspect the unit prior to each use.
4. Know the lift you are using and never exceed its capacity.
5. **Head protection is required** by all personnel on the lift, and those working below the lift.
6. Stay within the safety rails and **never climb on safety rails**.
7. Never stand on anything inside the lift, or build platforms on the lift.
8. Keep platforms clear of ice, snow, and other slippery conditions.
9. Keep the platform free of debris, unused tools, and materials.
10. The safety chains, bars or gate at the entrance area must be closed at all times.
11. Always be aware of the surface you are driving on and all obstacles and employees around you (communicate to others on/working around the lift before moving it).

Preparedness, Prevention, and Contingency Plan

Stewart & Tate, Inc. transports road oils, such as bituminous emulsion, and plant-mixed asphalt paving materials to various job sites within a 50-mile radius of York, Pennsylvania. The oils are transported in bulk tankers usually hauling 5,500 gallons or less. Plant-mixed asphalt paving material is hauled in dump trucks, tri-axles, or dump trailers to their appropriate weight class.

Spills may occur due to leaks in a tank, truck body, or gate. Valve leaks on bulk trailers can occur when not closed properly or if valve seats or gaskets fail. The most probable leak will occur if a trailer valve or dump gate is intentionally opened as an act of vandalism. Small spills can occur during loading or unloading of product. A vehicle accident during transport could result in the release of material.

In order to prevent accidental or intentionally malicious spills of emulsion from tankers, the tanker valves must be locked at all times when not in actual use. If the tanker is left unattended at any time, the valve must be locked. All Stewart & Tate tanker valve locks do not accept EC2 or master keys, but only special keys issued by the Equipment Manager. These keys will be issued only to those requiring access to the tankers and the Equipment Manager will maintain a list of individuals having keys.

The oils and paving products are usually shipped hot to enhance their ability to flow. In their cured state, or cold, the flow is greatly reduced and the spill potential is minimal. Spilled material will not travel far from the site. This type of heavy material also tends to pool as it cools. The product does emit noxious fumes but is considered non-toxic. Heated product may result in thermal burns.

Small spills should be cleaned up promptly. Sand, dirt, clay media, or absorbent material should absorb oils. Asphalt should be shoveled into a pile and removed. Absorbents should be applied to puddles to help reduce shipping hazards or tracking of material from the site.

Large spills should follow the emergency procedures below:

1. Survey the scene to be sure it is safe for you to enter. Keep other workers or pedestrians out of the area.
2. Stop traffic from entering spill site. Even a minor spill can be made worse by vehicles spreading the material.
3. Attempt to stop the leak at the source by closing the valve, plugging the hole or lowering the dump bed.
4. Notify the foreman immediately or if alone, call the dispatcher or operator at the shop.
5. Use dirt, sand, road debris or whatever is nearby to contain leaked material. If available, use spill containment supplies or support equipment, such as a backhoe.

In the event of a spill, contact these individuals in the following order:

1. Emergency Response/Fire/Police via 911
2. Dispatcher, who will determine the need to make additional contacts
3. The Fleet Manager or Maintenance Supervisor who serve as spills Managers if needed
4. National Response Center for major spills: 1-800-424-8802, (Large spills only)

5. Pennsylvania Department of Environmental Resources: 717-787-4343 (reportable spills)

The list of spill equipment maintained on the vehicles is as follows:

1. Dump Vehicles – Shovel
2. Tankers - Oil dry absorbent, spill pads, and shovel

The list of spill equipment maintained by the Fleet Manager and the Maintenance Department is as follows:

1. 4 Bales of spill absorbent pads;
2. 3 Bales of spill absorbent booms;
3. Sand pile in shop yard; Shovels, brooms, spreaders, and floats
4. Lumber; Plastic rolls; Oil-dry; Earth moving equipment; Excavating equipment; Communication equipment; Portable power supply
5. Barriers, barricades, warning signs

Respiratory Protection

This voluntary program has been established to protect employees from occupational diseases caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors.

All employees who choose to wear a respirator shall receive of copy of Appendix D per OSHA standards.

"**Appendix D to Sec. 1910.134 (Mandatory) Information for Employees Using Respirators When Not Required Under the Standard**

Respirators are an effective method of protection against designated hazards when properly selected and worn. Respirator use is encouraged, even when exposures are below the exposure limit, to provide an additional level of comfort and protection for workers. However, if a respirator is used improperly or not kept clean, the respirator itself can become a hazard to the worker. Sometimes, workers may wear respirators to avoid exposures to hazards, even if the amount of hazardous substance does not exceed the limits set by OSHA standards. If your employer provides respirators for your voluntary use, or if you provide your own respirator, you need to take certain precautions to be sure that the respirator itself does not present a hazard.

You should do the following:

1. Read and heed all instructions provided by the manufacturer on use, maintenance, cleaning and care, and warnings regarding the respirators limitations.

2. Choose respirators certified for use to protect against the contaminant of concern. NIOSH, the National Institute for Occupational Safety and Health of the U.S. Department of Health and Human Services, certifies respirators. A label or statement of certification should appear on the respirator or respirator packaging. It will tell you what the respirator is designed for and how much it will protect you.

3. Do not wear your respirator into atmospheres containing contaminants for which your respirator is not designed to protect against. For example, a respirator designed to filter dust particles will not protect you against gases, vapors, or very small solid particles of fumes or smoke.

4. Keep track of your respirator so that you do not mistakenly use someone else's respirator.

Rigging

General Safety

1. Rigging equipment for material handling shall be inspected prior to use on each shift and as necessary during its use to ensure that it is safe.
2. Defective rigging equipment shall be removed from service and either repaired or discarded.
3. Rigging equipment shall not be loaded in excess of its recommended safe working load, as prescribed in Appendix A.
4. The rigger must know the weight of the load and rated capacities of any rigging or rigging hardware.
5. The load should be attached at the center of gravity.
6. Slings should be protected from any sharp edges.
7. Shop hooks and links, or makeshift fasteners, formed from bolts, rods, etc., or other such attachments, shall not be used.
8. Welded alloy steel chain slings shall have permanently affixed durable identification stating size, grade, rated capacity, and sling manufacturer.
9. Wire rope shall not be used if, in any length of eight diameters, the total number of visible broken wires exceeds 10 percent of the total number of wires, or if the rope shows other signs of excessive wear, corrosion, or defect.
10. Slings shall not be shortened with knots or bolts or other makeshift devices.
11. Shock loading is prohibited.

Inspection of Rigging

1. Chain slings should not have any of the following;
   a.) Excessive wear
   b.) Missing or illegible tags
   c.) Bent hooks
   d.) Twisted or bent links
   e.) Severe corrosion

2. Synthetic web slings should not have any of the following;
   a.) Snags, punctures, tears, or cuts
   b.) Broken or worn stitching
   c.) Illegible or missing tag
   d.) Burns, melted or charred
   e.) Any other conditions that may reduce the load rating

3. Wire rope slings should not have any of the following;
   a.) Missing or illegible tag
   b.) Kinking, crushing or other damage to the braided structure
   c.) Bent hooks
   d.) Severe corrosion
   e.) Visible broken strands exceed 10% of total strands

The rated capacities for all rigging equipment shall meet all OSHA regulations. See the following tables for more details.

Roadwork

Purpose
Due to the hazardous conditions surrounding roadwork it is important to understand how to protect yourself and the passing motorists from becoming involved in a serious accident. There may be times when work is being done besides passing vehicles and/or lanes may need to be restricted or blocked. Many motorists today are either in a hurry or are preoccupied with cell phones, i-pods, and the many other gadgets that distract drivers' attention away from the roadway. The following steps will be taken where roadwork affects traffic, and is referred to as work zone activity.

Safe Work Practices
1. When working near traffic or heavy equipment you must wear a highly visible shirt or vest (CLASS 2). Highly visible means a color such as florescent yellow-green, florescent orange-red, or a florescent combination of these colors.
2. During night you must wear retro reflective vest (CLASS 2) and hardhat.
3. Work or station yourself where drivers can see you. Don't place yourself in shaded areas or too close to other objects that may obscure the motorist's vision and prevent them from seeing you.
4. Never stand behind a backing vehicle unless you can see its mirrors.
5. Radios, i-pods, and similar devices are prohibited. Stay alert at all times.

Protective Measures
1. Traffic control plan – Describes the measures used to keep traffic moving safely and efficiently through the work zone.
2. Signs – Regulatory, warning, and guide signs are the 3 types of traffic control signs.
3. Flaggers – There may be times when signs or signals do not provide enough protection for roadway operations and Flaggers may be needed. Flagging is dangerous because it exposes the Flaggers to traffic. All Flaggers must be trained to meet MUTCD standards.
4. Signals – warn of possible or existing hazards and include sign paddles, flags, digital message boards, and flashing arrow displays.
5. Channelization devices – May include, but are not limited to, cones, tubular markers, drums, vertical panels, barricades, and temporary islands. These devices protect workers in the work zone, warn and alert drivers to conditions created by road work and guide motorists.

PennDOT Requirements
Whenever work is being performed for PennDOT the following PPE and rules apply:
1. Hardhats must be worn at all times. Exception would be if you remain inside an enclosed cab of truck or equipment. As soon as you step outside the cab, the hardhat must be on.
2. Safety vests must be at least CLASS 2 (florescent 360E green), or shirts (florescent yellow-green) must be worn at all times while not in an enclosed cab.
3. Flaggers must have successfully completed a Flaggers training course under standards set forth by MUTCD within the past 3 years. Trained Flaggers shall carry a valid training card with name, signature, and date of training or the Safety Manager can provide a roster of all trained Flaggers to the Engineer prior to the start of flagging operations that contains the names of the Flaggers, training source, and date of completion.

Sanitation Requirements

Due to the remote location of most jobsites, the availability of certain sanitary requirements becomes a problem.

The following guidelines are the minimum standards required on the site.

Portable Drinking Water
Adequate supply shall be provided in all places of employment.

Containers must be tightly closed and have a tap.

Containers shall be clearly marked.

Single service cups must be provided. No common drinking cup. Disposal facilities shall be provided for discarded cups.

Toilet Facilities

Toilets shall be provided for employees as follows:

Number of Employees	Minimum number of facilities
20 or less	1 toilet
20 or more	1 toilet seat and 1 urinal per 40 workers
200 or more	1 toilet seat and 1 urinal per 50 workers

Sites without sanitary sewers must be provided with one of the following:

Privies (where the use will not contaminate ground or surface water)
Chemical toilets
Recirculation toilets
Combustion toilets

Scaffolding Safety

Purpose
It is this company's purpose in issuing these procedures to further ensures a safe workplace based on the following formal, written procedures for scaffold work. These procedures will be reviewed and updated as needed to comply with new OSHA regulations, new best practices in scaffolding, and as business practices demand.

Application
This general scaffold plan applies to

1. All employees who perform work while on a scaffold.
2. All employees who are involved in erecting, disassembling, moving, operating, repairing, maintaining, or inspecting scaffolds.

General Procedures
The following general procedures apply to all scaffold operations for Stewart and Tate, Inc.

Capacity

1. Each scaffold and scaffold component we use will support, without failure, its own weight and at least four times the maximum intended load applied or transmitted to it.
2. When we use non-adjustable suspension scaffolds, each suspension rope, including connecting hardware, will support, without failure, at least six times the maximum intended load applied or transmitted to that rope.

Platform Construction
The following safety rules apply for this scaffold platform construction:

1. Each scaffold plank will be installed so that the space between adjacent planks and the space between the platform and uprights is no more than one inch wide. If, in certain situations, we need to make this space wider, we will attach our demonstration in the appendix to this plan.
2. Except for outrigger scaffolds (3 inches) and plastering and lathing operations (18 inches), the front edge of all platforms will not be more than 14 inches from the face of the work, unless we have a guardrail or personal fall arrest system in place that meets regulations.

The following additional construction and safety information is included depending on the type of scaffold being erected.

Supported Scaffolds

1. Supported scaffolds with a height to base width ratio of more than four to one (4:1) must be restrained from tipping by guying, tying, bracing, or equivalent means.
2. Supported scaffold poles, legs, posts, frames, and uprights will always bear on base plates and mud sills or other adequate firm foundations.

Suspension Scaffolds

1. Before a scaffold is used, a competent person will evaluate connections. Our competent person will confirm, based on the evaluation, that the supporting surfaces are capable of supporting the loads that will be imposed.
2. When winding drum hoists are used on a suspension scaffold, they will never contain less than four wraps of the suspension rope at the lowest point of scaffold travel.

Gaining Access to Scaffolds

We know that getting to the working platform is critical to the safety of our employees. This section outlines the mechanical requirements for gaining access to scaffold platforms such as:

1. Ladders
2. Ramps and walkways
3. Stair rails
4. Direct access from another scaffold. This section is divided into two parts. The first part is for workers gaining access to scaffold platforms to do work; the second part is access for employees erecting and dismantling scaffolds.

Working Employees:

1. Portable, hook-on, and attachable ladders will be positioned so as not to tip the scaffold.
2. All stair rail systems and handrails will be surfaced to prevent injury to employees from punctures or lacerations, and to prevent snagging of their clothes.

Fall Protection Plan

Fall protection planning is critical to the safety and well being of our employees. Our fall protection plan follows the OSHA requirements, which are different depending on the type of scaffold we are using. In this plan, we address fall protection for our scaffold erectors and dismantlers separately. One fact never changes. We know we must provide fall protection for any employee on a scaffold more than 10 feet above a lower level.

Working Employees*:*

This fall protection plan for our working employees is for the following type(s) of scaffold(s):

Single or two-point adjustable suspension scaffold

1. We will protect each employee on our single- or two-point adjustable suspension scaffolds by a personal fall arrest system.
2. Our personal fall arrest systems meet the requirements of 1926.502(d) (OSHA's fall protection rule).

Self-contained adjustable scaffold supported by the frame structure

We will protect each employee on our self-contained, frame structure supported, adjustable scaffolds by a guardrail system. The guardrail system:

1. Has a minimum 200-pound top rail capacity.
2. Will be installed before being released for use by our employees

Falling Object Protection

All employees must wear hardhats when working on, assembling, or dismantling scaffolds. This is our primary protection from falling objects. Additionally, we will:

1. Install all guardrail systems with openings small enough to prevent passage of potential falling objects.
2. Prevent tools, materials, or equipment that inadvertently fell from our scaffolds from striking employees by barricading the area below the scaffold.

Using Scaffolds

Site preparation, scaffold erection, fall protection, and gaining access to the working platform are only part of the requirements for scaffold work. While this all takes concentration and safe work practices, the most dangerous time can be when employees are concentrating on their work and not particularly aware of the hazards of working from scaffolds. It is critical that employees who use scaffolds be trained, among other things, in the recognition of the hazards associated with the type of scaffold being used and to understand the procedures to control or minimize those hazards. Our competent person will inspect all scaffolds and scaffold components for visible defects before each work shift, and after any occurrence, which could affect a scaffold's structural integrity. However, in addition to that, all users of scaffolds in this company will know and understand the following safety rules:

1. Scaffolds and scaffold components will never be loaded in excess of their maximum intended loads or rated capacities.
2. Debris must not be allowed to accumulate on platforms.

Specific Procedures

In addition to the general procedures in this written safety plan, there are procedures that apply to specific types of scaffolds. The safety rules for these specific types of scaffolds are found in 1926.452.

Prohibited Practices

The following practices will not be tolerated:

1. Scaffold components manufactured by different manufacturers will never be intermixed unless the components fit together without force and the scaffold's structural integrity is maintained.
2. Unstable objects will never be used to support scaffolds or platform units. Footings must be level, sound, rigid, and capable of supporting the loaded scaffold without settling or displacement.
3. Cross braces will never be used as a means of access.
4. The use of shore or lean-to scaffolds is prohibited.
5. Scaffold components manufactured by different manufacturers will never be intermixed unless the components fit together without force and the scaffold's structural integrity is maintained.
6. Unstable objects will never be used to support scaffolds or platform units. Footings must be level, sound, rigid, and capable of supporting the loaded scaffold without settling or displacement.
7. Cross braces will never be used as a means of access.
8. The use of shore or lean-to scaffolds is prohibited.

Duties of Competent and Qualified Persons
When working with scaffolds in this company there are some tasks that must be done by our competent or qualified person. By definition they are:

1. Competent Person: One who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.
2. Qualified Person: One who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, has successfully demonstrated his/her ability to solve or resolve problems related to the subject matter, the work, or the project.

Qualified Person:

1. Scaffolds must be designed by a qualified person and shall be constructed and loaded in accordance with that design.
2. Swaged attachments or spliced eyes on wire suspension ropes of suspension scaffolds will not be used unless they are made by the wire rope manufacturer or a qualified person.
3. We will have each employee who performs work while on a scaffold trained by a person qualified in the subject matter to recognize the hazards associated with the type of scaffold being used and to understand the procedures to control or minimize those hazards.

Training
Recognizing the need for training for employees who:

1. Perform work while on scaffolds,
2. Are involved in erecting, disassembling, moving, operating, repairing, maintaining, or inspecting scaffolds, and
3. Have lost the requisite proficiency, the following training syllabus is a part of this written safety plan.

Employees Who Use Scaffolds:
Our employees who perform work on scaffolds will be trained by a qualified person to recognize the hazards associated with the type of scaffold being used and to understand the procedures to control or minimize those hazards. The training will include the following areas as applicable:

1. The nature of and the correct procedures for dealing with electrical hazards.
2. The nature of and the correct procedures for erecting, maintaining, and disassembling the fall protection and falling object protection systems used.
3. The proper use of the scaffold, and the proper handling of materials on the scaffold.
4. The maximum intended load and the load-carrying capacities of the scaffolds used.
5. Any other pertinent requirements of the OSHA rules.

Employees, Who Erect, Disassemble, Move, Operate, Repair, Maintain, or Inspect Scaffolds:
Our employees who erect, disassemble, move, operate, repair, maintain, or inspect scaffolds will be trained by our competent person to recognize the hazards associated with the work being

done. The training will include the following topics as applicable:

1. The nature of scaffold hazards
2. The correct procedures for erecting, disassembling, moving, operating, repairing, inspecting, and maintaining the type of scaffold in question
3. The design criteria, maximum intended load-carrying capacity, and intended use of the scaffold
4. Any other pertinent requirements of this subpart

Employees Who Need Retraining:

When we have reason to believe that one of our employees lacks the skill or understanding needed for safe work involving the erection, use or dismantling of scaffolds, we will retrain the employee so that the requisite proficiency is regained. Retraining will be done in at least the following situations:

1. Where changes at the worksite present a hazard about which the employee has not been previously trained.
2. Where changes in the types of scaffolds, fall protection, falling object protection, or other equipment present a hazard about which an employee has not been previously trained.
3. Where inadequacies in an affected employee's work involving scaffolds indicate that the employee has not retained the requisite proficiency.

Steel Erection

Erectors who are on a walking/working surface with an unprotected edge more than **15 feet above a lower level** must be protected by conventional fall protection system approved by OSHA. **Perimeter safety cables** must be installed at the final interior and exterior perimeters of multi-story structures as soon as the decking has been installed. Connectors and employees working in **controlled decking zones** must be protected from fall hazards by **conventional fall protection** when working on a surface with an unprotected edge **more than two stories or 30 feet** above a lower level; and have completed the **connector training as required by OSHA.** While working at heights **over 15 and up to 30 feet**, connectors must be provided with a complete **personal fall arrest system** or other allowable fall protection, and **wear the equipment** necessary for tying off.

A Controlled Decking Zone (CDZ) can be established as a substitute for fall protection where metal decking is initially being installed and forms the leading edge of a work area over 15 and up to 30 feet above a lower level. Leading-edge workers in a CDZ are required to be protected from fall hazards above 2 stories or 30 feet (whichever is less), and have completed CDZ training in accordance OSHA standards. Employees who are not engaged in leading-edge work and properly trained in the hazards involved are <u>prohibited from entering</u> the CDZ.

The CDZ is required to be no more than <u>90 feet wide and 90 feet deep</u> from any leading edge; not exceed <u>3,000 square feet</u> of unsecured decking; and have designated and clearly marked <u>boundaries with control lines</u> or the equivalent. It must also have <u>safety deck attachments</u> placed from the leading edge back to the control line, and have at least <u>two safety deck attachments</u> for each metal decking panel. Lastly, <u>final deck attachments</u> and the installation of <u>shear connectors</u> are prohibited from being done in the CDZ.

Temporary Heat

Temporary heat is a necessary requirement for winter work and if used properly it will be an asset to finishing a project in a timely manner. Many factors have to be followed to ensure safety for all concerned.

Ventilation, Clearances, Mounting, Regulators, and Storage Requirements

1. Fresh air shall be supplied in sufficient quantities to ensure proper combustion, limit temperature rise and the health and safety of personnel, whether by natural means or mechanical ventilation.
2. Temporary heating devices shall be installed to provide clearance to combustible material per the following chart:

	Minimum Clearance in inches		
Heating Appliance	Sides	Rear	Chimney Connector
Room heater, circulating type	12	12	18
Room heater, radiant type	36	36	18

3. Heaters shall be set on at least 1 inch concrete or equivalent material. Insulating material shall extend at least 2 feet or more in all directions beyond the heater.
4. All tarpaulins, canvas or similar coverings shall be securely fastened to prevent ignition or upsetting of the heater due to wind action on the covering.
5. Temporary heaters shall be located at least 6 feet from any LP-gas container.
6. Blower or radiant type heaters shall not be directed toward any LP-gas container.
7. Heaters shall be equipped with an approved regulator.
8. Regulators and low-pressure relief devices shall be rigidly attached to the cylinder valves, cylinders, supporting standards, the building walls, or otherwise rigidly secured.
9. LP-gas containers shall not be stored inside of the building.
10. LP-gas containers awaiting use shall be located from the nearest building or group of buildings as follows:

Quantity of LP gas stored	Distance in feet
500 lbs. or less ……..	0
501 to 6,000 lbs ……	10
6,001 to 10,000 lbs …….	20
Over 10,000 lbs ……..	25

11. All debris shall be removed from within 20 feet of heating unit.
12. All exit ways shall be marked and clear of material.
13. A fire extinguisher shall be available within 25 feet of the unit.

Welding & Cutting Procedures

These written Welding & Cutting Procedures establish guidelines to be followed whenever any of our employees work with welding and cutting equipment at this company. The procedures here establish uniform requirements designed to ensure that welding and cutting safety training, operation, and maintenance practices are communicated to and understood by the affected employees. These requirements also are designed to ensure that procedures are in place to safeguard the health and safety of all employees.

It is our intent to comply with the requirements of 29 CFR 1926.350 through .354. These regulations have requirements for welding and cutting operations. We also comply with applicable requirements of:

Standard or Regulation:	**Name:**
ANSI Z49.1-1967	*Safety in Welding and Cutting*
CGA Pamphlet P-1-1965	*Safe Handling of Compressed Gases*
29 CFR 1926, Subpart D	*Occupational Health and Environmental Controls*
29 CFR 1926, Subpart E	*Personal Protective And Life Saving Equipment*
29 CFR 1926.406(c)	*Electrical—Specific Purpose Equipment and Installations*
49 CFR 192	*Minimum Federal Safety Standards for Gas Pipelines*
49 CFR 178, Subpart C	*Specifications for Cylinders*

Administrative Duties
Safety Manager is responsible for developing and maintaining the written Welding & Cutting Procedures. These procedures are kept at the following location: Safety Manager's office.

Training
It is the policy of Stewart and Tate, Inc. to permit only trained and authorized personnel to operate welding and cutting equipment. The Safety Manager will identify all new employees in the employee orientation program and make arrangements with department management to schedule training.

The following person(s) will conduct initial training and evaluation: Safety Manager coordinates all training requirements. This instructor(s) has the necessary knowledge, training, and experience to train new welding and cutting equipment operators. The qualifications include a certified welder who provides the hands on training and the Safety Manager conducts the in class safety training.

Initial Training
Our classroom instruction includes the following formats: Lecture, discussion, and videotapes. Our practical training includes these formats: Demonstrations, practical exercises, and hands-on instruction. All welders and cutters are trained and tested on the equipment they will be operating before they begin their job.

The operational hazards of welding and cutting operations include:

1. Hazards associated with the particular make and model of the welding and cutting equipment
2. Hazards of the workplace; and
3. General hazards that apply to the operation of all or most welding and cutting equipment
4. An outside company does training.

Training Certification

After an employee has completed the training program, the instructor will determine whether the potential welder or cutter can safely perform the job. At this point, the trainee will take a performance test or practical exercise through which the instructor(s) will decide if the training has been adequate. All welding and cutting trainees are tested on the equipment they will be operating.

The Safety Manager is responsible for keeping records certifying that each employee who has successfully completed training and testing. Each certificate includes the name of the employee, the date(s) of the training, and the signature of the person who did the training and evaluation.

Performance Evaluation

Each certified welder or cutter is evaluated annually to verify that the welder or cutter has retained and uses the knowledge and skills needed to operate safely. The Safety Manager does this evaluation. If the evaluation shows that the welder or cutter is lacking the appropriate skills and knowledge, the welder or cutter is retrained by our instructor(s). When a welder or cutter has an accident or near miss or some unsafe operating procedure is identified, we do retraining.

Current Welders and Cutters

Under no circumstances may an employee operate welding or cutting equipment until he/she has successfully completed this company's welding and cutting training program. This includes all new welders and cutters regardless of claimed previous experience.

All employees have a general obligation to work safely with and around welding and cutting operations.

Fall Protection

1. A platform with railings, or safety harness and lifeline will be used when welding or cutting above ground or floor levels and there are falling hazards.
2. A clear welding or cutting area will be maintained to prevent slips, trips, and falls.

Maintenance

Any deficiencies found in our welding and cutting equipment are repaired, or defective parts replaced, before continued use. However, no modifications or additions that affect the capacity or safe operation of the equipment may be made without the manufacturer’s written approval. If such modifications or changes are made, the capacity, operation, and maintenance instruction plates, tags, or decals, must be changed accordingly. In no case may the original safety factor of the equipment be reduced.

While defective parts may be found, we prefer to invest time and effort into the proper upkeep of our equipment, which results in day-to-day reliability. Keeping up with the manufacturer's recommended maintenance schedules, and completing the proper records, will also increase our welding and cutting equipment's longevity. Small Tool Manger completes a receiving or delivery inspection whenever our company purchases welding and cutting equipment. Small Tool Manager follows the manufacturer's operator instruction manual for daily or weekly maintenance. Periodic maintenance (those completed monthly or less frequently) is done by a factory-trained-expert, or a dealer.

STEWART & TATE CONSTRUCTION

DAilY JOB BRIEFING

Stewart & Tate CONSIRUCTION

Job No. / Name: _____ **Name:** _____

Job Description: _____ **Date:** _____

Location of Work: _____ **Time:** _____ AM PM

Prior to the start of the work shift each supervisor shall review the safety hazards and proper work methods with the entire crew doing the work. At the end of the work shift the supervisor will review work activities performed, issues and/or hazards that arose, etc.

Task Description:

The items listed below are the minimum items to be discussed in a formal Pre Job Brief:

Discuss the scope of work to be performed

Discuss individual work assignments, roles and responsibilities

Discuss work place conditions and environment

Discuss hazards, controls and PPE

Check all that apply:

_____Heavy Equipment Usage

_____Confined Space

_____Lock Out / Tag Out

_____Traffic Control

_____Trenching/Excavation

_____Potential for Slips/Falls

_____Hot Work

_____Power Tools

_____Forklift

_____Utility Locating (Overhead Wires? YES/ **NO)** *Ticket# & Date:*_____

Have the employees been briefed on the hazards associated with the job?

List Hazards:

Check all PPE Required:

_____Hard Hat

_____Safety Glasses

_____Respirator

_____Dust Mask

_____Fall Protection

_____Hand Protection

_____Hearing Protection

_____Safety Vest

Face Shield

Foot Protection

Confined Space Equip

Fire Ext1ngu1shers

Report ALL Injuries to Your Supervisor Immediately!

ALL Accident Reports Must be Turned into the Safety Department Office within 24 Hours!

Pre-job Briefing Signatures:

I have been briefed on the correct procedures for doing this job and fully understand the hazards and the safe work methods to avoid the hazards.

_____

_____

_____

_____

_____

_____

Post-job Briefing Signatures:

I have received a post-job briefing regarding work performed. Any incidents that arose throughout the day have been reported and documented regardless of the severity.

	Any Work Injury?
_____	☐ Yes ☐ No
_____	☐ Yes ☐ No
_____	☐ Yes ☐ No
_____	☐ Yes ☐ No
_____	☐ Yes ☐ No
_____	☐ Yes ☐ No

Stewart
&TateC!J
CONSTRUCTION

SOIL STABILITY: (Check all that apply)

_____Previously disturbed underground structures or existing utilities.
_____Soil subject to thawing conditions.
_____Soil subject to vibration from adjacent area or from equipment used in excavation.
_____Soil subject to surcharge from spoils, materials or equipment.

VISUAL TEST: (Check all that apply)

_____Soil spill from the excavation bucket in cohesive clumps or in a granular stream.
__ __ __ __Soil is fissured.
_____Particle size of the predominant soil is fine grain, coarse grain or gravel.
_____Soil exists in a layered system.
__ __ __ __Presence of rock.
_____Accumulating run-off.
_____Water seeping from sides.
__ __ __ __Rock is stable.
_____High ground water table.
_____Submerged in surface water (stream, etc.).

GOLF BALL TEST:

_____Won't make a ball (type "C").
_____Makes a ball and stays together when tossed and caught. (Determine the type of soil with ribbon or worm test).

RESULTS OF TESTING -- Protection Chosen							
SOIL TYPE		SLOPING		SHIELDING		SHORING	
--	A	--	3/4: 1	--	Certified	--	Tabulated data
--	B	--	1: 1	--	Damage free	--	Damage free
--	C	--	1.5: 1	--	Data on site	--	Approved

BENCHING *NOT* ALLOWED IN TYPE "C" SOIL

Important Phone Numbers:

	Office	Cell
Medcor Nurse	844-871-8630	n/a
Safety Director	717-117-3506	717-324-2447
General Superintendent Site	717-771-3508	717-309-9070
General Superintendent Industr	717-747-4521	717-825-0135
Shop Manager	717-771-3538	717-309-9074
Dispatcher's Office	717-771-3500	717-309-9052

Stewart and Tate
DAILY EXCAVATION INSPECTION

Competent Person *ON-SITE* : _____

Weather: _____ C_____PC_____R _____ S Temp: _____ Degrees F
Depth of Trench: _____ FT Prev. 24-Hr. Rainfall: _____ Inches

JOB SITE HAZARDS: (Check the hazards observed & note the abatement method)

_____ Vehicular Traffic *Method:* _____
_____ Overhead Obstructions *Method:* _____
_____ Falling Loads *Method:* _____
_____ Adjacent Structure *Method:* _____
_____ Surface Encumbrances *Method:* _____
_____ Mobile Equipment *Method:* _____
_____ Underground Installations *Method:* _____
_____ Hazardous Atmosphere *Method:* _____

WORK PRACTICES: (Check all that apply)

Traffic Control: Signing _____ Coning _____ Barricades _____ Trained flagmen Ladders:
Within 25 feet Extends 3 feet Damage free De-
watering: CP Monitors Proper Operation Accumulation in excavation

SOIL STABILITY: (Check all that apply)

_____ Previously disturbed underground structures or existing utilities.
_____ Soil subject to thawing conditions.
_____ Soil subject to vibration from adjacent area or from equipment used in excavation.
_____ Soil subject to surcharge from spoils, materials or equipment.

VISUAL TEST: (Check all that apply)

_____ Soil spill from the excavation bucket in cohesive clumps or in a granular stream.
_____ Soil is fissured.
_____ Particle size of the predominant soil is fine grain, coarse grain or gravel.
_____ Soil exists in a layered system.
_____ Presence of rock.
_____ Accumulating run-off.
_____ Seeping from sides.
_____ Rock is stable.
_____ High ground water table.
_____ Submerged in surface water (stream, etc.).

GOLF BALL TEST:

_____ Won't make a ball (type "C").
_____ Makes a ball and stays together when tossed and caught. (Determine the type of soil with ribbon or worm test).

RESULTS OF TESTING -- Protection Chosen			
SOIL TYPE	**SLOPING**	**SHIELDING**	**SHORING**
_____ A	_____ 3/4 : 1	_____ Certified	_____ Tabulated data
_____ B	_____ 1 : 1	_____ Damage free	_____ Damage free
_____ C	_____ 1.5 : 1	_____ Data on site	_____ Approved

BENCHING *NOT* ALLOWED IN TYPE "C" SOIL

Stewart & Tate - HOT WORK PERMIT

Date Issued:	Valid Until:
Location of Work:	
Type of Work:	
Facility Representative/Phone Number:	
Hot Work Operator (Name):	
Type of Welding Equipment:	
Required PPE:	

This permit has been reviewed with and understood by the hot work operator and fire watch before the commencement of work activities.

Fire Watch Signature Date

Hot Work Operator Signature Date

FIRE SAFETY PRECAUTIONS - Please mark each box as items are completed.

BEFORE THE WORK - *All* of the following precautions must be taken:

- ☐ Cutting and/or welding equipment must be thoroughly inspected and found to be in good repair, free of damage or defects.
- ☐ Hot work operator equipped with communication device, protective equipment and is knowledgeable regarding the emergency response procedures for the facility.
- ☐ Floor areas under and at least 35 feet around the cutting/welding operation must be swept clean of combustible and flammable materials.
- ☐ Flammable and combustible liquids must be relocated at least 35 feet away from the cutting/welding operation.
- ☐ Ensure area is cordoned off to prevent unauthorized access during hot work activities.
- ☐ Fire watch person(s) are to be supplied with multi purpose dry chemical, portable fire extinguisher such that it is immediately available for use and trained in its use.

Where applicable, the following precautions will also be taken before the work begins:

- ☐ Fire resistant shields must cover combustible floors and must be below any elevated cutting/welding operation.
- ☐ All floor and wall openings must be covered to prevent sparks/slag from traveling to other unprotected areas.
- ☐ Containers in or on which cutting/welding will take place must be purged of flammable vapors.
- ☐ Fire alarm system deactivation
- ☐ Fume collector or local exhaust ventilation in work area to remove smoke/vapor.
- ☐ Protective screens positioned to protect nearby personnel from hazardous light.

DURING / AFTER THE WORK - The following precautions will be taken:

- ☐ Fire watch must inspect the area for at least 30 minutes after all cutting/welding ceases.

The location where this work will take place has been examined before the start of hot work operations and all the appropriate precautions have been taken.

Foreman Signature Date

The work area and all adjacent areas to which sparks and heat might have spread (including floor levels above and below and on opposite side of walls) were inspected 30 minutes after the cutting and or welding operations ceased for the day and were found to be fire safe.

Fire Watch Signature Date

STEWART & TATE, INC. ENVIRONMENTAL HEALTH & SAFETY
LOCKOUT/ TAGOUT PERMIT

Machine/ Equipment Name:

_____

Type of Energy:

_____

Purpose for Lockout/ Tagout:

_____

Supervisor Name:

_____

Affected Employees:

_____

_____

Checklist:

1. Have all non-essential items been removed from the work area?

Yes No

2. Are all of the machine or equipment components operationally intact?

Yes No

3. Are all employees safely positioned or have cleared the area?

Yes No

4. Have all employees affected been notified of the lockout/ tagout procedure?

Yes No

5. Have all employees involved been briefed and understand their responsibilities for the lockout/ tagout procedure?

Yes No

6. Did all personnel involved in the shutdown place their own lock on the power source?

Yes No

7. Was the power source tested and ensure of no accidental startup?

Yes No

8. Are the tags on the locks completed with employee contact information?

Yes No

9. Are locks in good working condition?

Yes No

10. Have the tools been removed and equipment guards been replaced prior to re-energization?

Yes No

11. Are employees cleared of the equipment before reenergizing?

Yes No

12. Are lockout/ tagout devices removed by person who applied them?

Yes No

13. Are all affected employees notified that LOTO devices have been removed?

Yes No

14. Has energy been restored properly and equipment is running in the proper working condition?

Yes No

Supervisor Signiture: _____

Affected Employees Signatures:

_____

_____

_____

_____

Date: _____

STEWART & TATE, INC.
ENVIRONMENTAL HEALTH & SAFETY
CONFINED SPACE ENTRY PERMIT

Permit Number_____ Date _____

Location & Description of Confined Space:

_____

_____

Purpose of Entry:

_____

_____

Scheduled Start_____ a.m. p.m.
Day / Date / Time

Scheduled Finish_____ a.m. p.m.
Day / Date / Time

Employee(s) in charge of entry: _____

Entrants:

_____

_____

Attendants:

_____

_____

Pre-Entry Authorization:

{Check those items below which are applicable to your confined space permit.}

TYPES OF HAZARDS

- ☐ Oxygen-Deficient Atmosphere
- ☐ Oxygen-Enriched Atmosphere
- ☐ Welding/Cutting
- ☐ Engulfment
- ☐ Toxic Atmosphere (ex. CO, H_2S)
- ☐ Flammable Atmosphere (ex. H_2S)
- ☐ Energized Electrical Equipment
- ☐ Entrapment
- ☐ Hazardous Chemical

SAFETY PRECAUTIONS

- ☐ Self-Contained Breathing Apparatus
- ☐ Air-Line Respirator
- ☐ Fire-Retardant Clothing
- ☐ Ventilation
- ☐ Protective Gloves
- ☐ Lifelines
- ☐ Respirators
- ☐ Lockout/Tagout
- ☐ Fire Extinguishers
- ☐ Barricade Job Area
- ☐ Signs Posted
- ☐ Clearances Secured
- ☐ Lighting
- ☐ Ground Fault Interrupter
- ☐ Remarks _____

ENVIRONMENTAL CONDITIONS

TESTS TO BE TAKEN	DATE / TIME	RE-TESTING	DATE / TIME
Oxygen (19.5-23.5):_____%	_____am/pm	Oxygen (19.5-23.5):_____%	_____am/pm
LEL<10:_____%	_____am/pm	LEL<10:_____%	_____am/pm
CO<35:_____ppm	_____am/pm	CO<35:_____ppm	_____am/pm
H_2S<10:_____ppm	_____am/pm	H_2S<10:_____ppm	_____am/pm
Toxic Atmosphere: _____		Toxic Atmosphere: _____	
Instruments Used: _____		Instruments Used: _____	

Employee Conducting Safety Checks ☒ **SIGNATURE**: _____

Remark on the overall condition of the confined space.

_____

_____

_____

ENTRY AUTHORIZATION	ENTRY CANCELLATION
All actions and/or conditions for safe entry have been performed.	Entry has been completed and all entrants have exited permit space.
Person in Charge of Entry _____ PLEASE PRINT	Person in Charge of Entry _____ PLEASE PRINT

IN CASE OF EMERGENCY CALL 911

CFR 1910.146 (f)(11)

Stewart & Tate
A STEWART COMPANY
CONSTRUCTION

WE SWEAT
THE DETAILS.

Heat and Cold Stress

Introduction

Working in extreme temperatures (hot or cold) can overwhelm the body's internal temperature control system. When the body is unable to warm or cool itself, heat or cold related stress can result. Heat and cold stress can contribute to adverse health effects which range in severity from discomfort to death. The Safety Department has developed this Heat and Cold Stress Safety Program to minimize the effects of heat and cold stress to Stewart and Tate employees.

The Occupational Safety and Health Administration (OSHA) does not currently have specific standards for heat or cold stress. However, the Occupational Safety and Health Act of 1970 General Duty Clause (Section 5(a)(1)) states that "Each employer shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees." In addition, 29 CFR Subpart I relating to personal protective equipment requires employers to provide protection to employees exposed to hazards in the workplace. The OSHA website contains Fact Sheets and Guidance Documents that relate to heat and cold stress that have been incorporated into this program.

Responsibilities

Safety Department:

Safety shall maintain, review, and update this program as needed. Safety will also provide monitoring, upon request, and assist employees with the development of procedures to minimize the adverse effects of heat and cold stress in the workplace.

Supervisors:

Each supervisor managing employees exposed to heat and/or cold stress has the following responsibilities:

- Review and comply with the provisions outlined in this program.

- Ensure all employees are properly trained before working in extreme temperature conditions.
- Document any in-person training conducted
- Assess the day-to-day heat or cold stresses on employees.
- Assess employees' workload and assigning work and rest schedules as needed.
- Ensure all employees have the appropriate personal protective equipment (PPE) prior to working in extreme temperature conditions.
- Ensure employees are familiar with this safety program.

Employees:

Employees exposed to heat and/or cold stress when performing their job duties have the following responsibilities:

- Review and comply with the provisions outlined in this program.
- Complete training before working in extreme temperature conditions.
- Wear the appropriate PPE.
- Report heat and cold stress concerns to their supervisor.

Heat Related Illness: Signs, Treatment and Prevention

Signs and Treatment

While working in hot conditions, the human body may not be able to maintain a normal temperature just by sweating. If this happens, heat-related illnesses may occur. The most common health problems caused by hot work environments include:

Heat stroke – This is the most serious heat related effect. Heat stroke occurs when the body temperature increases above 1040F. Signs and symptoms of heat stroke are confusion, loss of consciousness, seizures, and lack of perspiration. This condition must be treated as a medical emergency and the employee must receive immediate medical attention. While waiting on medical assistance, the victim should be moved to a cool/shaded area, cooled with water/wet towels/ice packs, and fanned to increase cooling.

Heat exhaustion – Signs and symptoms of heat exhaustion include headache, nausea, dizziness, weakness, irritability, confusion, thirst, heavy perspiration and a body temperature greater than 100.40F. Employees experiencing heat exhaustion should be moved to a cool area, given fluids to drink and given cold compresses for their head, face and neck. Employees should also be taken to a clinic or emergency room to be monitored by medical personnel.

Heat cramps – Signs and symptoms of heat cramps include muscle pains usually caused by the loss of body salts/fluids, this can happen later as well. Employees should replace fluid loss by drinking water and/or carbohydrate-electrolyte replacement liquids (e.g. Gatorade) every 15 to 20 minutes. If cramps are severe, seek medical attention.

Heat rash – Heat rash is caused by excessive perspiration and looks like a red cluster of pimples or small blisters. Heat rash usually appears on the neck, upper chest, in the groin, under the breasts and in elbow creases. Treatment for heat rash is to provide a cooler, less humid environment.

Dehydration – Dehydration is a major factor in most heat disorders. Signs and symptoms of dehydration include increasing thirst, dry mouth, weakness or light-headedness (particularly if worse upon standing), and a darkening of the urine or a decrease in urination. Dehydration can be reversed or put back in balance by drinking fluids that contain electrolytes (i.e. Gatorade) that are lost during work related activities. Avoid caffeinated drinks.

Prevention

While heat related illness are dangerous and potentially life threating, they can be prevented. Prevention methods include:

Acclimation – Acclimation is a process by which the physical processes of an employee's body adjusts to the environment over a period of time. Based on data obtained from OSHA, this process usually takes five to seven days. This process could take up to three weeks depending on the individual and their work environment. According to the American Industrial Hygiene Association, the process requires a consistent work level for at least two hours each day during the acclimation period in order for an employee to become acclimatized. Mere exposure to heat does not confer acclimatization, nor does acclimatization at one heat stress level confer resistance to heat stress at a higher temperature or more vigorous workload. Employees who are not adequately acclimatized to the heat may experience temporary heat fatigue resulting in a decline in performance, coordination or alertness. They may also become irritable or depressed. This can be prevented through gradual adjustment to the hot environment. People

in good physical condition tend to acclimatize better because their cardiovascular systems respond better.

Engineering Controls – For employees working indoors, the best way to prevent heat-related illness is to make the work environment cooler. Where and if possible, use air conditioning to cool the work area. Alternatively, increase the general ventilation as much as possible by opening windows or doors. When available, use cooling fans to aid in increasing ventilation.

Safe Work Practices – For employees working outdoors or working indoors without air conditioning or ventilation, take scheduled breaks in cool areas. Ensure there is plenty of cool water to drink and take water breaks as needed. Immediately report any problems to a supervisor. Supervisors should consider scheduling the hottest work for the coolest part of day, assigning extra employees to high demand tasks, and using work-saving devices (e.g. power tools, hoists or lifting aids) to reduce the body's work load. All employees should watch out for the safety of their coworkers.

Heat Index – The Heat Index is a single numeric value that uses both temperature and humidity to inform the public on how the weather outdoors "feels". The higher the Heat Index, the hotter the weather feels. OSHA has used the Heat Index to assign protective measures for workers as the Heat Index increases. These protective measures may reduce the likelihood of heat related illnesses. The Heat Index and related protective measures are contained in Appendix A.

Cold-Related Illness and Injuries: Signs, Treatment and Prevention

Signs and Treatment

During cold weather, an employee's body will use energy to maintain a normal internal body temperature. This will result in a shift of blood flow from employee's extremities (hands, feet and legs) and outer skin to the employee's core (chest and abdomen). If this happens, cold-related illnesses and injuries may occur if exposed to cold conditions for an extended period of time. The most common health problems caused by cold work environments include:

Hypothermia – Hypothermia is a potentially serious health condition. Hypothermia occurs when body heat is lost faster than it can be replaced. When the core body temperature drops to approximately 95°F, the onset of symptoms normally begins. The employee may begin to shiver, lose coordination, have slurred speech, and fumble with items in the hand. The employee's skin will likely be pale and cold. As the body temperature continues to fall these

symptoms will worsen and shivering will stop. Once the body temperature falls to around 85°F severe hypothermia will develop and the person may become unconscious, and at 78°F, vital organs may begin to fail.

Treatment depends on the severity of the hypothermia. For cases of mild hypothermia move to warm area and stay active. Remove wet clothes and replace with dry clothes or blankets, cover the head. To promote metabolism and assist in raising internal core temperature drink a warm (not hot) sugary drink. Avoid drinks with caffeine. For more severe cases do all the above, plus contact emergency medical personnel (Call 911 for an ambulance), cover all extremities completely, place very warm objects, such as hot packs or water bottles on the victim's head, neck, chest and groin. Arms and legs should be warmed last. In cases of severe hypothermia, treat the employee very gently and do not apply external heat to rewarm. Hospital treatment is required.

Frostbite – Frostbite occurs when the skin freezes and loses water. In severe cases, amputation of the frostbitten area may be required. While frostbite usually occurs when the temperatures are 30° F or lower, wind chill factors can allow frostbite to occur in above freezing temperatures. Frostbite typically affects the extremities, particularly the feet and hands. The affected body part will be cold, tingling, stinging or aching followed by numbness. Skin color turns red, then purple, then white, and is cold to the touch. There may be blisters in severe cases.

Do not rub the area to warm it. Wrap the area in a soft cloth, move the employee to a warm area, and contact medical personnel. Do not leave the employee alone. If help is delayed, immerse in warm (maximum 105 °F), not hot, water. Do not pour water directly on affected part. If there is a chance that the affected part will get cold again do not warm. Repeated heating and cooling of the skin may cause severe tissue damage.

Trench Foot – Trench Foot is caused by having feet exposed to damp, unsanitary and cold conditions including water at temperatures above freezing for long periods of time. It is similar to frostbite, but considered less severe. Symptoms usually consist of tingling, itching or burning sensation. Blisters may be present. For treatment, soak feet in warm water, then wrap with dry cloth bandages. Drink a warm, sugary drink. Seek medical attention if necessary.

Dehydration – It is easy to become dehydrated during cold weather. Signs of dehydration include increasing thirst, dry mouth, weakness or light-headedness (particularly if worse upon standing), and a darkening of the urine or a decrease in urination. Dehydration can be reversed or put back in balance by drinking fluids that contain electrolytes (i.e. Gatorade) that are lost during work related activities. Avoid caffeinated drinks.

Prevention

Just as with heat related illness, cold related illnesses and injuries are dangerous and potentially life threating, however, they can be prevented. Prevention methods include:

Acclimation – Employees exposed to the cold should be physically fit, without any circulatory, metabolic, or neurologic diseases that may place them at increased risk for hypothermia. A new employee should not be required to work in the cold full time during the first days of employment until they become adjusted to the working conditions and required protective clothing. New employees should be introduced to the work schedule slowly and be trained accordingly.

Engineering Controls – For employees working indoors, the best way to prevent cold-related illness is to make the work environment warmer. Where and if possible, use heaters to warm the work area. Alternatively, decrease the general ventilation as much as possible by closing windows or doors.

Safe Work Practices – For employees working outdoors or working indoors without heat, take scheduled breaks in warm areas. If available, use wind barricades to block the wind from the employees. Ensure there is plenty of water to drink and take water breaks as needed. Immediately report any problems to a supervisor. Supervisors should consider scheduling the most work for the warmest part of day, assigning extra employees to high demand tasks that will require longer periods in cold areas. All employees should watch out for the safety of their coworkers.

Personal Protective Equipment (PPE) – PPE is an important factor in preventing cold stress related illnesses and injuries. Employees should adhere to the following recommendations when dressing for work in a cold environment:

- Wear at least three layers of clothing; an inner layer of wool, silk or synthetic to wick moisture away from the body; a middle layer of wool or synthetic to provide insulation even when wet; an outer wind and rain protection layer that allows some ventilation to prevent overheating.
- Wear a hat or hood; up to 40% of body heat can be lost when the head is left exposed.
- Wear insulated boots or other footwear.
- Do not wear tight clothing; loose clothing provides better ventilation.
- Keep a change of clothing available in case work clothes become wet.

The Cold Stress Equation - OSHA has incorporated information obtained from the American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit values into the Cold Stress Equation. As the temperature decreases and/or the wind speed increases, the potential for cold stress related illnesses and injuries increases. The Cold Stress Equation and the Wind Chill Temperature Index is contained in Appendix B.

Appendix A: Heat Index

The heat index is a simple tool and a useful guide for employers/employees making decisions about protecting employees in hot weather. It does not account for certain conditions that contribute additional risk, such as physical exertion. Consider taking the steps at the next highest risk level to protect employees from the added risks posed by:

- Working in the direct sun (can add up to 15°F to the heat index value)
- Wearing heavy clothing or protective gear

Relative Humidity (%)

Heat Index (Apparent Temperature)

Air Temperature °F	40	45	50	55	60	65	70	75	80	85	90	95	100
110	136												
108	130	137											
106	124	130	137										
104	119	124	131	137									
102	114	119	124	130	137								
100	109	114	118	124	129	136							
98	105	109	113	117	123	128	134						
96	101	104	108	112	116	121	126	132					
94	97	100	103	106	110	114	119	124	129	135			
92	94	96	99	101	105	108	112	116	121	126	131		
90	91	93	95	97	100	103	106	109	113	117	122	127	132
88	88	89	91	93	95	98	100	103	106	110	113	117	121
86	85	87	88	89	91	93	95	97	100	102	105	108	112
84	83	84	85	86	88	89	90	92	94	96	98	100	103
82	81	82	83	84	84	85	86	88	89	90	91	93	95
80	80	80	81	81	82	82	83	84	84	85	86	86	87

With Prolonged Exposure and/or Physical Activity

Extreme Danger	Heat stroke or sunstroke highly likely
Danger	Sunstroke, muscle cramps, and/or heat exhaustion likely
Extreme Caution	Sunstroke, muscle cramps, and/or heat exhaustion possible
Caution	Fatigue possible

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Appendix A: Heat Index Continued…

Heat Index	Risk Level	Protective Measures
Less than 91°F	Lower (Caution)	Basic heat safety and planning
91°F to 103°F	Moderate	Implement precautions and heighten awareness
103°F to 115°F	High	Additional precautions to protect workers
Greater than 115°F	Very High to Extreme	Triggers even more aggressive protective measures

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Appendix B: Wind Chill Temperature Index

WIND CHILL TEMPERATURE INDEX
Frostbite Times are for Exposed Facial Skin

Air Temperature (°C)

Wind Speed (km/h)	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50
5	4	-2	-7	-13	-19	-24	-30	-36	-41	-47	-53	-58
10	3	-3	-9	-15	-21	-27	-33	-39	-45	-51	-57	-63
15	2	-4	-11	-17	-23	-29	-35	-41	-48	-54	-60	-66
20	1	-5	-12	-18	-24	-30	-37	-43	-49	-56	-62	-68
25	1	-6	-12	-19	-25	-32	-38	-44	-51	-57	-64	-70
30	0	-6	-13	-20	-26	-33	-39	-46	-52	-59	-65	-72
35	0	-7	-14	-20	-27	-33	-40	-47	-53	-60	-66	-73
40	-1	-7	-14	-21	-27	-34	-41	-48	-54	-61	-68	-74
45	-1	-8	-15	-21	-28	-35	-42	-48	-55	-62	-69	-75
50	-1	-8	-15	-22	-29	-35	-42	-49	-56	-63	-69	-76
55	-2	-8	-15	-22	-29	-36	-43	-50	-57	-63	-70	-77
60	-2	-9	-16	-23	-30	-36	-43	-50	-57	-64	-71	-78
65	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79
70	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-80
75	-3	-10	-17	-24	-31	-38	-45	-52	-59	-66	-73	-80
80	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81

FROSTBITE GUIDE

Increasing risk of frostbite for most people in 10 to 30 minutes of exposure
High risk for most people in 5 to 10 minutes of exposure
High risk for most people in 2 to 5 minutes of exposure
High risk for most people in 2 minutes of exposure or less

BLOODBORNE PATHOGEN EXPOSURE CONTROL PLAN

For Compliance With

OSHA 1910.1030

BLOODBORNE PATHOGENS EXPOSURE CONTROL PLAN

In accordance with the OSHA Bloodborne Pathogens Standard, 1910.1030, the following exposure control plan has been developed:

A. Purpose

The Bloodborne Pathogens Exposure Program is to reduce occupational exposure to bloodborne pathogens.

B. Exposure Determination

Designated employees that may come into contact with human blood or other potentially infectious materials (OPIM): (list job classifications)

1. Superintendents
2. Project Manager
3. Field Personnel
4. Authorized Visitors

C. Methods of Compliance

Universal Precautions will be utilized in the handling of all human blood and OPIM's.

D. Engineering Controls

1. Hand sinks or hand sanitizer is located on all jobsites and are readily accessible to all employees who have the potential for exposure.

2. Employees will wash their hands and any other exposed skin with soap and hot water immediately or as soon as possible after contact with blood or OPIM, for 15 seconds, in a manner causing friction on both inner and outer surfaces of the hands.

3. Employees will be provided with antiseptic hand cleaner and paper towels when hand washing is not feasible. However, hand washing must still take place as soon as possible after exposure.

4. Eating, drinking, smoking, applying cosmetics or lip balm and handling contact lenses is prohibited in work areas where there is the potential for exposure to bloodborne pathogens.

5. If professional medical attention is required, a local ambulance will be the first choice; a personal car will be the second. If a personal car is taken, impervious material should be used to prevent contamination of the vehicle.

6. New employees or employee being transferred to will receive training about any potential exposures.

E. Personal Protective Equipment

All personal protective equipment used at this facility will be provided without cost to employees. Personal protective equipment will be chosen based on the anticipated exposure to blood or OPIM. The protective equipment will be considered appropriate only if it does not permit blood or OPIM to pass through or reach the employees' clothing, skin, eyes, mouth, or other mucous membranes under normal conditions of use.

F. Disposal of Contaminated Items and Communication of Hazard

1. Employees must:

   a. Use bleach to disinfect any blood or OPIM.

   b. Apply the bleach with single-use gloves and allow to sit for 15 minutes.

   c. Place any single-use gloves that have been contaminated in a biohazardgarbage bag and cover.

   d. Dispose of the bag.

2. Regulated waste should be placed in appropriate containers, label and dispose of in accordance with applicable state, federal and local laws.

G. Housekeeping

Maintaining our work areas in a clean and sanitary condition is an important part of Stewart & Tate Inc. Bloodborne Pathogens Compliance Program. Employees must decontaminate working surfaces and equipment with an appropriate disinfectant after completing procedures involving blood or OPIM. All equipment,

environmental surfaces and work surfaces shall be decontaminated immediately or as soon as feasible after contamination.

1. Employees must clean and disinfect when surfaces become contaminated and after any spill of blood or OPIM.

2. Employees will use a solution of one part bleach to ten parts water for cleaning and disinfecting.

3. Working surfaces and equipment will be cleaned, disinfected and maintain.

4. Potentially contaminated broken glass will be picked up using mechanical means, such as dustpan and brush, tongs, etc.

5. Stewart & Tate Inc. use universal precautions for handling of all soiled laundry.

6. Laundry contaminated with blood or OPIM will be handled as little as possible. Employees who handle contaminated laundry will utilize personal protective equipment to prevent contact with blood or OPIM from coming into contact skin or street clothes.

H. Hepatitis B Vaccination and Post-Exposure Evaluation and Follow-Up

An exposure incident is any contact of blood or OPIM's with non-intact skin or mucous membranes. Any employee having an exposure incident shall contact the safety department. All employees who have an exposure incident will be offered a confidential post-exposure evaluation and follow-up in accordance with the OSHA standard. This includes a visit to a physician selected by the employer. The health care professional written opinion will be provided to the employee within 15 days of the evaluation.

I. Training

Training is provided at the time of initial assignment to tasks where occupational exposure may occur, and that it shall be repeated within twelve months of the previous training. Training shall be tailored to the education and language level of the employee, and offered during the normal work shift. The training will be

interactive and cover the following:

a. a copy of the standard and an explanation of its contents;

b. a discussion of the epidemiology and symptoms of bloodborne diseases;

c. an explanation of the modes of transmission of bloodborne pathogens;

d. an explanation of the Stewart & Tate Inc. Bloodborne Pathogen Exposure Control Plan, and a method for obtaining a copy;

e. the recognition of tasks that may involveexposure;

f. an explanation of the use and limitations of methods to reduce exposure, for example engineering controls, work practices and personal protective equipment;

g. information on the types, use, location, removal, handling, decontamination, and disposal of PPE;

h. explanation of the basis of selections of PPE;

i. information on the Hepatitis B vaccination, including efficacy, safety, method of administration, benefits, and that it will be offered free of charge.

j. information on the appropriate actions to take and persons to contact in an emergency involving blood or OPIM;

k. explanation of the procedures to follow if an exposure incident occurs, including the method or reporting and medicalfollow-up;

l. information on the evaluation and follow-up required after an employee exposure incident;

m. an explanation of the signs, labels, and color-coding systems.

The person conducting the training shall be knowledgeable in the subject matter.

J. Recordkeeping

Medical records shall be maintained in accordance with OSHA Standards. These records shall be kept confidential, and must be maintained for at least the duration of employment plus 30years.

APPENDIX F

OPERATIONS SAFETY MANUAL

SAFETY MANUAL

BIC SITE

28338 Enviro Way, Seaford, DE 19973

(302) 628-2360

Date	Revision	Approved By	Status
11/05/2020	00		For Review

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SECTION 1 EMERGENCY CONTACTS

	Bioenergy Innovation Center
	Emergency Notification Information
Bioenergy DevCo, LLC 50 State Circle Annapolis MD 21401 USA Phone: (302) 628-2360 Fax: (XXX) XXX-XXXX	Created By:
	Drafted By:
Review Date:	Reviewed By:
Issue Date:	Signature:

1-1. Notice

This notification provides the contact information to be used in an emergency that may arise during operation of the Bioenergy Innovation Center, located at 28338 Enviro Way Seaford Delaware.

Should anyone have an emergency condition requiring immediate response or an emergency shutdown of the Bioenergy Innovation Center compost or AD plant, please contact Plant Maintenance Superintendent Frank Messick (302) 853-2545 at any time 24 hours a day 7 days a week at or one of the BDC plant operations staff listed below:

Title	Name	Mobile phone number
Emergency Response Coordinator	TBD	
Office Manager	Michele Adkins	(302) 344-0218
Railroad crossing hotline	Crossing # 516 376X	1-(844) 426-8400
BIC Compost Supervisor/ Safety Manager	Mike Manna	(609) 744-2819
AD Plant Supervisor/ Safety Manager	Doug Renk	(321) 863-8055

For any other concerns regarding the Plant Operations and Maintenance, contact

Scott Warfield – (719) 502-6100

SECTION 2 INTRODUCTION

2-1. Copyright

Copying and distribution of the BDC/BIC Safety Manual or parts of it or of a translated version is allowed only by written permission from Bioenergy DevCo (BDC) or Bioenergy Innovation Center (BIC). BDC reserves the right to update this. All trademarks and their respective owners mentioned are accepted. BDC does not claim any rights to these trademarks. OSHA rules are in the public domain and may be reproduced, by BDC without permission.

2-2. Purpose

This manual is to serve as a guideline to routine safety practices. It is no substitute for common sense measures. Failure to comply will lead to investigation and disciplinary consequences

2-3. Safety philosophy

At Bioenergy DevCo, safety is considered a condition of employment. The safety program protects the employee, company assets and the environment. Safety is built into the culture of the organization as well as the engineering and design of a facility. While no facility can be guaranteed free from risk of injury, the intent is to minimize risk and every employee has the right to a safe work environment. BDC is dedicated to promoting and providing a Safe and Healthy Workplace using the following principles:

- Safety will be the responsibility of Management, Supervisors, and all Associates.
- Management and all Associates will be instructed on their responsibilities within the company structure and company Safety Policies and Procedures.
- Associates will be trained on the proper Safety Methods to use while performing their individual job assignments and responsibilities.
- All Associates will be properly trained in Accident Prevention to avoid the hazards associated within our industry, company, and individual job assignments.
- Records of all Safety Training will be kept on file by the Facility Manager, and Safety Director. Records will be available for review by any associate during normal business hours.
- Company Management will continually monitor the effectiveness of the Safety & Health Program. Company Management will have Associate Safety & Health and the Reduction of Claims as one of its priorities and goals.
- All Federal, State, Regional ai1d Local Safety Rules & Regulations and Codes and Standards pertaining to Safety and Health will be strictly adhered to and enforced.

Employees will be coached and monitored through orientation and training. Communication and teamwork are to be practiced. IF YOU SEE SOMETHING, SAY SOMETHING.

All staff must be dedicated to the idea that every accident can be prevented and that all elements of our Safety Program are necessary to ensure that safety gets first consideration in all areas of responsibility.

We must all pledge our personal commitment to safety as a way of life and be guided by the conviction that "no job is so important and no service is so urgent that we cannot take the time to perform our work safely".

2-4. Requirements for EHS compliance

Compliance emanates from BDC concern and respect for the worker's right to a safe and healthy work experience. Concern and respect cultivate teamwork. State and federal law guides and enforces EHS standards.

The Occupational Safety & Health Administration (OSHA) does not require a specific training length. However, OSHA wants to ensure that employers are providing workplace specific training based of the hazards employees may encounter on the job. BDC has established minimum safety training standards for employees.

2-5. Incentives for safety performance

Employees will be formally recognized for safe work history and promoting a safe, healthy work environment.

2-6. Disciplinary action for safety violation

Lack of regard for safety procedures and careless attitude leads to a breakdown in responsible safety culture. Disciplinary action can be:

- Counseling/ warning
- Suspension with pay- deliberate or repeated violation after initial warning; re-training required
- Dismissal

SECTION 3 SAFETY RESPONSIBILITY AND PROGRAM OVERVIEW

Safety is everyone's responsibility. Bioenergy DevCo management is committed to the philosophy of the Safety Program. Delegation of safety duties are the function of management. The associates are committed to participating in the Safety Program and pointing out unsafe conditions or violations of the policy. This section summarizes responsibilities that are described fully further in the Program's respective sections.

3-1. Display and Posting of Safety Information

Management display safety information to ensure Work Site Safety and Health. Written policy statements which identify safety and health goals, objectives, and management commitment are included in the Safety Program located in each facility, and readily available to all associates and contractors.

Facility Managers are responsible for informing contractor supervision of BDC polices before work begins.

The Human Resources Department has policies concerning disciplinary action frequency/severity.

Facility Managers conduct visual site inspections daily, and document monthly safety inspections using the BDC Maintenance Management System

The Fire Departments are invited to tour our facilities on an annual basis.

3-2. Safety and Health Responsibility

1. Health and Safety responsibility is assigned to every associate. Facility Managers are held accountable for safety as a job function. The Safety Manager provides aid and guidance.

Management Performance and Review of Safety and Health Duties.

Each Facility Manager is evaluated annually on safety as part of their performance review.

- Safety and Health Resources

BDC corporate management approves funding for safety improvements.

The Safety Manager and Facility Managers communicate with the Engineering Department who submits work orders for correcting potential hazards. The Engineering Department gives priority to safety related work orders.

Facility Managers have experience and have received training in hazard recognition and applicable OSHA requirements.

The Facility Manager will be responsible for overseeing the training of each associate.

Each Facility Manager has readily available access to OSHA standards and Safety Department guidance for interpretation and assistance.

The Safety Manager and Facility Managers have the authority to order/purchase safety and health equipment with approval of the Director of Operations.

Site safety and health rules are developed, instituted, revisited and amended by the Safety Manager with input from associates.

Managers and Associates create written procedures, policies; SOPs are updated at least annually.

- Associate/ Operator Involvement in the Site Safety and Health Program

The Safety Committee, comprised primarily of production and operation associates, meets monthly to evaluate the status of safety and health issues. The meeting participants include facility management. Hazard identification is an integral part of safety committee meetings and written documentation is distributed to management.

Associates and Operators are encouraged to share safety and health concerns with the Facility Manager and Safety Manager.

Mobile equipment operators are required to perform documented safety/operational checks daily.

Associates are taught about reporting safety concerns during orientation. Facility Managers evaluate situations and take appropriate action.

Associates review safety statistics, newly purchased equipment, process changes, and proceedings from safety meetings

Associates have access to monitoring results (hearing conservation, hexane testing, industrial hygiene sampling, lead testing, hydrogen testing, and confined space monitoring results).

Safety reports and audits are shared with associates. These are discussed at Safety Committee meetings and members are encouraged to pass information on to coworkers.

Safety work orders are accessible to associates for review.

3-3. Program overview

Program topics are listed here.

- Contractor Safety

Contractor safety is an important element of the Safety Program. The Facility Manager, Engineering Department and Safety Manager monitor contractor compliance with OSHA regulations. Contractors are required to complete a contractor packet documenting their safety programs and safety training programs.

- Safety and Health Performance Review

1. Safety statistics are published and sent to each Facility Manager quarterly. The Human Resources Office generates these reports.

2. The Safety Manager reviews facility action plans and goals during site visits.

- Work site Hazard Analysis

The hearing conservation program is overseen by an outside service, professional survey/monitoring and suggestions for control measures are developed and shared with the Facility Manager.

Hazardous chemicals have been identified and appropriate precautions and training provided.

Outside inspection agencies (insurance and fire) are performed and documented annually.

- Process Safety and Health Hazards Associated with New Equipment and Processes

Equipment and products are purchased with the specification that they meet OSHA and other applicable health and safety standards.

SDS sheets on products purchased are reviewed by the Environmental Department and the Safety Manager to assure safe usage.

Installation and introduction of equipment and new processes are reviewed by representatives of Safety, Engineering, Purchasing, and Facility Managers to avoid the creation of hazards.

- Job Safety Analysis

Job hazard analysis has been completed on all jobs. This includes the Work Plan, job description and physical demands and determining appropriate protective equipment.

3-4. Process Safety Management

The Process Safety Management (PSM) team includes Regional and Facility and Safety Managers, while considering input from site leaders other associates. The Process Safety Management Team meets monthly. PSM audits of all unit operations are conducted by the BDC Director of Operations. The Facility Manager quarterly completes a PSM matrix until all items are completed. This is turned over to BDC Management for compliance tracking.

- Ongoing Site Safety and Health Inspections.

The Regional Managers and the Safety Manager do on site audits at least annually.

3-5. Accident and Illness Record Keeping

All OSHA recordable injuries require Facility Managers to notify the Regional Manager and Safety Manager within two hours.

Various analysis is looked at in the Maintenance Management System. Electronic records are kept on computer to facilitate producing a variety of reports that can be analyzed.

All OSHA recordables are entered in the system within 6 days.

3-6. Incident Investigation

All incidents including near misses are investigated within eight hours. All incident investigation forms are I sent to the Safety Manager for review and follow-up. Facility Managers, Safety Manager. and Risk.

- Hazard Prevention and Control Hazard Prevention

Major programs are in place (LOTO, BBP, materials handling etc.) Hazard controls are in place (machine guarding, PPE). Reviews by Health, Safety and Engineering professionals are conducted.

- Daily Rounds/ Checklists

- Medical Monitoring Program

Facilities that do not have access local medical centers are used with approval of the BDC HR

The Safety Director monitors associates' health utilizing numerous programs found in the BDC Safety Manual. These programs include:

  - Hearing Conservation
  - Industrial Hygiene
  - Sampling
  - Bloodborne Pathogens
- Post- Employment Health Assessments
- Drug & Alcohol Testing Program
- Restricted Duty/Medical Monitoring Program
- Personal Protective Equipment

The facility provides a variety of personal protective equipment, which is determined by job hazard assessments or medical management program.

- Respiratory Protection Plan

Respirators are used on a limited basis but are required for entry into hazardous areas where trace quantities of ammonia and hydrogen sulfides or other VOCs could be present. The Respiratory Protection Program includes:

- Appropriate Respirator Selection
- Employee Medical Evaluation

Each new associate will receive a safety orientation before they start work. Associates required to enter a confined space, lockout equipment, drive a powered industrial truck, perform cutting and welding, wear a respirator, work around electrical components, or use fall protection must receive technical safety training before they conduct such work. On the Job Training with experienced associates is encouraged.

Other Safety Programs include

- Equipment Inspections and Maintenance Procedures
- Site's Safety and Health Rules and Enforcement.
- Emergency Response Plan
- First Aid
- Confined Space/Rescue
- Bloodborne Pathogen Program.

SECTION 4 DOCUMENTATION

Digital or hard copies of documents below will be filed for three (3) years

4-1. Employee training documents

An important element of employee safety and health training is proper OSHA documentation. Employees must sign safety training logs upon successful completion of each applicable OSHA topic. OSHA training documentation must be accessible in the event of an OSHA inspection. All training documents for the facility shall be kept on file for life. Both current and last year's training shall be kept in the safety notebooks. Any additional training records shall be kept in a separate file by associate name.

4-2. Facility and equipment inspection

- Hazard Assessment Forms
- Safety Audit Reports
- Forklift, Bob Cat, Front End Loader
- Housekeeping
- Monthly/ annual Inspections
- Fire Extinguisher Inspections (tags)
- Confined Space Meter Calibration

4-3. Daily Safe Work Plan

- Confined Space Entry Permit
- Line-breaking Permits
- Hot Work Permits

4-4. Incident report form

4-5. Contractor Safety Documentation

All contractors and subcontractors must include copies of the table of contents for their safety manual, insurance certificates and at a minimum the following programs:

- Lockout tagout
- Hazard Communication
- Substance Abuse Program (Drug & Alcohol}
- Crane Operator ·Training with proficiency Program
- Lead and Asbestos Program
- Fall Protection
- Employee and supervisor training records depending upon the scope of work.
- Critical Safety By-Pass Permit

Additional programs may be requested based on the scope of work.

4-6. Emergency and notification procedures

SECTION 5 EMPLOYEE TRAINING PROGRAM

The employee is entitled to proper safety training prior to their initial assignment, performing any task or operating any equipment. Training is part of the orientation and ongoing routine safety training program.

Training follows the outline of this manual and each program will be detailed in the respective section. For each standard operation, an SOP is generated and filed in the Standard Operating Procedures Manual. BDC specific operations training will be conducted by the Facility Manager/ Safety Manager. Specialized training will be conducted by a recognized competent authority.

- Evacuation and Emergency Action Plan
- Chemical and Exposure/ Safety Hazard Communication
- Confined Space Entry Program
- Hot Work Permits
- Electrical safety
- Fire Safety
- Equipment operation
    - Aerial lift
    - Forklift
    - Skid steer
    - Loader operation and safety inspection
    - Windrow turner
- First Aid Basic/ Advanced
- OSHA 10/ 30
- Ladder safety/ harness
- Proper lifting techniques/ lower back and joint protection
- Power Industrial Trucks
- LOTO
- Fall Protection
- Respiratory Protection
- Hearing Conservation
- Cutting and Welding Safety
- House Keeping

Training Records

- Each Facility Manager will be responsible for maintaining copies of current training on site. All training documentation is to be entered into the Maintenance Management System.
- All training documentation is to be maintained permanently on file.

Training Frequency

- Training is scheduled in accordance with programs and policies. Additional training is provided based on management review and assessment of need.

SECTION 6 CONTRACTOR SAFETY PROGRAM

6-1. Contractor requirements

BDC considers all contractors and subcontractors who work on our projects to be part of the extended work force. Contractors must be pre-qualified before their bid will be opened on construction type projects. This pre-qualified process Is necessary for both contractors and subcontractors for any project. Each contractor is required to designate a responsible safety representative for each job conducted on a BDC site. This employee will have the authority and responsibility to immediately correct any safety deficiencies.

6-2. Contractor Information

Company Name:_____Years Est.: _____

Street Address:_____City/State/ZIP _____

Phone Number: _ Cell: _ Fax: _

Company Contact(s): _____

- Certificates of insurance

Certificates of insurance should be filed and include the following:

Insurance Carrier:_____Phone Number: _____

Worker's Compensation Statutory Limits Amount $_____

Employers Liability Amount $_____Bodily Injury only

General Liability, including: Premises & Operations Amount $ _____

Contractors' Protective Liability Products Liability, including: Completed Amount $ _____

Operations Coverage Contractual Liability

Auto Liability, including all owned automobiles and non-owned automobiles Amount $_____

- Contractor Safety Qualification Questionnaire

Is your company self-insured? Yes____No____If yes, the Perdue Project Manager must contact the Perdue Risk Management Office.

Total # of employees:____Total # of part time employees: _____

Who maintains your OSHA 300 log:___Please attach a copy of the last three years

Experience Modification Rate (EMR) include documentation. Please attach copies of your EMR's from the insurance company.

Has your company received any OSHA citations in the last three years? Yes___No____If yes please attach copies.

Do you have written safety policies? Yes___No If yes please attach copies. Do you hold safety meetings with your supervisor and employees? Yes___No ___

Do you conduct field safety inspections to determine compliance with applicable federal, state, local and company regulations/Procedures? Yes____No____If yes please attach copy of form used.

Do you generate inspection reports? Yes____No____If yes please attach a copy of the form used.

Do you have a follow up system to track items identified during safety inspections? Yes No

If yes, then please describe system used. _____

_____

Do you have a documented pre-job or new employee occupational safety & health orientation program? Yes___No____Who conducts this training? _____

Do you have a documented occupational safety & health training program for newly hired or promoted first line supervisors or foremen? Yes____No____Who conducts this training? _____

Do you have a company safety incentive program? Yes____No____If yes please describe.

Do you have an existing Alcohol/Substance Abuse Program? Yes No ___

Do you conduct incident and near miss investigations? Yes___No____Who conducts the investigation? _____

Do you provide first aid/CPR training for your employees? Yes____No____

Do you own your own crane? Yes___No If yes who certifies your operators?

If no, then do you use a subcontractor? Yes____No____If yes what is the name of the subcontractor? How many years of experience do you have working with organic waste management systems?

Do you have certified welders? Yes____No____If yes please attach copy of certificate

Are all the welders that you intend to employ either directly or Indirectly through subcontractors, ASME certified to perform welding on gas systems? Yes____No____

Do you have certified electricians? Yes____No____If yes please provide a copy of their certifications.

Do you use issue trenching permits? Yes____No____If yes do you have an individual to oversee the process? If Yes who is that? _____

6-3. General Safety Review

Safety Reviews

A comprehensive pre-work safety review conference will be conducted for all contractor work that involves the topics in this section. Safety review participants will consist of BDC and contractor safety representatives. All task specific safety concerns shall be addressed and resolved prior to commencement of work by the contractor.

Hazardous Chemical/Substance Notification

Contractor must follow the OSHA Hazard Communication Standard requirements including use safe handling and storage of chemicals. Contractors are required to inform -the-Company of all hazardous substances which may be brought on to BDC property, including providing the most current Material Safety Data Sheet for each substance, All spills and leaks of hazardous chemicals must be immediately reported to the Facility Manager.

Welding & Hot-Work Permit Program

All hot work and welding operations must be conducted under the control of a Hot Work Permit that has been pre-approved by the Facility Manager.

Confined Space Entry

Contractor employees are not authorized to enter any confined spaces on the BDC property unless specifically required by the service or construction contract and with a permit completed by the facility manager.

Work at Elevated Locations

All contractor employees when working at elevated locations higher than four (4) feet above the ground or floor shall use required fall protection equipment.

Other Policies and Procedures

All contractor employees shall adhere to all other BDC Policies, including but not limited to: access to company facilities, company equipment, and use of controlled substances, firearms & explosive restrictions, harassment of other persons, traffic and parking regulations.

Safety Violations

Unfortunately, some Contractors and/or employees of the Contractor may be unwilling or unable to follow the health and safety requirements for the work to be performed. Any Contractor's employees not following the rules and regulations of the company who receives two verbal warnings will be barred from the site.

6-4. Contractor Sign-off

Contractor Safety Training Sign off Sheet for Contractors and their Employees

I have reviewed the below items and agree to follow all the requirements listed in each. (Check boxes to indicate each item has been reviewed)

- General safety precautions associated with the facility.
- Preventive measures related to dust accumulations and common ignition sources
- Housekeeping procedures
- Hot work and fire prevention procedures
- Lockout and tagout
- Confined space procedures
- Hazard communication

- Emergency evacuation procedures
- Powered industrial trucks
- Personal protective equipment
- Electrical safety work practices/ Arc Flash (NFPA 70E)
- Fall protection
- Respiratory protection

Company Date

Print Contractors Name

Signature of Contractors Employee Name

Contractors Supervisor Only

I fully understand the above items and agree to ensure that all employees follow all requirements listed in each above. Our company will work safely and comply with Federal, State, and local laws, rules, and regulations.

I will review these requirements with each of my employees before allowing them on BDC Property and ensure that they have completed the Contractor Safety Training sign-off sheet.

Company_____Date _____

Print Name of Contractor's Supervisor

Signature of Contractor Supervisor

6-5. Contractor Equipment

All equipment utilized on BDC sites will be required to meet minimum OSHA standards and BDC Safety policies i.e.: saws, drills, hand tools, ground fault (GFCI), grinders, Arc Flash Equipment, forklifts.

All cranes must have an annual inspection, a copy of which is stored within the cab of the crane. Each operator must have:

- An annual physical (DOT equivalent or better)
- A proficiency test
- A written operator test

This information must be submitted with the qualification package for each operator. Only Certified Crane Operators that are listed with complete qualifications will be allowed to operate this equipment at BDC sites. The proficiency test must demonstrate the following capabilities: Proficiently handling the vehicle through its full range of motions, understanding of proper hand signals, ability to read and apply load chart, pre-start inspections.

- Heading level 3

Heading level 4

SECTION 7 EVACUATION AND EMERGENCY ACTION PLAN

The purpose of this Evacuation and Emergency Action Plan (EEAP) is to outline the procedures and guidelines for associates to follow in case of an emergency. An emergency is defined as any situation where the health and safety of an associate is in danger. Emergency situations that could occur include but are not limited to:

- Tornado
- Hurricane
- Earthquake
- Fire
- Bomb threat
- Spills and gas releases
- Medical emergencies

This plan is designed to protect associates and company property from danger or injury in the event of such circumstances. If the EEAP is changed or any responsibilities or duties associated with the plan are changed, associates will be promptly notified.

7-1. Media Communication

All interaction and communication with outside news media and associate's families will be coordinated through BDC Management. Only the BDC CEO (or designee) is authorized to make statements to the media. No company associates are to discuss, or release, information about ongoing emergency response with the news media.

7-2. EEAP Associate Training

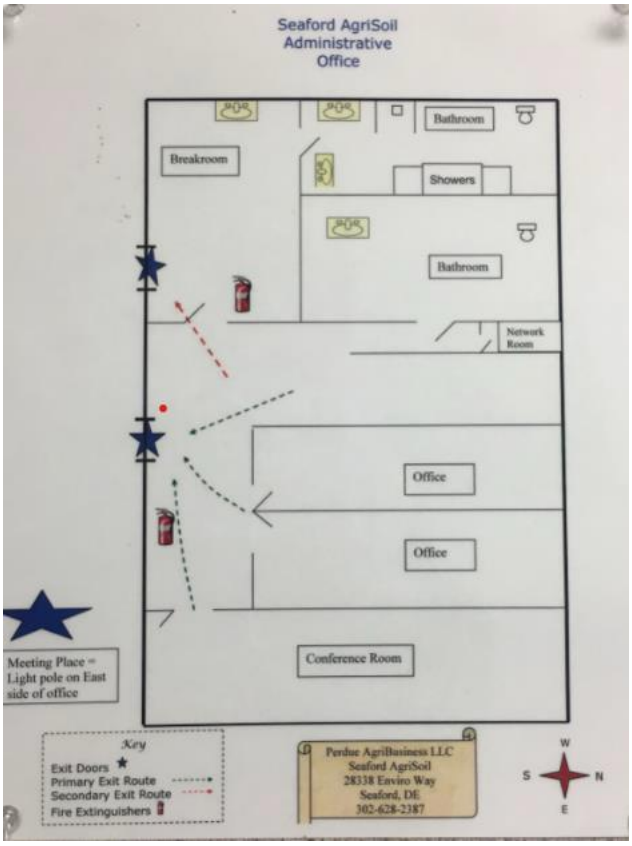
Emergency readiness is critical. All associates will be properly trained and capable of executing the EEAP according to their job classification.

Management has identified specific hazards that could create or complicate emergency situations. Managers have the responsibility of training associates within their department annually. Newly hired associates will be trained prior to their initial assignment. An evacuation and emergency response/ action plan must be communicated and rehearsed. An overview with Muster Points and shelters to remain posted in a common area. Routine rehearsal drills will be performed quarterly.

Types of training will include (but are not limited to) the following:

1. Written Emergency Action Plan.
2. Written evacuation procedures.
3. Alert signal(s) for evacuation.
4. Primary and secondary escape routes.
5. Designated assembly area and accountability.
6. Location of hazardous chemicals or materials in the facility.
7. Specific safety procedures unique to a department.

7-3. Emergency Evacuation



To provide for the safety of associates and visitors, it is essential that early warning of emergency situations be made so that evacuation procedures can be implemented, and emergency response organizations notified of the situation. Evacuation of associates and visitors from the facility is of the utmost importance. Most emergency situations will require the evacuation of all or part of the facility. To achieve a safe and timely evacuation, it is critical that an early warning of the emergency situation be communicated to personnel and action implemented to remove personnel from the hazard area.

Management will immediately start actions, taking into consideration the nature and extent of the emergency. Each facility will follow their procedures outlined in the site-specific evacuation plan and:

1. Lead the associates from work areas when evacuation is warranted.
2. Provide necessary assistance to any associates with disabilities. This will be accomplished through the Facility Manager or his/her designee.
3. Escort associates to the designated assembly area.
4. Account for associates and guests at the designated assembly area. This will be accomplished by using timecards, work-assignment sheets, sign-in sheets, and the general knowledge of associates that everyone is accounted for.
5. Notify the Facility Manager or his designee with the names of associates not accounted for. Refer to Work Assignment Sheets for employees
6. Provide control of associates at assembly areas.

- **Evacuation Drills**

Evacuation drills will be conducted at least every 6 months. Prior to the evacuation, all associates should be trained in the procedures outlined in your individual EAP. Copies of the emergency evacuation floor plans and procedures should be given to each associate. It is important that the associate understand that they must:

- Follow all directions.
- Form single file lines.
- No horseplay of any kind will be tolerated.
- Report to your designated meeting location.

Once everyone is located at their designated meeting location, only the Facility Manager or his designee can give the clearance to enter the facility.

- **Resuming Normal Activities**

Once the building has been evacuated, no one shall re-enter the building for any reason, except for designated and properly trained rescue personnel (such as fire department or emergency medical professionals). Untrained individuals may endanger themselves and/or those they are trying to rescue.

All associates shall remain at the Designated Assembly Area until the fire department or other emergency response agency notifies The Facility Manager or his designee that either:

- The building is safe for re-entry, in which case personnel shall return to their workstations; or
- The building/assembly area is not safe, in which case personnel shall be instructed by The Facility Manager or his designee on how/when to vacate the premises.

7-4. Associate Procedures for Severe Weather

Severe weather can take many forms, including tornado, hurricane, or earthquake. Of the types of severe weather listed, all of them could have an impact on Bioenergy Innovation Center.

- **Management Pre-action**

Most severe weather situations provide some degree of warning or buildup, which will allow for necessary preparations to be implemented.

During Thunderstorm season ensure NOAA Weather Radio (with warning alarm & battery backup) is functioning properly. During Tornado Watches, assign a specific person to monitor the radio.

During high probability periods or during Tornado Watches, consider placing spotters to warn of approaching systems. This will be accomplished by Security or other outside personnel and all information will be broadcast over the short-wave radios.

Pre-alert supervisors concerning the possibility of the need for directing associates to emergency shelter.

- **Tornado watch**

Keep outdoor activities to a minimum. If outdoors, be observant for revolving, funnel-shaped clouds.

Listen to the facility radio for weather updates. During Tornado Watches, place a sign at the main entrance & exit to notify people of the potentially hazardous condition.

If a tornado is sighted, immediately take shelter, and notify the Facility Manager

- **Tornado warning**

Immediately take shelter. Your best protection is a reinforced concrete or steel-framed structure. An interior hallway on the lowest level of the structure will be the safest.

[Insert Map]

Take action to protect yourself from being blown away or struck by falling or flying objects. Stay away from windows to avoid flying debris. If a tornado is rapidly approaching and you cannot reach a safe shelter, lie flat in the nearest depression or ditch and cover your head with your arms.

- **Types of shelters**

The best protection in a tornado is usually an underground area. The best above ground areas in a building are:

Small interior rooms on the lowest floor without windows.

Hallways on lowest floor away from outside doors and windows.

Rooms constructed of reinforced concrete, brick or block with no windows and a heavy concrete floor or roof system. Buildings with flat, wide-span roofs are not considered safe.

Each facility will have meeting points identified with signs.

- **Earthquakes**

Earthquakes occur without warning. Some earthquakes are instantaneous tremors and others are significant events followed by aftershocks.

Stay indoors if already there. If indoors take cover. Suggested locations inside buildings that provide cover include:

- Standing in a doorway and bracing your hands and feet against each side.
- Getting under sturdy furniture, such as worktables or desks.
- Standing flat against an interior wall.
- Stay near the center of the building and avoid glass windows and doors.

If outdoors, stay in open areas, away from structures, and a safe distance from utility wires.

After tremors have stopped quickly leave the building or work area and proceed to the designated emergency meeting location. If you encounter associates or visitors, then you should direct them to evacuate the building or work area and have them proceed to the designated emergency meeting location.

- **Hurricane**

The nature of a hurricane provides for more warning than other natural and weather disasters. A hurricane watch issued when the hurricane becomes a threat to a coastal area. A hurricane warning is issued when sustained winds of 74 mph or higher, or a combination of dangerously high water and rough seas, are expected in the area within 24 hours.

Once a hurricane watch has been issued:

  - Stay calm and await instructions from the Facility Manager.
  - Continue to monitor local TV and radio stations for instructions
  - Be ready to evacuate as directed by your Facility Manager.

- **Flood**

BIC is above the 500-year flood plain. When preparing for a flood, a detailed checklist should be developed indicating the order in which processes are to be shut down and the electricity secured. The length of time needed - expressed in hours or days- to accomplish these tasks should be determined in advance so that appropriate actions can be initiated at the proper time. Then, as each task is completed during either a flood watch or flood warning, check it off and move on to the next one.

- Shut down processes safely and drain open tanks of flammable or combustible liquids.
- Brace unsupported structural members at construction sites.
- Up-date important backup records and move them to a location not vulnerable to flooding.
- Anchor yard items that can be moved by floodwaters, such as trailers, lumber, or lose yard storage. Move stored materials inside if practical. Barricade critical outdoor equipment with sandbags to provide protection against floating debris.

Assemble the following supplies and equipment at a central, secure location:

- Portable pumps and hose
- Mops and squeegees
- Emergency lighting_
- Tarpaulins
- Lumber and nails
- Power and manual tools
- Sandbags
- Shovels and axes

Ensure that the emergency crew remaining on the premises has the following:

- Nonperishable food
- Two-way radios
- First Aid kit
- Stored Drinking water

Flood checklist:

- Fill emergency generator and fire pump fuel tanks.
- Inspect all fire protection equipment to be sure it is in service.
- Check travel brakes on movable cranes and bridges. Anchor them in accordance with the manufacturer's out-of-service instructions
- Place sandbags at vulnerable building openings and around critical outdoor equipment.
- Divert water from critical areas such as holes in foundations, doorways, and skills.
- Move important machinery, stock, and reports to higher elevations. By knowing the past flooding history of the area, reasonably safe areas can be selected. If major equipment cannot be moved, coat vulnerable metal surfaces with grease.
- Shut off all flammable and combustible liquids and gases lines at their source to pre- vent the discharge of such liquids and gases from piping broken by floating debris.

Support exposed piping properly.

- Make sure above and below ground tanks are properly anchored to prevent flotation. Fill empty tanks with water or product and extend vent lines on active tanks above the anticipated maximum water level.
- Tie down portable containers of flammable or combustible liquids.
- Main gas and oil lines shut off.
- All signs that are not bolted are to be taken inside Trash cans are to be put inside.
- Receiving pit covered with tarp and tied down. Dump doors closed
- Place all vehicles inside and with full fuel tanks if possible. Remove all overhead objects that are not secured permanently. Inspect each guide wire for tension and clamps.
- All debris should be picked up and put away.

7-5. Medical Emergencies

It may become necessary in an emergency to rescue personnel and perform some specified medical duties, including first-aid treatment. All associates assigned to perform such duties will have been properly trained and equipped to carry out their assigned responsibilities properly and safely. All Medical Emergency Care Providers will use the proper PPEs as outlined in the Control of Blood-home Pathogens Program and will follow the proper standards of care.

All injured or ill associates requiring emergency medical care for life/death medical emergencies will be transported by local Emergency Medical Services (EMS) to the nearest local Hospital. All non-life/death medical emergencies will be managed by the (Occupational Health Care Nurse) and the Facility Manger or his/her designee.

All associates who are involved in an injury or accident shall be screened for drugs and alcohol as prescribed by company policy.

7-6. Incident Response- general

See Incident Reporting

Release: The term “release” means any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping or disposing into the environment (including the abandonment or discarding of barrels, containers and other closed receptacles) of any hazardous chemical, extremely hazardous substance or toxic chemical.

7-7. Gas release

Gas release is defined as the unintended release of fumes or process gasses to the atmosphere, indoor or outdoor.

7-8. Spill Response and prevention plan

Spills are defined as the unintended release of liquid to an uncontained surface, such as water and land, pervious or impervious.

The first action is to contact the Supervisor on hand

- **Containment Plan**

A spill containment plan submitted to DNREC Environmental authorities

Contain the spill with the appropriate containment equipment as required by the volume of spill

1-5 gallons can be absorbed by adsorbent powder/ pellets or absorbent pads

Spills 5 -55 gallons can be contained by sock tube type booms until adsorbed by wood chips/ compost. The material is then collected by front-end loader and managed in accordance with all local, state and federal laws, rules and regulations." ~~into a dumpster and sent to sanitary landfill~~

See SOP Spill Prevention, Control, and Countermeasure (SPCC)

- **Process liquid spill**

Process liquid can be leachate, digestate, condensate, and feedstock, stored or being delivered (Copy from Stormwater plan)

- **Chemical Spill**

Fuels, chemicals, cleaning agents

Immediately notify the Facility Manager or his designee of the spill and the location of the spill.

Do not attempt to clean the spill unless trained to do so.

Before cleaning up spills don the proper PPE.

Consult MSDS/SDS sheets for information on clean up and disposal instructions.

- **Spill Reporting**

Spills will be reported as required to the DNREC Emergency Response at 1-800-662-8802. Report will be made to Compliance and Permitting Section (CAPS) within 24 hours, report in 5 business days.

Spills of any quantity that have the potential to impact surface or groundwater (permeating the soil) will be reported.

For spills that are contained on an impermeable surface that do not have the potential to flow into surface water or impact groundwater, spill quantities will be reported in excess of specified amounts below within any rolling 24 hour period:

-25 gallons for petroleum substances, heating oil, motor fuel, used oil
-150 gallons for petroleum subs., other than heating oil, motor fuel, used oil
-10,000 gallons for any poultry related liquid feedstocks
- Other hazardous chemicals on-site will be identified

~~(what are we required to report and to whom?~~)

7-9. Fire Response

When an associate becomes aware of a fire on the facility, he/she will immediately notify his/her supervisor. Firefighting is a specialized skill to be conducted by authorized and trained associates only.

- **Prevention**

Fire Prevention and Safety is described in depth in Section XXX. Fire prevention and reporting procedures for compost plant permit requirements must be adhered.

- **Small Fires**

If the fire is small and localized or in the incipient phase (beginning stage), the Facility Manager or his designee will direct associates to leave the immediate area.

The Facility Manager or his/her designee may then direct associates trained in the use of fire extinguishers to put out the small fire. The Facility Manager or his/her designee who was notified has communication responsibilities and will not involve himself/herself in firefighting.

If the fire appears to be spreading, then the affected Facility Manager or his/her designee will direct the associates fighting the fire to evacuate. The Facility Manager or his/her designee will then implement the procedure for large fires found in the next section. Associates evacuated from the area shall not be allowed to return until the fire has been completely extinguished, the smoke removed, and the area declared safe by the Facility Manager or his designee.

Under no circumstances shall an employee attempt to fight a fire that has passed the incipient stage (that which can be put out with a fire extinguisher), nor shall any associate attempt to enter a burning building to conduct search and rescue. These actions shall be left to emergency services professionals who have the necessary training, equipment, and experience (such as the fire department or emergency medical professionals). Untrained individuals may endanger themselves and/or those they are trying to rescue.

- **Large Fires**

When an associate becomes aware of a large-scale fire, he/she will immediately notify their supervisor.

When a Facility Manager or his designee is made aware of a large fire, he/she shall immediately direct all associates in the area to leave and shall also leave the area themselves. Associates removed from the facility shall not be allowed to return until the fire has been completely extinguished, the smoke removed, and the Facility Manager or his designee declares the facility safe.

7-10. Terrorist Threat

7-11. Bomb threats

However unlikely to even receive a bomb threat, the possibility cannot be dismissed as the consequences are great.

It is therefore essential for local management at each location to be familiar with the following policy and procedures for handling bomb threats. The local law enforcement agency must be notified as soon as possible after a bomb threat is received.

- **If received by phone**

Most bomb threats are received by telephone, so each person answering the phones play a key role in helping to evaluate the situation.

Whenever possible, the phone call should be transferred to the Human Resources Department. If the person answering the phone feels that interrupting the caller may frighten him into hanging up, the call should be handled at that phone. If this should occur someone. in the area should notify Human Resources of the situation and start to fill out the bomb threat checklist attached to the end of this policy.

Whoever handles the call should try to keep the caller on the line so that additional information can be obtained. Most of the phones in our facility have caller ID, so writing down any phone numbers would help with identifying the caller. Take notes and ask the caller questions like:

- When will the bomb explode?

- Where is the bomb located? If the caller refuses to answer this remind him that many innocent people may be killed or seriously injured if the bomb area is not cleared.
- To whom am I speaking?
- What is your phone number?
- Your address?
- What kind of bomb is it?
- How big is the bomb (physical size)? What does it look like?
- Is the bomb in a container?
- Why was the bomb placed?
- Do you have a friend or relative who works here?
- Why are you calling now?

Note whether the caller was male or female and indicate an estimate of his/her approximate age. Were there unusual characteristics to the voice-- an accent or speech impediment? For example: listen for background noise such as music, laughter, traffic noise, etc.

- **Decide whether to evacuate**

The decision of whether to evacuate or not will be made by Management. Local authorities will frequently offer counsel and advice, but in most cases they will not make the actual decision. The first consideration in every case must be the safety of all personnel. While this might seem to dictate automatic evacuation for every threat, it must be remembered that most bomb threats turn out to be hoaxes. Moreover, aside from the expense of a production interruption, the caller's object may be to cause confusion and disruption; thus, automatic evacuation after each threat may precipitate further threats.

- **If evacuation is indicated**

If, based on the facts available, there is a probability that the bomb threat may be real, a further decision is needed. Should the entire facility be evacuated or only the area around the target? The Facility Managers and Human Resources will make this decision.

When the target area is specified by the caller, individuals must be evacuated from a space at least 300 feet surrounding the target. People must also evacuate the same space on floor immediately above and/or below the target.

If evacuation on the facility is indicated, then all associates and other individuals must be promptly advised. Associates will be paid for the time spent standing by until the decision has been made to send them home.

- **If evacuation is not indicated**

If, after careful evaluation of the situation, a decision is made that the threat is a hoax and evacuation should not be called, all associates must be promptly advised that a bomb threat has been received, that management has decided the threat is a hoax and that the facility will remain in operation.

SECTION 8 WORK PLAN

"Plan your work and work your plan" Thoughtful and thorough planning is the first step in preventing accidents. No work is to be conducted without a written work plan outlining the procedures and tasks and a thorough hazard assessment. Tasks will be described in an SOP

8-1. Contractor and visitor sign-in

Contractors and visitors must sign in at the front office upon arrival. They must also not forget to sign out when leaving. The sign-in list is used for head count in the event of an emergency.

Unattended facilities associated with the Compost and AD facility should be locked to limit risk to individuals unfamiliar with the surroundings and to ensure that the system continues to operate efficiently. Employees familiar with the facility should always escort visitors. Visitors to the facility are not to operate any switches, controllers, or other electrical functions, including light switches.

8-2. Contractor and Visitor orientation

Contractor orientation is site specific and supplements standard OSHA recognized training. The orientation is arranged with the safety director or plant supervisor in advance of the contractor's arrival. All contractors and each of their staff onsite must go through basic safety training upon initial visit and renew annually. The training reviews the essentials of the Work Plan. A BDC staff member will review the contractor's specific work plan for all activities conducted.

Visitors will undergo a general safety review to create a basic awareness of potential hazards during their visit. All visitors will be escorted by an operator or BIC tour guide. Limited access and safety are the responsibility of the escort.

8-3. Contractor Work Plan

All contracted work will be outlined in a written document submitted to BDC EH&S prior to acceptance of proposal. The minimum requirements include

- Who and how many are performing the work?
- Duration of project
- Where will the work be conducted?
- What equipment will be needed?
- Any Hot Work or Confined- Space Entry?
- Any elevated work?
- What assistance will be needed from BDC to complete the task?
- Is the contractor licensed, insured, and qualified to perform the work?
- Is any fire watch, retrieval or rescue anticipated?

8-4. Post job walk-through

After work is complete, walk through with the supervisor and/or sign off the post-job checklist

- Tools and parts put away
- Dust and debris from surfaces in work area have been cleaned up
- Equipment washed down

SECTION 9 PERSONAL PROTECTIVE EQUIPMENT (PPE)

Personal Protection Equipment (PPE) is the responsibility of the employer to enforce and the responsibility of the employee and contractor to wear. PPE is required when engineering or administrative controls are inadequate. They must be properly selected and worn. Employee and contractor training are required. A pre-Job analysis and hazard assessment are required to determine which equipment is needed.

This section serves as an introduction to the PPE Equipment. See relevant sections for specific safety program of each hazardous exposure.

9-1. Exposure

Exposure pertains to chemical safety, noise, potential atmospheric hazards and other air-borne/ water-borne conditions where PPE is relevant.

9-2. Terminology for Exposure and PPE:

- Permissible Exposure Limit - OSHA PEL
- Threshold Limit Value - ACGIH TLV
- Time-Weighted-Average - TWA
- Short Term Exposure Limit - STEL
- Ceiling Limit - TLV-C or PEL-C
- "Skin" notation
- Protection for a Working Lifetime

9-3. PPE- clothing

- Foot protection
  - Steel toe boots- protect against compression, puncture
  - Metatarsal guards- protects top of foot behind toe
  - Chemical resistant rubber or other polymer- prevents contact with chemicals
- Reflective vest, shirt, or jacket

A high visibility shirt vest or jacket must always be worn outside of office, break rooms or administrative areas

- Hard hat or Bump cap

Hard hats are required in all construction zones and areas of overhead work. Bump caps are not ANSI approved; therefore, they are not OSHA approved. Bump caps do not protect against falling objects. They are never appropriate for workplaces requiring hard hat protection. Hard hats are selected for most appropriate application:

  - Class A - Limited voltage protection
  - Class B - High voltage protection
  - Class C - No voltage protection
  - Class D - Firefighter's helmet
- Fire retardant clothing

Fire retardant clothing may be required in certain areas of occupation. Poly-blend clothing, such as polyester, is not permitted to be worn for outer or inner layers. Watches, rings, and other potentially conductive jewelry and apparel, (i.e. metal buttons), must be removed.

9-4. PPE- Safety glasses

Safety glasses are always to be worn except in office, break rooms or administrative areas. Safety glasses are selected for most appropriate application

- Safety Glasses (minimum requirement)
- Goggles - better protection for chemicals, splashes, dusts, or projectiles.
- Face Shield - better for splashes or projectiles
- Chemical Splash Hood- shoulder length or longer

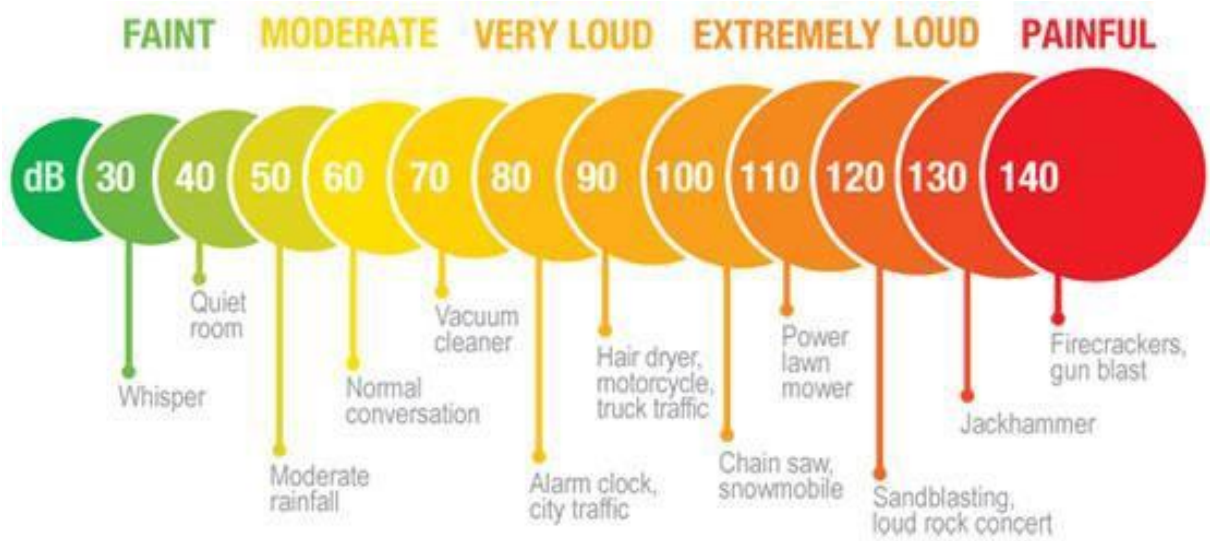
9-5. PPE- Gas detection

Decomposing organic material and gas/ air handling systems can emit odors and flammable gasses while displacing oxygen. In addition to facility gas monitoring, anyone on site must wear Personal Gas Monitors or remain in the same area as a person wearing one. They are to be calibrated as required. The device shall monitor and alert operator to unsafe levels of hydrogen sulfide, LEL of hydrocarbons, carbon monoxide, and oxygen.

In addition, the operator shall monitor short and long-term exposure limits for ammonia gas.

9-6. PPE- Hearing protection

(See also Hearing Protection Program) The decibel (dB) scale increases exponentially. 70 is ten times louder than 60; 80 is 100 times louder than 60, etc. OSHA Limit (PEL) - 85 dB, beyond which hearing protection is required.



Noise can be classified as:

- Continuous: constant level over time
- Intermittent: levels vary over an area or start and stop
- Impact: sharp burst of sound (nail gun, hammer)

Noise Reduction Rating (NRR) - an approximate decibel reduction provided by the protector in controlled testing conditions. Subtract 7 dB for approximate "real world" application)

- Ear Plugs - preferred (NRR* 20-30 dB)
- Ear Muffs - 2nd choice (NRR 15-30 dB)
- Double Hearing Protectors (plugs and muffs)
- (NRR 30-40 dB) used for levels over 115 dB

9-7. PPE- Gloves

- Gloves / gloves with sleeves
  - General duty
- -Cotton, leather
  - Sharp objects
- -Leather, Kevlar
  - Cuts
  - Welding
- Chemical
  - Multiple types, appropriate for chemicals encountered

9-8. PPE-Respirator

(See also Respiratory Protection Program) Respirators and other breathing apparatuses are essential for preventing asphyxiation or engulfment from vapors or low oxygen. Breathing devices are part of the plan which includes avoidance of such conditions and retrieval or evacuation from entrapment.

- Maintenance and Inspection
- Work Area Surveillance
- Medical Fitness
- Program Auditing
- No Glasses with Full Face mask or respirator
- Training of Users
- Fit-Testing
  - Initial
  - NO BEARDS
  - Annual
- Changing brand
- Cleaning and Storage

Selection of Respirators

Use only Certified respirators

- Air-Purifying Respirator (APR)
  - Dust Mask
  - Half/ Full Face
- APR Respirators must adequately protect from the following respiratory hazards:
  - Toxic atmosphere
  - Dusts, fumes, and mists
  - Gases and vapors
- Air-Purifying (APR)
  - Concentration of contaminant must be known; align respirator selection with the proper Protection Factor (PF)
  - Oxygen level (19.5%-23.5%)
  - Cartridge has a limited useful life
  - Warning properties (some substances can't be detected or are too toxic)

- APR respirators are not designed to protect from
  - Oxygen deficiency or enrichment
  - Immediately Dangerous to Life and Health (IDLH)
- In these circumstances a Supplied Air Respirator (SAR) must be deployed
  - Air-line
  - Self-Contained Breathing Apparatus (SCBA)
- They may be Half/full facepiece style or hood style. An escape provision must be identified
  - Supplied Air (SAR)- Training required
    - Concentration of contaminant must be known; align mask selection with the proper Protection Factor (PF)
    - SCBA or air-line must provide "Grade D" air source
    - SCBA and Air-line are more cumbersome / unwieldy; vision can be obstructed
    - Mobility is limited (air-line style)
    - Length of work time is limited (SCBA style)

SECTION 10 FIRST AID

10-1. Supplies and equipment

BDC will supply and maintain First Aid kits. Each facility will maintain at least one Automatic External Defibrillator on site.

This section can easily be its own book. Please provide concise references from Certified training courses.

10-2. Training

Each employee is required to complete First Aid/ CPR basic training through the Red Cross or equivalent recognized authority. The certification is to be maintained current.

All associates will be trained in Cardio-Pulmonary Resuscitation (CPR) and the proper use of the Automatic External Defibrillator (AED).

First Aid Training topics include:

- Medical emergencies
- Patient Assessment and Movement
- Scene Assessment
- Choking skills
- Injuries and traumatic emergencies
- Personal protective equipment for First Aid
- Responding to an emergency
- Environmental emergencies
- Bloodborne pathogens
- Legal Issues and consent
- First aid kit contents

SECTION 11 WORK-RELATED HEALTH CONDITIONS AND CONDUCT

Stress conditions affect worker performance as well as health and safety. BDC Safety Program addresses stress induced by weather and unsafe conditions created by distraction and behavior.

11-1. Distraction

Mindful awareness of surroundings must be maintained throughout all operations. Multi-tasking, such as phone conversations, music, sports, and daydreaming distract from focused attention and can lead to injury and loss.

11-2. Heat

The following information has been collected from the National Institute for Occupational Safety and Health (NIOSH). The purpose of this program is to provide guidance for protecting associates from hazards of high heat conditions and to provide information on engineering, administrative and PPB controls. Being uncomfortable is not the major problem with working in high temperatures. Workers who are suddenly exposed to working in a hot environment face additional and generally avoidable hazards to their safety and health.

How the body handles heat

The human body, being warm blooded, maintains a relatively constant internal temperature, even though it is being exposed to varying environmental temperatures. To keep internal body temperatures within safe limits, the body must get rid of its excess heat, primarily through varying the rate and amount of blood circulation through the skin and the release of fluid onto the skin by the sweat glands. These automatic responses usually occur when the temperature of the blood exceeds 98.6^{o}F and are kept in balance and controlled by the brain. In this process of lowering internal body temperature, the heart begins to pun1p more blood; blood vessels expand to accommodate the increased flow, and the microscopic blood vessels (capillaries) which thread through the upper layers of the skin begin to fill with blood. The blood circulates closer to the surface of the skin, and the excess heat is lost to the cooler environment.

If heat loss from increased blood circulation through the skin is not adequate, the brain continues to sense over-heating and signals the sweat glands in the skin to shed large quantities of sweat onto the skin surface. Evaporation of sweat cools the skin, eliminating large quantities of heat from the body.

As environmental temperatures approach normal skin temperature, cooling of the body becomes more difficult. If air temperature is as warm as or warmer than the skin, blood brought to the body surface cannot lose its heat. Under these conditions, the heart continues to pump blood to the body surface, the sweat glands pour liquids containing electrolytes onto the surface of the skin and the evaporation of the sweat becomes the principal effective means of maintaining a constant body temperature. Sweating does not cool the body unless the moisture is removed from the skin by evaporation. Under conditions of high humidity, the evaporation of sweat from the skin is decreased and the body's efforts to maintain an acceptable body temperature may be significantly impaired.

These conditions adversely affect an individual's ability to work in the hot environment. With so much blood going to the external surface of the body, relatively less goes to the active muscles, the brain, and

other internal organs; strength declines; and fatigue occurs sooner than it would otherwise. Alertness and mental capacity also may be affected. Workers who must perfo1m delicate or detailed work may find their accuracy suffering, and others may experience diminished comprehension and retention of information.

- **Safety Problems**

Certain safety problems are common to hot environments. Heat tends to promote accidents due to the slipperiness of sweaty palms, dizziness, or the fogging of safety glasses. Wherever there's molten metal, hot surfaces, steam, etc., the possibility of burns from accidental contact also exists.

Aside from these obvious dangers, the frequency of accidents, in general, appears to be higher in hot environments than in more moderate environmental conditions. One reason is that working in a hot environment lowers the mental alertness and physical performance of an individual. Increased body temperature and physical discomfort promote irritability, anger, and other emotional states which sometimes cause workers to overlook safety procedures or to divert attention from hazardous tasks.

- **Health Problems**

Excessive exposure to a hot work environment can bring about a variety of heat-induced disorders.

Heat Stroke

Heat stroke is the most serious of health problems associated with working in hot environments. It occurs when the body's temperature regulatory system fails, and sweating becomes inadequate. The body's only effective means of removing excess heat is compromised with little warning to the victim that a crisis stage has been reached.

A heat stroke victim's skin is hot, usually dry, red, or spotted. Body temperature is usually 105_F or higher, and the victim is mentally confused, delirious, perhaps in convulsions, or unconscious. Unless the victim receives quick and appropriate treatment, death can occur.

Any person with signs or symptoms of heat stroke requires immediate hospitalization. However, first aid should be immediately administered. This includes removing the victim to a cool area, thoroughly soaking the clothing with water, and vigorously fanning the body to increase cooling. Further treatment at a medical facility should be directed to the continuation of the cooling process and the monitoring of complications which often accompany the heat stroke. Early recognition and treatment of heat stroke are the only means of preventing permanent brain damage or death.

Heat Exhaustion

Heat exhaustion includes several clinical disorders having symptoms which may resemble the early symptoms of heat stroke. Heat exhaustion is caused by the loss of large amounts of fluid by sweating, sometimes with excessive loss of salt. A worker suffering from heat exhaustion still sweats but experiences extreme weakness or fatigue, giddiness, nausea, or headache. In more serious cases, the victim may vomit or lose consciousness. The skin is clammy and moist, the complexion is pale or flushed, and the body temperature is normal or only slightly elevated.

In most cases, treatment involves having the victim rest in a cool place and drink plenty of liquids. Victims with mild cases of heat exhaustion usually recover spontaneously with this treatment. Those with severe cases may require extended care for several days. There are no known permanent effects.

CAUTION: Persons with heart problems or those on a low sodium diet who work in hot environments should consult a physician about what to do under these conditions.

Heat Cramps

Heat cramps are painful spasms of the muscles that occur among those who sweat profusely in heat, drink large quantities of water, but do not adequately replace the body's salt loss. The drinking of large quantities of water tends to dilute the body's fluids, while the body continues to lose salt. Shortly thereafter, the low salt level in the muscles causes painful cramps. The affected muscles may be part of the arms, legs, or abdomen, but tired muscles (those used in performing the work) are usually the ones most susceptible to cramps. Cramps may occur during or after work hours and may be relieved by taking salted liquids by mouth.

CAUTION: Persons with heart problems or those on a low sodium diet who work in hot environments should consult a physician about what to do under these conditions.

Fainting

A worker who is not accustomed to hot environments and who stands erect and immobile in the heat may faint. With enlarged blood vessels in the skin and in the lower part of the body due to the body's attempts to control internal temperature, blood may pool there rather than return to the hea1i to be pumped to the brain. Upon lying down, the worker should soon recover. By moving around, and thereby preventing blood from pooling, the patient can prevent further fainting. Heat Rash Heat rash, also known as prickly heat, is likely to occur in hot, humid environments where sweat is not easily removed from the surface of the· skin by evaporation and the skin remains wet most of the time. The sweat ducts become plugged, and a skin rash soon appears. When the rash is extensive or when it is complicated by infection, prickly heat can be very uncomfortable and may reduce a worker's performance. The worker can prevent this condition by resting in a cool place part of each day and by regularly bathing and drying the skin.

Transient Heat Fatigue

Transient heat fatigue refers to the temporary state of discomfort and mental or psychological strain arising from prolonged heat exposure. Workers unaccustomed to the heat are particularly susceptible and can suffer, to varying degrees, a decline in task performance, coordination, alertness, and vigilance. The severity of transient heat fatigue will be lessened by a period of gradual adjustment to the hot environment (heat acclimation).

Preparing for the Heat

One of the best ways to reduce heat stress on workers is to minimize heat in the workplace. However, there are some work environments where heat production is difficult to control, such as when furnaces or sources of steam or water are present in the work area or when the workplace itself is outdoors and exposed to varying warm weather conditions.

Humans are, to a large extent, capable of adjusting to the heat. This adjustment to heat, under normal circumstances, usually takes about 5 to 7 days, during which time the body will undergo a series of changes that will make continued exposure to heat more endurable.

On the first day of work in a hot environment, the body temperature, pulse rate, and general discomfort will be higher. With each succeeding daily exposure, all these responses will gradually decrease, while the sweat rate will increase. When the body becomes acclimated to the heat, the worker will find it possible to perform work with less strain and distress.

Gradual exposure to heat gives the body time to become accustomed to higher environmental temperatures. Heat disorders in general are more likely to occur among workers who have not been given time to adjust to working in the heat or among workers who have been away from hot environments and who have gotten accustomed to lower temperatures, Hot weather conditions of the summer are likely to affect the worker who is not acclimated to heat. Likewise, workers who return to work after a leisurely vacation or extended illness may be affected by the heat in the work environment. Whenever such circumstances occur, the worker should be gradually reacclimated to the hot environment.

Number and Duration of Exposures

Rather than be exposed to heat for extended periods of time during a job, workers should, wherever possible, be permitted to distribute the workload evenly over the day and incorporate work-rest cycles.

Work-rest cycles give the body an opportunity to get rid of excess heat, slow down the production of internal body heat, and provide greater blood flow to the skin.

Workers employed outdoors are especially subject to weather changes, A hot spell or a rise in humidity can create overly stressful conditions. The following practices can help to reduce heat stress:

Postponement of nonessential tasks.

Permit only those workers acclimated to heat to perform the more strenuous tasks. Provide additional workers to perform the tasks keeping in mind that all workers should have the physical capacity to perform the task and that they should be accustomed to the heat.

Rest Areas

Providing cool rest areas in hot work environments considerably reduces the stress of working in those environments. There is no conclusive information available on the ideal temperature for a rest area. However, a rest area with a temperature near 76 degrees F appears to be adequate and may even feel chilly to a hot, sweating worker, until acclimated to the cooler environment. The rest area should be as close to the workplace as possible.

Individual work periods should not be lengthened in favor of prolonged rest periods. Shorter but frequent work-rest cycles are the greatest benefit to the worker.

Drinking Water

Over a day's work in the heat, a worker may produce as much as 2 to 3 gallons of sweat. Because so many heat disorders involve excessive dehydration of the body, it is essential that water intake during the workday be about equal to the amount of sweat produced. Most workers exposed to hot conditions drink

fewer fluids than needed because of an insufficient thirst drive. A worker, therefore, should not depend on thirst to signal when and how much to drink. Instead, the worker should drink 5 to 7 ounces of fluids every 15 to 20 minutes to replenish the necessary fluids in the body. There is no optimum temperature of drinking water, but most people tend not to drink warm or very cold fluids as readily as they will cool ones. Whatever the temperature of the water, it must be readily available to the worker. Individual drinking cups should be provided, never use a common drinking cup. Heat acclimatized workers lose much less salt in their sweat than do workers who are not adjusted to the heat.

The average American diet contains sufficient salt for acclimatized workers even when sweat production is high. If, for some reason, salt replacement is required, the best way to compensate for the loss is to add a little extra salt to the food. Salt tablets should not be used.

CAUTION Persons with heart problems or those on a low sodium diet who work in hot environments should consult a physician about what to do under these conditions.

Protective Clothing

Clothing inhibits the transfer of heat between the body and the surrounding environment. Therefore, in hot jobs where the air temperature is lower than skin temperature, wearing clothing reduces the body's ability to lose heat into the air.

When air temperature is higher than skin temperature, clothing helps to prevent the transfer of heat from the air to the body. However, this advantage may be nullified if the clothes interfere with the evaporation of sweat.

In dry climates, adequate evaporation of sweat is seldom a problem. In a dry work environment with very high air temperatures, protective clothing could be an advantage to the worker. The proper type of clothing depends on the specific circumstance. Certain work in hot environments may require insulated gloves, insulated suits, reflective clothing, or infrared reflecting face shields. For extremely hot conditions, thermally- conditioned clothing is available. One such garment carries a self-contained air conditioner in a backpack, while another is connected a compressed air source which feeds cool air into the jacket or coveralls through a vortex tube. Another type of garment is a plastic jacket which has pockets that can be filled with dry ice or containers of ice.

Associate Awareness

The key to preventing excessive heat stress is educating the employer and worker on the hazards of working in heat and the benefits of implementing proper controls and work practices. The employer should establish a program designed to acclimatize workers who must be exposed to hot environments and provide necessary work-rest cycles and water to minimize heat stress.

Special Considerations

During unusually hot weather conditions lasting longer than 2 days, the number of heat illnesses usually increases. This is due to several factors, such as progressive body fluid deficit, loss of appetite (and possible salt deficit), buildup of heat in living and work areas, and breakdown of air-conditioning equipment. Therefore, it is advisable to make a special effort to adhere rigorously to the above preventive measures during these extended hot spells and to avoid any unnecessary or unusual stressful activity. Sufficient

sleep and good nutrition are important for maintaining a high level of heat tolerance. Workers who may be at a greater risk of heat illnesses are the obese, the chronically ill and older individuals.

When feasible, the most stressful tasks should be performed during the cooler parts of the day (early morning or at night). Double shifts and overtime should be avoided whenever possible. Rest periods should be extended to alleviate the increase in the body heat load.

The consumption of alcoholic beverages during prolonged periods of heat can cause additional dehydration.

Persons taking certain medications (e.g., medications for blood pressure control, diuretics, or water pills) should consult their physicians to determine if any side effects could occur during excessive heat exposure. Daily fluid intake must be sufficient to prevent significant weight loss during the workday and over the workweek.

11-3. Cold

Workers who are exposed to extreme cold or work in cold environments may be at risk of cold stress. Extreme cold weather is a dangerous situation that can bring on health emergencies in susceptible people, such as those without shelter, outdoor workers, and those who work in an area that is poorly insulated or without heat. What constitutes cold stress, and its effects can vary across different areas of the country. In regions relatively unaccustomed to winter weather, near freezing temperatures are considered factors for cold stress. Whenever temperatures drop decidedly below normal and as wind speed increases, heat can more rapidly leave your body. These weather-related conditions may lead to serious health problems.

Hypothermia

When exposed to cold temperatures, your body begins to lose heat faster than it can be produced. Prolonged exposure to cold will eventually use up your body's stored energy. The result is hypothermia, or abnormally low body temperature. A body temperature that is too low affects the brain, making the victim unable to think clearly or move well. This makes hypothermia particularly dangerous because a person may not know it is happening and will not be able to do anything about it.

Symptoms of hypothermia can vary depending on how long you have been exposed to the cold temperatures.

Early Symptoms

- Shivering
- Fatigue
- Loss of coordination
- Confusion and disorientation

Late Symptoms

- No shivering
- Blue skin
- Dilated pupils
- Slowed pulse and breathing
- Loss of consciousness

First Aid

- Take the following steps to treat a worker with hypothermia:
- Alert the supervisor and request medical assistance.
- Move the victim into a warm room or shelter.
- Remove their wet clothing.
- Warm the center of their body first-chest, neck, head, and groin-using an electric blanket, if available; or use skin-to-skin contact under loose, dry layers of blankets, clothing, towels, or sheets.
- Warm beverages may help increase the body temperature, but do not give alcoholic beverages. Do not try to give beverages to an unconscious person.
- After their body temperature has increased, keep the victim dry and wrapped in a warm blanket, including the head and neck.
- If victim has no pulse, begin cardiopulmonary resuscitation (CPR).

Frostbite

Frostbite is an injury to the body that is caused by freezing. Frostbite causes a loss of feeling and color in the affected areas. It most often affects the nose, ears, cheeks, chin, fingers, or toes. Frostbite can permanently damage body tissues, and severe cases can lead to amputation. In extremely cold temperatures, the risk of frostbite is increased in workers with reduced blood circulation and among workers who are not dressed properly.

Symptoms of frostbite include:

- Reduced blood flow to hands and feet (fingers or toes can freeze)
- Numbness
- Tingling or stinging
- Aching
- Bluish or pail, waxy skin

First Aid

Workers suffering from frostbite should:

Get into a warm room as soon as possible.

Unless absolutely necessary, do not walk on frostbitten feet or toes-this increases the damage.

Immerse the affected area in warm-not hot-water (the temperature should be comfortable to the touch for unaffected parts of the body).

Warm the affected area using body heat; for example, the heat of an armpit can be used to warm frostbitten fingers.

Do not rub or massage the frostbitten area; doing so may cause more damage.

Do not use a heating pad, heat lamp, or the heat of a stove, fireplace, or radiator for warming. Affected areas are numb and can be easily burned.

Trench Foot

Trench foot, also known as immersion foot, is an injury of the feet resulting from prolonged exposure to wet and cold conditions. Trench foot can occur at temperatures as high as 60 degrees F if the feet are constantly wet. Injury occurs because wet feet lose heat 25-times faster than dry feet. Therefore, to prevent heat loss, the body constricts blood vessels to shut down circulation in the feet. Skin tissue begins to die because of lack of oxygen and nutrients and due to the buildup of toxic products.

Symptoms of trench foot include:

- Reddening of the skin
- Numbness
- Leg cramps
- Swelling
- Tingling pain
- Blisters or ulcers
- Bleeding under the skin
- Gangrene (the foot may turn dark purple, blue, or gray)

First Aid

Workers suffering from trench foot should:

- Remove shoes/boots and wet socks.
- Dry their feet.
- Avoid walking on feet, as this may cause tissue damage.

Chilblains

Chilblains are caused by the repeated exposure of skin to temperatures just above freezing to as high as 60 degrees F. The cold exposure causes damage to the capillary beds (groups of small blood vessels) in the skin. This damage is permanent, and the redness and itching will return with additional exposure. The redness and itching typically occurs on cheeks, ears, fingers, and toes.

Symptoms

Symptoms of chilblains include:

- Redness
- Itching
- Possible blistering
- Inflammation

- Possible ulceration in severe cases
- First Aid

Workers suffering from chilblains should:

- Avoid scratching
- Slowly warm the skin
- Use corticosteroid creams to relieve itching and swelling
- Keep blisters and ulcers clean and covered

11-4. Poor Lighting

Poor lighting in the work area can lead to poor work practices that result in injuries of many types. Make sure lighting is adequate for the task at hand, replace burnt out bulbs, and point out hazardous areas to your immediate supervisor.

11-5. Fatigue

- **Repetitive motion**

Ergonomics means "the study of work." The objective of ergonomics is to adapt the job and workplace to the worker by designing tasks, work stations, tools, and equipment within a worker's physical capabilities and limitations. Rather than forcing a person to fit into a job, adapting the task to fit the worker can reduce ergonomic stress and eliminate many potential ergonomic disorders. Injuries resulting from tasks that require a high level of repetitive motion, also known as Repetitive Motion Injuries (RMI), can be very debilitating to an employee and should be avoided.

These types of injuries are also referred to as cumulative trauma disorders (CTD) or repetitive motion disorders and are injuries to the musculoskeletal and nervous systems. Tendons and muscles in the upper extremities and hands are the most affected body regions. Fatigue or tiredness in muscles and/or joints is the body's way of telling you to change your pattern of working. Doing the same motion repeatedly or using certain types of positions or grips can cause pain and inflammation.

The following steps can be taken to curb or limit an employee's exposure to highly repetitive tasks:

- Maintain good body posture.
- Periodic walk-through surveys, or whenever a job task changes.
- Complete a job analysis for all "at risk" positions.
- Train employees with an ergonomic professional or health care provider.
- Report early signs and symptoms of a complication to a manager.
- Encourage employees to take micro-breaks and stretch.
- Implement a job rotation schedule.
- Use mechanical assists and implement engineering controls wherever possible.
- Try to eliminate or reduce overtime work.

By following the above preventative measures, you can reduce and even prevent the RMI and CTD in your workplace.

- **Extended sitting or standing**

Certain jobs require long hours of standing or sitting. These conditions can create back troubles. Get up and stretch frequently if required to sit for long periods. If standing, ease the strain on your lower back by changing foot positions often, placing one foot on a rail or ledge. However, keep your weight evenly balanced when standing. Do not lean to one side.

Be aware of proper posture when sitting, standing, or reclining. When sitting, your knees should be slightly higher than your hips and your shoulders and upper back should be straight.

- **Work hours**

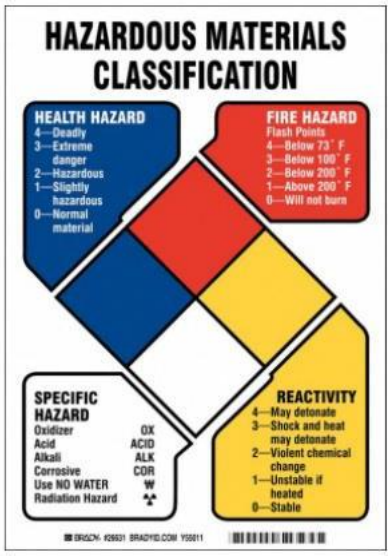
Associates and contractors are to work no more than 16 hours per day and 72 hours per week followed by at least one day (24 hours) of rest.

A variance to the 72-hour week may be granted on a case-by-case basis with PRIOR approval of upper management.

No approval of any kind will be given to exceed 16 hours a day

Each employee is required to complete First Aid/ CPR basic training through the Red Cross or equivalent recognized authority. The certification is to be maintained current.

SECTION 12 HAZARD COMMUNICATION/ RIGHT-TO-KNOW



Hazard Communication Standard (HCS) is based on the concept identified in Chemical Hazard Communication (OSHA 3084).-- that employees have both a need and a right to know the hazards and identities of the chemicals they are exposed to when working. Chemicals include hazardous materials in all forms- liquid, gases/ fumes, solids, dusts, and aerosols. Non-hazardous chemicals have no risk of exposure and are not covered in the plan.

OSHA has provided a simple summary of the HCS in a pamphlet entitled Chemical Hazard Communication (OSHA 3084).

12-1. Chemical Safety

BDS has a safety training program to ensure hazardous chemical safety information is provided to exposed employees. Chemical use includes any situation where a chemical is present in such a way that employees may be exposed under normal conditions of use or in a foreseeable emergency.

12-2. Hazardous Material Classification

A four-section multicolor “square-on-point” (diamond/placard) is used to address the health, flammability, instability and special hazards presented by short-term, acute exposures that could occur during fires, spills or other similar emergencies.

12-3. Hazardous signage

NFPA 704 compliant signage with clear explanation is posted in a common area

12-4. Chemical protective clothing

Chemical protective clothing is selected for qualities

- Puncture resistance
- Wear resistance
- Tactility
- Degradation
- Permeation

Types of chemical protective clothing may include

- Full Encapsulating suit
- Splash suit
- Coveralls
- Hoods
- Gloves
- Boots
- Boot / Shoe covers

Always read the label and MSDS to assure the proper precautions are taken. Chemical protective clothing may be manufactured from materials as follows:

- Tyvek (white suits) -dusts, dirt, grease
- Saranex- coated Tyvek, better for mild chemicals
- Polyethylene- alternative to Tyvek
- PVC rain suits, splash suits- moderate chemicals

Chemical gloves and boots

- Neoprene- acids, caustics, solvents
- Butyl rubber- resists gases
- Nomex- flame protection
- Kevlar- cut protection
- MANY OTHERS

12-5. Safety shower

A safety shower and eye wash basin will be located near the chemical storage with warm water. A clear path will always be maintained. Daily functional checks are required

Eye wash basin

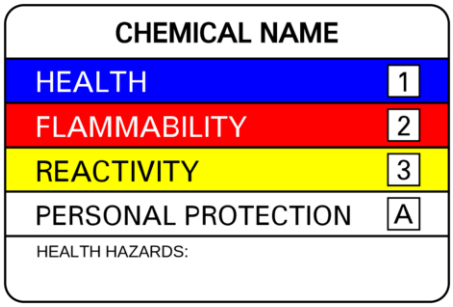
Eye Rinse

SECTION 13 CHEMICAL STORAGE

13-1. Cabinet requirements

13-2. Labeling

Chemical manufacturers evaluate the hazards of the chemicals they produce or import. With that information, they prepare labels for containers and more detailed technical bulletins called material safety data sheets (MSDSs). The details of the Chemical safety program are in section xxxx



SECTION 14 INCIDENT REPORTING

Objective

To ensure all injuries, illnesses, property damage and near misses are being reported in a timely manner it is the responsibility of each associate to work safely and to follow all established safety policies, procedures, and guidelines.

Policy

Associates must report all loss incidents and near misses immediately to their supervisor no matter how minor. In the case of visitors or contractors. The loss incident or near miss must be reported to the individual responsible for that person on site. Incidents are categorized as follows:

A. **Near Miss Incident**: All incidents that occurred that had the potential to cause injury, illness, significant property damage, or adverse environmental or community impact will be verbally reported immediately to the plant supervisor and a written report within 8 hours of incident.
B. **Property Damage Incident**: All significant damage to company property or any property damage that had the potential to cause an injury or illness to an associate, contractor or visitor will be verbally reported immediately to the plant supervisor and written report within 8 hours of incident
C. **Injury or Illness Incident**: All injuries or illnesses that occurred to an associate, contractor, or visitor while at work will be verbally reported immediately after the incident.

Upon notification of a loss incident or near miss the supervisor will complete an incident report.

14-1. Investigation

To ensure proper safety precautions are being followed a comprehensive investigation will be conducted on each loss incident or near miss that occurs on the job. All accidents and incidents including near misses are investigated within 8 hours. All incident investigation forms are sent to the Safety Manager for review and follow-up

14-2. Prevention

The incident evaluation will set forth prevention procedures from lessons learned. A Management of Change will document the procedural modification.

SECTION 15 AREA DESIGNATIONS

Access to the facility is restricted to employees and visitors under strict guidelines. No unauthorized access is permitted. Visitors and deliveries must check in and out at the front office.

Areas of the plant are designed for various functions and accessibility.

15-1. Area Signage

Signs throughout the facility will be OSHA compliant according to ANSI Z535: Standards for Safety Signs and Labels.

Signage, markings, and barriers delineate restricted access to areas as defined in this section.

15-2. Hazard Area Classification

The potential for explosive gas condition is always present in the facility. NFPA code 497 and API RP500 designate workspace relevant to explosion hazards. A Hazard Zone plan will be displayed in a known location. See Figur~~e 1 for~~ Figures 1A and !B for Area Cl~~assificat Plan.~~. BDC will have gas detection equipment ~~to~~ in hazard zone to detect explosion potential and minimize impact of explosion and fire detection and protection equipment capable of detecting, controlling, and extinguishing any fires that may occur as a result of facility operation.

Class 1 Division 1

Class 1 Division 2

15-3. Work Zone hazards

Areas that are undergoing non-ordinary operations, such as repair or shutdowns are to be isolated by flagging or cones. The intent is to warn individuals not authorized on the work plan to keep clear.

15-4. Confined Space Permit classified zones

A Confined or Permit Required Space has limited or restricted means for entry or exit and is not designed for continuous occupancy. Confined spaces at BIC include, but are not limited to, tanks, vessels, silos, storage bins, hoppers, vaults, pits, manholes, tunnels, equipment housings, ductwork, and pipelines. Specifically, for BIC facility, this includes buffer tanks for raw and separated liquids, condensate pits,

leachate sump pits and Digester tanks. (Policy and procedure is described in Section XXX)

15-5. Smoking

No smoking is permitted on site except for designated smoking areas. The BIC compost permit explicitly prohibits smoking in the receiving, processing, screening and storage area. Smoking or other incendiary or spark producing devices are restricted in the classified areas of the AD plant.

15-6. Eating

No food or drink is permitted in the facility operations where organic material and gases may be present

SECTION 16 ELECTRICAL SAFETY/ LOTO

Lockout/ Tagout (LOTO) policy and procedures are administered when machines or equipment are being shut down for service or maintenance. They often contain some form of “hazardous energy” that can cause harm to people in the area. Hazardous energy means any type of energy that can be released and might harm a person. This could include energy of the following types:

- Chemical
- Electrical
- Hydraulic
- Mechanical
- Pneumatic
- Thermal

Without the use of proper LOTO safety procedures, the serviced equipment can unexpectedly start up or otherwise release these forms of energy. This can lead to serious injuries and even death to the people working on the machine and even to others working in the area or living in the community. The OSHA General Industry standard is 1910.147, The Control of Hazardous Energy (Lockout/Tagout).

16-2. Preparation for LOTO

Prior to applying lock or tag, perform a Job Hazard Analysis and conduct a briefing with all involved and/or affected personnel. Make a survey to locate and identify all isolating devices to be certain which switch(es), breaker(s), valve(s), or other energy isolating devices apply to the equipment.

Notify all affected employees that the energized system will be shut down and, if possible, estimate for how long.

The authorized employee/ contractor should know the type and magnitude of energy that the machine or equipment utilizes and should understand the hazards thereof and safe procedures for deenergizing the equipment. Contractors may need assistance or procedures to identify all energy sources.

The individual that is applying the lock or tag must be wearing the same level of PPE that will be required for the person that is performing the work on the system.

16-3. Tagout Procedure

NOTE: “Tag Only” procedure is only in rare case If A Lock Cannot Be Used. Tags are to be used together with the lockout procedure. Standardized tags for use in tagging out equipment are available from facilities and grounds. Durable reusable plastic tags are used. The tag has the word "Danger" on a red field and the words "Do Not Operate." The tag is attached with a single use, self-locking nylon cable tie. The authorized employee's name and the date of application to a piece or equipment are written on the tag.

Locks must be used whenever possible, as tags used alone are essentially a warning device and do not provide the physical restraint that is provided by a lock. If only a tag is used, the following conditions apply:

- A tag is to be removed only by the authorized employee responsible for it, and it is never to be bypassed, ignored, or otherwise defeated.
- Tags must be legible and understandable by all employees in order to be effective.

- Tags and their means of attachment must be able to withstand environmental conditions.
- Tags may evoke a false sense of security and should be understood as part of an overall energy control program.
- Tags must be securely attached so they cannot be inadvertently or accidentally detached during use.

For electrical systems, use of a tag must be supplemented by "at least one additional safety measure that provides a level of safety equivalent to that obtained by the use of a lock." Examples given in the regulation are the removal of an isolating circuit element, blocking of a controlling switch, or opening of an extra disconnecting device

16-4. Lockout Procedure

Authorized employees will be issued a standardized lock(s) with an individual key. These locks are only used for this lockout procedure. Additional locks, again issued to a specific authorized employee, are available from the plant supervisor Each lock must have a securely fastened tag with the employee's name and the date of application to a piece of equipment clearly written on the tag.

Lockout All Energy Isolating Devices That Will Accept A Lock.

If more than one individual is required to lock out equipment, then each shall place his or her own personal lockout device or tagout device on the energy-isolating device(s). When an energy-isolating device cannot accept multiple locks or tags, a hasp or lockbox may be used. Each person will remove his/her lock from the isolating device.

One authorized employee will be appointed to oversee the group lockout or tagout device. All employees participating in a group lockout/tagout procedure should be made aware of the type and magnitude of the hazardous energy.

- **Shutdown**

Shutdown Equipment- Follow normal stopping procedures according to stand operating procedures. Allow motion to stop.

Stored electrical energy, which might endanger personnel, must be released, (e.g., capacitors discharged, high capacitance elements short circuited and grounded).

Stored non-electrical energy such as springs, hydraulic systems, overhead doors, etc. must be restrained by methods such as repositioning or blocking. Air, steam, gas, or water pressure must be dissipated by bleeding down or other method.

- **Isolation**

Operate the switch(es), breaker(s), valve(s), or other energy isolating device(s) so that the equipment is isolated from its energy source(s).

- **Stored Energy check**

Even after the energy source has been disconnected, in step 3 of the lockout safety process, and the machine has been locked out, in step 4, that doesn't entirely guarantee that there's no hazardous energy still stored within the machine or that it's safe to perform maintenance.

Look for any hazardous energy that's been "stored" within the machine, or any "residual" energy. During this phase, any potentially hazardous stored or residual energy must be relieved, disconnected, restrained, or made non-hazardous in some other way.

- **Isolation verification**

After all previous steps, double-check for safety to work on the machine or equipment. At this point, an authorized employee verifies the machine has been properly isolated and de-energized. Verify isolation - "Try the switch. Try the start button from the device and SCADA

- **Equipment specific procedures**

A written procedure detailing the required procedure for each piece of equipment that requires lockout or tagout is developed by the department responsible for the equipment. This procedure will identify all energy sources, the system voltage, and required PPE and shock and flash protection boundaries, and be posted on or near the piece of equipment.

- **Documentation**

The authorized employee must write his/her name and the date of application to the piece of equipment on the lock or tag.

The Authorized Employee who attached the tag Is The Only Person That Can Remove That Tag, (except in the emergency procedure described below).

Failure to observe any portion of the BDC lockout/tagout program will be viewed as a serious safety violation and may be subject to disciplinary action. Failure to make use of locks or tags, bypassing, ignoring or otherwise defeating a tag, or any other deviation from the established program will be considered a serious violation. The backside of each tag will bear the warnings "Do Not Remove This Tag" and "Necessary Disciplinary Action Will Be Taken If These Orders Are Disregarded."

SECTION 17 ELECTRICAL SAFETY GENERAL PROGRAM

Associates who face a risk of electrical shock or related injuries must be trained in appropriate electrical safety work practices. In addition, associates that work around-but not on-electrical systems must be trained in the hazards associated with electricity. Perdue Agribusiness has developed this electrical safety program to assure that locations understand and comply with the regulatory requirements related to electrical work and assure the safety of associates who may work in the vicinity of, or on, electrical systems. This Electrical Safety Program describes work practices for both qualified and unqualified persons. (As defined by the National Fire Protection Agency (NFPA 70E), the National Electrical Code (NEC), Occupational Safety and Health Administration (OSHA) and the Ground Fault Circuit Interrupter (GFCI).

General Electrical Safety

- All portable tools and flexible cords will have Ground-Fault Protection (GFCis) during use.
- All Ground-Fault Protection (GFCis) shall be tested once a month and after installation. The testing must be documented.
- Flexible flat extension cords are not allowed in any facility.
- All electric room doors must swing out and the interior handle must be a panic bar.
- All facilities will have their Arc-Flash analysis updated every 5 years.

17-1. Electrical safety/ Extension cords

17-2. Electrical Safety/ Equipment inspection

The following section provides common practices to help maintain safety by reducing the potential for electrical hazards that may occur at a Compost and AD facility.

Daily inspections

The facility should instruct operators to perform daily inspections of the electrical system. This inspection should include, but not be limited to, the following:

- Conduit connections to panels
- Panel cover integrity
- Conduit integrity
- Exposed and damaged wires
- Corrosion of wires
- Signs of electrical overheating

If there is any sign of the aforementioned problems, operators should contact the site manager or a licensed electrician to resolve the issue. The operator should not attempt to fix the problem unless he or she is the appointed qualified electrician for the facility.

17-3. Electrical Safety/ Task qualification

Qualified persons are those who have received specific training and have demonstrated the skills necessary to work safely on or near exposed energized parts. A person may be qualified to work, for

example, on circuits up to 600 volts, but may be unqualified to work on higher voltages. Only qualified persons may place or remove locks and tags on energized electrical systems. Unqualified persons are those with little or no such training.

- **Training**

Training for Unqualified Associates

Training for unqualified associates is general electrical safety precautions to provide an awareness and understanding of electrical hazards.

Electrical Safety Rules for Unqualified Associates

- Do not conduct any repairs to electrical equipment.
- Report all electrical deficiencies to your supervisor.
- Do not operate equipment if you suspect and electrical problem.
- Do not use cords or plugs if the ground prong is missing.
- Do not overload electrical receptacles.

Bioenergy DevCo Training Certification

Electrical Safety Training

OSHA 29 CFR 1910.331-335

I, certify that I have been trained by my employer, Bioenergy Devco, on Electrical Safety. I have been informed about specific hazards and work area safety procedures that will enable me to actively participate in the contents of this program. The following have been covered and I understand the basic knowledge in each topic.

- My associate classification is an "Unqualified Worker".
- Not to conduct any repairs on electrical equipment.
- To report all electrical deficiencies to my supervisor immediately.
- Not to operate equipment with electrical problems.
- Not to use cords or plugs if ground prong is missing or there is damage to the cord.
- Not to overload electrical receptacles.
- What electrical equipment markings mean

Location_____

Trainer Signature _____ Date:_____

Training for Qualified Intermediate Associates

Electrical safety training will be required initially to qualify associates and annually to maintain the "qualified" status. The purpose of the training is to discuss the details of each hazard that they may encounter for their level of qualification. The objective of the training is to build an understanding about the hazards and proper procedures to be used. Training to qualify associates for Intermediate Electrical Classification is identified below.

Training for Qualified Intermediate (Level 2) Associates

Electrical safety training will be required initially to qualify associates and annually to maintain the "qualified" status. The purpose of the training is to discuss the details of each hazard that they may encounter for their level of qualification. The objective of the training is to build an understanding about the hazards and proper procedures to be used. Training to qualify associates for intermediate Electrical Classification is identified below.

Qualified Intermediate Level 2 Electrical Classification

Initial Training: To be considered eligible for Level 2 training, you must successfully complete the intermediate training. To obtain this level of qualification, an associate must receive approved training on electrical safety and basic electrical circuits. To be considered eligible for Level 2 training, you must successfully complete the intermediate training. Of this training, 8 hours must be classroom instruction that will include hands-on training. After successful completion of classroom training, an on-site hands-on evaluation will be administered by a qualified electrical associate. Upon successful completion of classroom training and on-site evaluation, an associate will be considered an intermediate Level 2 electrician.

PPE Requirements: Associate will be responsible for inspecting and maintaining assigned electrical PPE. The following is a list of assigned electrical PPE:

- Arc-flash face shield and balaclava
- Arc-flash rated smock

- Voltage rated gloves - gloves must be replaced every 6 months.
- 10O0V rated insulated hand tools; screwdriver, fuse puller, etc.
- Fluke TS-600 - electrical multi-meter
- Fluke 1507 - electrical insulation tester
- Annual Refresher Training: Associate must successfully complete the annual re-fresh hands on evaluation to maintain their qualified status

Approved Tasks for Intermediate Electrician

All tasks are limited to the following; not to exceed 500V and not to exceed available PPE for Arc-flash protection required.

- Check voltage
- Check amps - Amperage must not exceed rating of tester.
- Reset breakers - Not to exceed 3 resets per incident.
- Change rotation of motors - Rotation changes will be limited to 4 times, per incident.
- Check and change fuses
- Check and reset motor overloads
- Wire, unwire and troubleshoot motors

if there is a condition that was not covered in your training, call an electrician to complete the task.

Electrical Safety

All AC systems of 50 to 1,000 volts must normally be grounded as required by the NEC and OSHA. The path to ground from circuits, equipment and enclosures must be permanent and continuous. Existing ungrounded premises wiring do not meet the OSHA requirements and must be replaced or modified as needed to meet this requirement.

Conductors entering boxes, cabinets or fittings must be protected from abrasion, and openings through which conductors enter must be effectively closed. Unused openings in cabinets, boxes and fixtures must also be effectively closed.

All pull boxes, junction boxes and fittings must be provided with covers approved for the purpose. If metal covers are used, then they must be grounded. In completed installations, each outlet box must have a cover, faceplate, or fixture canopy. Pull boxes and junction boxes for systems over 600 volts, nominal, must provide complete enclosure, the boxes must be closed by suitable covers securely fastened in place, and the cover must be permanently marked "High Voltage."

Switchboards and panel boards that have exposed live parts must be in permanently dry locations and accessible to qualified persons only. Panel boards must be mounted in cabinets, cutout boxes or other approved enclosure, and must be dead front unless accessible to qualified persons only. Exposed blades of knife switches must be dead when open. Receptacles installed in damp or wet locations must be suitable for the location.

Cabinets, cutout boxes, fittings, boxes, and panel board enclosures in damp or wet locations must be installed to prevent moisture or water from entering and accumulating within the enclosure. In wet locations the enclosures must be weatherproof.

Fixtures, lamp holders, lamps, rosettes, and receptacles may have no live parts normally exposed to employee contact.

Screw-base light socket adapters do not maintain ground continuity and may not be used.

Multiplug receptacle adapters may not maintain ground continuity or may overload circuits and must not be used. If additional receptacles are needed in a work location, additional circuits and/or receptacles must be installed. Multi-plug power strips with over current protection are acceptable for use with electronic equipment if they are used to reduce line noise or to provide surge or over current protection.

Electrical equipment, wiring methods and installations of equipment in hazardous classified locations must be intrinsically safe, approved for the location, or safe for the location. Hazardous classified locations are areas where flammable liquids, gases, vapors, or combustible dusts or fibers exist or could exist in sufficient quantities to produce an explosion or fire.

Any exception to the above and/or to any code requirement must be approved by the Electrical Dept.

Refer to Electrical Standards for all electrical installations that are not directly covered in this policy.

Requirements for Temporary Wiring

Temporary electrical power and lighting installations 600 volts or less, including flexible cords, cables, extension cords and distribution panels, may only be used during and for renovation, maintenance, repair, or experimental work. Temporary wiring may also be used for decorative lighting for special events and similar' purposes for a period not to exceed 90 days. The following additional requirements apply:

Ground-fault protection (e.g., ground-fault circuit interrupters or GFCI) must be provided on all temporary-wiring circuits, including extension cords, used on construction sites. GFCI must also be used when extension cords and/or equipment are used in wet, damp, or conductive locations.

In general, all equipment and tools connected by cord and plug must be grounded. Listed or labeled double insulated tools and appliances need not be grounded.

SECTION 18 HEARING PROTECTION PROGRAM

Conservation of hearing is an important preventative measure. To reduce occupational hearing loss, all associates, who work in potentially noisy areas, are provided hearing protection, training and annual hearing tests. OSHA's hearing conservation standard is covered in 29 CFR 1910.95. A copy of the Noise Standard and Hearing Conservation Amendment 1910.95 must be posted in the workplace and accessible to associates.

18-1. Training

At time of hire and annually thereafter, all affected associates must attend Hearing Conservation Training. The initial training is conducted as part of the New Hire Orientation Program by the Facility Manager and consists of:

- The effects of noise on hearing.
- The purpose of hearing protectors.
- The advantages, disadvantages, and attenuation of various types of hearing protectors.
- The purpose of audiometric testing, with an explanation of the test procedures.

18-2. Engineering Controls

After it is determined that noise exposure above 85 dBA is present, engineering controls should be evaluated and implemented to reduce the noise exposure before administrative controls are initiated. Some examples of engineering controls include:

- Noise-reducing baffles.
- Compartmentalization.
- Installing noise reducing gears.
- Installing rubber pads under machinery.

When new equipment or machinery is evaluated for purchase, the Safety Manager should be consulted to conduct an evaluation from a safety and health standpoint. One criteria of the evaluation should include the amount of noise the equipment will produce and how it will affect the overall noise exposure.

18-3. Administrative Controls

After engineering controls are evaluated for effectiveness or feasibility, administrative controls should be considered to reduce noise exposure. Administrative controls include restricting exposure time or using personal protective equipment (PPE).

Personal Protective Equipment, such as ear plugs or muffs, may be used to reduce the amount of noise exposure.

Each plug or muff has a noise reductions factor (NR) as evaluated by ANSI Standards. For example, if work area has an ambient noise exposure of 96 dba, then the hearing protectors should be rated 6 NR or better to be effective.

- **Hearing Protection Devices**

Hearing protectors must be made available to all associates exposed to 85 dBA or greater. Use of hearing protectors is mandatory for associates in the hearing conservation program who:

- Are exposed to greater than 90 dBA TWA.
- Have demonstrated a Standard Threshold Shift.

Have been employed by the company for 6 months, are exposed to 85 dBA TWA or greater and whose baseline audiograms have been delayed because a mobile test service visits the facility only once a year.

- **Use of Hearing Protectors**

Management, Supervision and Associates shall properly wear the prescribed hearing protectors while working in or traveling through any section of a location that is designated a High Noise Area. (Excluding offices, break rooms, and rest facilities). The following rules will be enforced:

- Personal stereos, such as I-Pods, etc., will not be permitted in production area.
- Hearing protectors, at least two types of plugs and one type of muffs, will be provided and maintained by BDC.
- Hearing protectors and replacements will be provided free of charge. ·
- Hearing protectors must always be properly worn, except in offices, break rooms, rest facilities.
- Preformed earplugs and earmuffs should be washed periodically and stored in a clean area, and foam inserts should be discarded after each use. It is important to wash hands before handling pre-formed earplugs and foam inserts to prevent contaminants from being placed in the ear which may increase your risk of developing infections.

- **Noise Monitoring**

A complete and up-to-date noise survey must be conducted every three (3) years and be on record.

Monitoring must be repeated whenever a change in production process, equipment or controls increase noise exposures enough to affect the hearing conservation program. Associates must be informed of the results of monitoring.

Audiometric Testing

1. A baseline audiogram (after 14 hours of quiet or supervised hearing protection use) must be obtained within 6 months of hire (1 year if a mobile testing service is used).

2. Associates must be tested at least annually thereafter (anytime during work shift).

Audiometer calibration, test environment background noise levels and tester qualifications must meet OSHA standards. The audiometric test must include test frequencies 500, 1000, 2000, 3000, 4000, and 6000 Hz.

Audiometric Data Analysis and Follow-up

The audiologist, otolaryngologist or physician must review problem audiograms and determine the need for further evaluation. If the annual audiogram shows a Standard Threshold Shift (STS) an average change of 10 dBA or more from the baseline at 2000, 3000, and 4000 Hz, the following actions are required:

- Counsel and inform the associate of the STS in writing within 21 days of determination.
- If the associate is currently not wearing hearing protection and is exposed to 85 dBA or greater, hearing protection use is now mandatory. The associate should be fit with hearing protection and trained in its care and use.
- If the associate is currently wearing hearing protection that does not offer adequate protection, then different protective devices with greater noise reduction must be provided.

Hearing protection fit should be checked, the associate refit if necessary and retrained in the proper use and care of hearing protection.

SECTION 19 RESPIRATORY PROTECTION PROGRAM

The respiratory protection program is designed to protect associates by establishing accepted practices for respirator use, providing guidelines for training and respirator selection, and explaining proper storage, use and care of respirators.

19-1. Assignment of Responsibility

Bioenergy DevCo (BDC) is responsible for providing respirators to associates when they are necessary for health protection. BDC will provide respirators that are applicable and suitable for the intended purpose at no charge to affected associates. Any other expenses associated with the respiratory protection program such as training, medical evaluations and respiratory protection equipment will be paid for by BDC.

The Program Administrator for BDC is the Safety Manager. The Program Administrator is responsible for administering the respiratory protection program. Duties of the program administrator include:

- Identifying work areas, process or tasks that require workers to wear respirators.
- Evaluating hazards.
- Selecting respiratory protection options.
- Conducting qualitative fit testing.
- Administering the medical surveillance program.
- Evaluating the program.
- Updating written program, as needed.

Facility Managers are responsible for ensuring that the respiratory program is implemented in their areas. In addition to being knowledgeable about the program requirements for their own protection, facility managers must also ensure that the program is understood and followed by the associates under their charge. Duties of the Facility Manager include:

- Ensuring that associates under their supervision (including new hires) receive appropriate training, fit testing, and annual medical evaluation.
- Ensuring the availability of appropriate respirators and accessories.
- Being aware of tasks requiring the use of respiratory protection.
- Enforcing the proper use of respiratory protection when necessary.
- Ensuring that respirators are properly cleaned, maintained, and stored according to this program.
- Coordinating with the Program Administrator on how to address respiratory hazards or other concerns regarding this program.

Each associate is responsible for wearing his or her respirator when and where required and in the way they are trained. Associates must also:

- Care for and maintain their respirators as instructed, guard them against damage, and store them in a clean, sanitary location.

- Inform their supervisor if their respirator no longer fits well and request a new one that fits properly.
- Inform their supervisor or the Program Administrator of any respiratory hazards that they feel is not adequately addressed in the workplace and any other concerns that they have regarding this program.
- Use the respiratory protection in accordance with the manufacturer's instructions and the training received.

19-2. Applicability

This program applies to all associates who are required to wear respirators during normal work operations as well as during some non-routine or emergency operations such as confined space rescue and HAZMAT.

In addition, an associate who voluntarily wears a respirator when one is not required is subject to the medical evaluation, cleaning, maintenance, and storage elements of this program, and will be provided the necessary training. Associates who voluntarily wear filtering face pieces (dust mask) are not subject to the medical evaluation, cleaning, storage, and maintenance provisions of this program.

19-3. Respiratory Program

The Program Administrator will select respirators to be used on site, based on the hazards to which workers are exposed and in accordance with OSHA Respiratory Protection Standard.

The proper type of respirator for the specific hazard involved will be selected in accordance with the manufacturer instructions. A list of associates and appropriate respiratory protection will be maintained by the program administrator.

The proper type of respirator for the specific hazard involved will be. selected in accordance with the manufacturer's instructions. A list of associates will be maintained by the Program Administrator.

19-4. Training

The Facility Manager will provide training to respirator users. The training course will cover the following topics:

- The BDC Protection Program.
- The OSHA Respiratory Protection Standard (29 CFR 1910.134).
- Respiratory hazards encountered and their health effects.
- Proper selection and use of respirators.
- Limitations of respirators.
- Respirator donning and user seal (fit) checks.
- Fit testing.
- Emergency use procedures.
- Maintenance and storage.
- Medical signs and symptoms limiting the effective use of respirators.

Associates will be retrained annually or as needed. Associates must demonstrate their understanding of the topics covered in the training through hands on exercises and written testing.

NIOSH Certification

All respirators must be certified by the National Institute for Occupational Safety and Health (NIOSH) and shall be used in accordance with terms of that certification, Also, all filters, cartridges, and canisters must be labeled with the appropriate NIOSH approval label.

~~Respirator~~ Use

The Facility Manager and Program Administrator shall authorize all voluntary users on a case-by-case basis, depending on specific workplace conditions and the results of medical evaluations.

Associates who choose to wear a half piece APR must comply with the procedures for medical evaluation, respirator use, cleaning, maintenance, and storage portions of this program.

When air monitoring has established time weighted averages that are below the permissible exposure level, associates may be provided a filtering face piece (i.e. dust mask) upon request. Only filtered face pieces (i.e. dusk masks) will be permitted for voluntary use and do not require medical evaluations or fit testing. All associates and processes that fall under the provisions of this program are listed in Appendix D of the OSHA 29 CFR 1910.134.

- Fit Testing

Associates who are required to or who voluntarily wear respirators will be fit tested prior to being allowed to wear any respirator with a tight-fitting face piece annually; or when there are changes in the associate's physical condition that could affect respiratory fit. Associates will be fit tested with the make, model, and size of respirator that they will wear.

The Program Administrator or his designee will conduct fit tests in accordance with the OSHA Reparatory Protection Standard.

19-5. General Respirator Use Procedures

Associates will use their respirators under conditions specified in this program, and in accordance with the training they receive on the use each model. In addition, the respirator shall not be used in a manner for which it is not certified by NIOSH or by its manufacturer.

All associates shall conduct user seal checks each time they wear their respirators. Associates shall use either the positive or negative pressure check as specified in the OSHA Respiratory Protection Standard.

Positive pressure test: This is test is performed by closing off the exhalation valve with your hand. Breathe air into the mask. The face fit is satisfactory if some pressure can be built up inside the mask without any air leaking out between the mask and the face of the wearer.

Negative pressure test: This test is performed by closing of the inlet openings of the cartridge with the palm of your hand. Some masks may require that the filter holder be removed to seal off the intake valve. Inhale gently so that a vacuum occurs within the face piece. Hold your breath for ten (10) seconds. If the vacuum remains, and no inward leakage is detected, the respirator is fit properly.

Associates are not permitted to wear tight-fitting respirators if they have any condition, such as facial scars, facial hair, or missing dentures that would prevent a proper seal.

- Cartridge change schedules

Respirator cartridges shall be replaced as determined by the Program Administrator, Supervisors, and the manufacturer's recommendations.

- Cleaning

Respirators are to be regularly cleaned and disinfected at the end of each shift. The Facility Manager shall ensure an adequate supply of appropriate cleaning and disinfection materials at the cleaning station.

- Maintenance

Respirators are always to be properly maintained to ensure that they function properly and protect associates adequately. Maintenance involves a thorough visual inspection for cleanliness and defects. Worn or deteriorated parts will be replaced prior to use. No components will be replaced, or repairs made beyond those recommended by the manufacturer. Repairs to regulators or alarms of atmosphere-supplying respirators will be conducted by the manufacturer.

Respirators that are defective or have defective parts shall be taken out of service immediately. If an associate finds a defect during an inspection, he/she shall bring the defective respirator to the attention of the supervisor.

- Storage

After inspection, cleaning, and necessary repairs, respirators shall be stored appropriately to protect against dust, sunlight, heat, extreme cold, excessive moisture, or damaging chemicals.

Each associate will clean and inspect their own respirator in accordance with the provisions of this program and will store their respirator in accordance with the provisions of this program, and will store their respirator in a plastic bag in the designated area. Each associate will have his/her name on the bag and that bag will only be used to store that associate's respirator.

Respirators maintained at stations and work areas for emergency use shall be stored in compartments built specifically for that purpose, and always be quickly assessable and clearly marked.

19-6. Emergency Procedures

In emergency situations where an atmosphere exists in which the wearer of the respirator could be overcome by a toxic or oxygen-deficient atmosphere, the following should be followed.

- When the associate is made aware that a hazardous atmosphere exists, he/she must immediately don their emergency respirator and exit the building.
- All associates must immediately evacuate the building following the facilities emergency action plan.
- If associates must remain in a dangerous atmosphere the following precautions shall be followed:
- Associates must never enter a dangerous atmosphere without first obtaining the proper protective equipment and notification of the Facility Manager.
- Associates must never enter a dangerous atmosphere without at least one additional associate present. The additional associate must remain in the safe atmosphere.
- Communications must always be maintained between both associates.

19-7. Qualitative Fit Testing Protocol and Signoff

- Sensitivity Screening

An irritant or pungent smoke chemical is administered while wearing the fitted respirator. Staff indicates detection before and after administration

Before____After_____

- Pressure checks
  - Positive pressure check (Close off exhalation valve)
  - Negative pressure check (Close off inlet opening)

Test Exercises

- Test Exercises
  - Normal breathing (about 1 minute)
  - Deep breathing (about 1 minute)
  - Turning head side to side (about 2minutes)
  - Moving head up and down (about 2 minutes)
  - Talking (about 1 minute, rainbow passage or count backward from 100 or ABC's)
  - Bending over (about 1 minute)

This is to certify that I have been administered a successful fit test and that I will wear my respirator in the exact manner as prescribed. Failure to wear this respirator as prescribed can lead to disciplinary action up to and including termination. If any changes to this program are made only the Facility Manager with the direction of the safety manager can make any changes.

Print Name:_____Date: _____

Signature:_____-

SECTION 20 PINCH POINTS

(See also Machine Guarding) A pinch point or often called “Nip Point” is any space where a part of or a person’s body can be caught between a stationary and a moving object or between two moving objects. Pinch Points include equipment, machinery doors, drawers, hammer, and shovel action.

If a person or their body part occupies that space during the pinching movement, there is a high probability of injuries such as crushing of tissues, fractures and even amputations.

Pinch Point Safety Precautions:

- Identify possible pinch point hazards in your work area
- Focus on objects that move or possibly could move. Ask yourself, “What will happen if this moves? Will I be in the path of that movement?
- Be aware of pinch points created by objects that move and come into direct contact with relatively fixed objects
- Be on guard whenever you put your hands, fingers, toes, or feet “between” anything.
- Discuss and point out pinch point hazards as part of your JSA.
- Verify effective communication methods are established before the work begins when working with someone else or as a group to avoid putting your safety in someone else’s control.
- Pay attention when opening drawers, doors, filing cabinets, etc.

SECTION 21 ELEVATED WORK

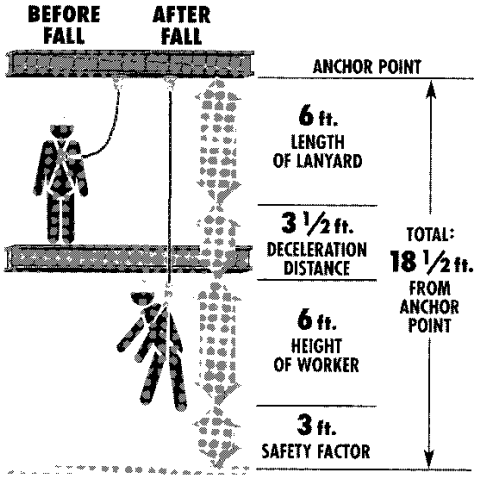
Working at elevated heights creates the need for fall protection and safety. Fall protection is primarily designed into the facility, such as guard rails and platforms and ladder cages.

- Any open edge higher than six (6) feet requires:
  - Guardrail System
  - Safety Net System
  - Personal Fall Arrest System
- Any fixed ladder higher than 20 feet requires
  - Ladder Safety Device (with body harness)
  - Safety Cage with offset landings every 30 feet

21-2. Personal fall protection

Personal fall protection is used in Confined Space Entry and other special work applications

- Full Body Harness
- Lanyard (regular or retractable)
- Shock Absorber
- Locking Snap Hooks (no single action)
- Lifeline (as needed)
- Anchorage
  - Must hold 5000 lbs.



21-3. Elevated work safety- for non-stationary applications

Ladder safety

21-4. Basic Ladder Safety

- Survey the area for overhead power lines before setting up and climbing ladders
- Inspect ladders before usage- never use damaged or unsafe ladders
- Verify ladder capacity before climbing

- Don't use the ladder for anything other than the job they're intended for- Do not use as platform or scaffold
- Use only approved ladders
- Use both hands, three points of contact on the ladder always
- One person on the ladder only
- Firm, level footing
- Use fall arrest if > 6 ft. working from ladder
- Secure top of extension ladders to platform or anchor point
- Extend 3 feet above access or working level
- Use 4:1 lean ratio; no more, no less

Working alone at heights with extension ladders, scaffolding, or any other type of ladder can be dangerous. It's always best to have someone else with you to make working at height safer.

21-5. Rolling Staircases

The Rolling Safety ladder is also known as Rolling Warehouse Ladder or Rolling Staircase. They are used by many warehouses, retail outlets, storage facilities, fire stations, and even truck stops to name a few. They are made of fiberglass, aluminum, and steel. Guidelines you should adhere to:

- Keep rolling ladders in good mechanical condition
- Keep rolling ladders free of oil, grease, wet paint, and other slipping hazards including rain, snow, and ice
- Rolling ladders that are stored outside should be regularly inspected for rust and corrosion
- Rolling ladders that have been damaged or "sprung" must be removed from service
- Rolling ladders that have missing rubber feet should have them replaced
- Rolling ladders should be climbed facing the ladder – not facing outward unless designed for this purpose
- Climb rolling ladders using 3-point contact (two hands and one foot, or one hand and two feet)
- Do not carry loads that are too bulky or heavy
- Do not over-reach – could cause ladder to tip
- Do not stand on the handrails
- Climb down from "rolling" scaffold/ staircase prior to moving it; do not move an occupied ladder
- Never stand with one foot on the ladder and the other on an object such as shelving
- Do not set up rolling ladders in passageways, doorways, driveways, or any location where they may be displaced
- Avoid setting up rolling ladders in direct proximity to any type of vehicle traffic
- Do not tamper with or modify rolling ladders
- Remove tools and equipment before moving a rolling ladder
- Use the step brake / lock assembly if equipped
- Consider tying off or securing the rolling ladder if tipping is a concern

- Do not attempt to gain additional height by standing on boxes or buckets atop rolling ladder platforms

21-6. Rolling scaffold

- DO NOT RIDE ROLLING SCAFFOLDS.
- SECURE OR REMOVE ALL MATERIAL AND EQUIPMENT from platform before moving scaffold.
- CASTER BRAKES MUST always BE APPLIED when scaffolds are not being moved.
- CASTERS WITH PLAIN STEMS shall be attached to the panel or adjustment screw by pins or other suitable means.
- DO NOT ATTEMPT TO MOVE A ROLLING SCAFFOLD WITHOUT SUFFICIENT HELP – watch out for holes in the floor and overhead obstructions.
- DO NOT EXTEND ADJUSTING SCREWS ON ROLLING SCAFFOLD MORE THAN 12”.
- USE HORIZONTAL DIAGONAL BRACING near the bottom and at 20’ intervals measured from rolling surface.
- DO NOT USE BRACKETS ON ROLLING SCAFFOLDS without consideration of overturning effect.
- THE WORKING PLATFORM HEIGHT OF A ROLLING SCAFFOLD must not exceed four times the smallest base dimension unless guyed or otherwise stabilized.

21-7. Scaffolding

Following are some common-sense rules designed to promote safety in the use of steel scaffolding. The rules do not purport to be all-inclusive or to supplant or replace other additional safety and precautionary measures to cover usual or unusual conditions. They are not intended to conflict with, or supersede, any state, local, or federal statute or regulation; reference to such specific provisions should be made by the user.

- Scaffolding must be erected by “Competent Person” on sound, rigid footing
- Stay within rated weight limit- No overloading
- “Scaffold Grade” Planking or walk boards are to be used
- Railings / toeboards are needed, otherwise Tie-off if no railing
- Access ladders are secured to the scaffolding. No portable ladders to be placed on scaffolding

21-8. Aerial Lift

SECTION 22 CONFINED SPACE PERMIT PROGRAM

This policy pertains to all "Confined Spaces" as defined by Occupational Safety and Health Administration under US Department of Labor (OSHA) under Section 1910.146 of the Code of Federal Regulations. This section contains requirements for practices and procedures to protect employees in general industry from the hazards of entry into permit-required confined spaces.

22-1. Identify Permit Areas

Confined space is defined as any space that:

(1) Is large enough and so configured that an employee can bodily enter and perform assigned work

(2) Has limited or restricted means for entry and exit

(3) Is not designed for continuous employee occupancy. Examples of confined spaces include manholes, stacks, pipes, storage tanks, trailers, tank cars, pits, sumps. Entry into permit required confined spaces without proper precautions could result in injury, impairment, or death.

A permit required confined space is defined by a space that:

(1) Contains or has a potential to contain a hazardous atmosphere

(2) Contains a material that has the potential for engulfing an entrant

(3) Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross section; or (4) Contains any other recognized serious safety or health hazard.

The facility manager shall ensure a survey of the worksite is conducted to identify confined spaces. This survey can be partially completed from initial and continuing site characterizations, as well as other available data (i.e., blueprints and job safety analyses). The purpose of the survey is to develop an inventory of those locations and/or equipment at their site that meets the definition of a confined space. This information shall be communicated to personnel, and appropriate confined space procedures shall be followed prior to entry. The initial surveys shall include air monitoring to determine the air quality in the confined spaces.

If the workplace contains permit spaces, the employer shall inform exposed employees, by posting danger signs or by any other equally effective means, of the existence and location of and the danger posed by the permit spaces.

NOTE: A sign reading DANGER -- PERMIT-REQUIRED CONFINED SPACE, DO NOT ENTER or using other similar language would satisfy the requirement for a sign.

If the employer decides that its employees will enter permit spaces, the employer shall develop and implement a written permit space program that complies with this section. The written program shall be available for inspection by employees and their authorized representatives.

22-2. Permit Scope and Duration

A permit is only valid for one shift. For a permit to be renewed, the following conditions shall be met before each reentry into the confined space:

- The Facility manger shall verify that all precautions and other measures called for on the permit are still in effect.
- Only operations or work originally approved on the permit shall be conducted in the confined space.

22-3. Responsibilities

- Entry Supervisor

The employer shall ensure that each entry supervisor:

- Knows the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure.
- Verifies, by checking that the appropriate entries have been made on the permit, that all tests specified by the permit have been conducted and that all procedures

- Rescue Team

Employees who have been designated to provide permit space rescue and emergency services shall take the following measures:

- Provide affected employees with the personal protective equipment (PPE) needed to conduct permit space rescues safely and train affected employees, so they are proficient in the use of that PPE.
- Complete a training drill using mannequins or personnel in a simulation of the confined space prior to the issuance of an entry permit for any confined space and at least annually thereafter.
- Respond immediately to rescue calls from the Attendant or any other person recognizing a need for rescue from the confined space.
- In addition to emergency response training, receive the same training as that required of the authorized entrants.
- Have current certification in first aid and CPR.

- Entrants

Associates who are granted permission to enter a confined space shall:

- Read and observe the entry permit requirements.
- Remain alert to the hazards that could be encountered while in the confined space.
- Properly use the personal protective equipment that is required by the permit
- Alert Attendant(s) when a prohibited condition exists and/or when warning signs or symptoms of exposure exist
- Immediately exit the confined space when:
  - they are ordered to do so by an authorized person
  - they notice or recognize signs or symptoms of exposure
  - a prohibited condition exists
  - the automatic alarm system sounds.

- Equipment

Personal protective equipment insofar as feasible engineering and work practice controls do not adequately protect employees.

Each authorized entrant shall use a chest or full body harness, with a retrieval line attached at the center of the entrant's back near shoulder level, above the entrant's head, or at another point which the employer can establish presents a profile small enough for the successful removal of the entrant. Wristlets may be used in lieu of the chest or full body harness if the employer can demonstrate that the use of a chest or full body harness is infeasible or creates a greater hazard and that the use of wristlets is the safest and most effective alternative.

Ventilating equipment needed to obtain acceptable entry conditions

- Positive - blowing air into the space, exhaust is through openings
- Negative - pulling air out of the space, exhaust through blower inlet
- Explosion-proof equipment if needed
- Purging / Inerting - inert gas (nitrogen, carbon dioxide, argon) used to replace oxygen atmosphere in space for HOT work

Other equipment:

- Communications equipment- Both Attendant and associate entering the permitted confined space must have functional two-way radio in place before entering permitted confined space
- Barriers and shields
- Equipment, such as ladders, needed for safe ingress and egress by authorized entrants.
- Lighting equipment needed to enable employees to see well enough to work safely and to exit the space quickly in an emergency

22-4. Protect the area

When entrance covers are removed, the opening shall be promptly guarded by a railing, temporary cover, or other temporary barrier that will prevent an accidental fall through the opening and that will protect each employee working in the space from foreign objects entering the space.

22-5. Isolation and Lockout/ Tagout Safeguards

All energy sources that are potentially hazardous to confined space entrants shall be secured, relieved, disconnected, and/or restrained before personnel are permitted to enter the confined space. Equipment systems or processes shall be locked out and/or tagged out as required by the BDC Lockout/Tagout Progran1 prior to permitting entry into the confined space.

22-6. Atmospheric testing

Atmospheric testing shall be conducted, and the results should be within acceptable limits. If atmospheric test results are not within acceptable limits, precautions to protect entrants against the hazards should be addressed on the permit and should be in place.

Atmospheric testing conducted with a calibrated direct-reading instrument, in accordance with Appendix B to section 1910.146 would be considered as satisfying the requirements. If a hazardous atmosphere is detected during entry:

Each employee shall leave the space immediately. The space shall be evaluated to determine how the hazardous atmosphere developed; and measures shall be implemented to protect employees from the hazardous atmosphere before any subsequent entry takes place.

Test or monitor the permit space throughout the procedure to determine if acceptable entry conditions are being maintained during the course of entry operations; and when testing for atmospheric hazards, test first for oxygen, then for combustible gases and vapors, and then for toxic gases and vapors.

Provide each authorized entrant or that employee's authorized representative an opportunity to observe the pre-entry and any subsequent testing or monitoring of permit spaces.

Reevaluate the permit space in the presence of any authorized entrant or that employee's authorized representative who requests that the employer conduct such reevaluation because the entrant or representative has reason to believe that the evaluation of that space may not have been adequate;

Communicate with the attendant as necessary to enable the attendant to monitor entrant status and to enable the attendant to alert entrants of the need to evacuate the space. Communicate with authorized entrants as necessary to monitor entrant status and to alert entrants of the need to evacuate the space

Monitor activities inside and outside the space to determine if it is safe for entrants to remain in the space and orders the authorized entrants to evacuate the permit space immediately under any of the following conditions:

- The entrant recognizes any warning sign or symptom of exposure to a dangerous situation
- if the attendant detects a prohibited condition
- If the attendant detects the behavioral effects of hazard exposure in an authorized entrant
- If the attendant detects a situation outside the space that could endanger the authorized entrants; or
- If the attendant cannot effectively and safely perform all the duties required

Summon rescue and other emergency services as soon as the attendant determines that authorized entrants may need assistance to escape from permit space hazards. Take the following actions when unauthorized persons approach or enter a permit space while entry is underway:

- Warn the unauthorized persons that they must stay away from the permit space, advise the unauthorized persons that they must exit immediately if they have entered the permit space
- Inform the authorized entrants and the entry supervisor if unauthorized persons have entered the permit space
- Perform non-entry rescues as specified by the employer's rescue procedure
- Perform no duties that might interfere with the attendant's primary duty to monitor and protect the authorized entrants.

22-7. Vertical/ Horizontal Rescue Procedure

The purpose of this procedure is to establish general procedures to follow in the event of an emergency that requires the rescue of a person or persons at this facility. However, each rescue must be evaluated on an individual basis since situations vary based on the space and circumstances involved.

The Facility Manager is responsible for coordinating rescues with the in-house rescue team, and the local fire department.

The attendant must try to rescue a victim from the outside the space whenever possible. Under no circumstances should the attendant enter a confined space to perform rescue. The attendant must notify the facility manager by if a rescue is needed and must stay at the space to be sure others who are not trained in rescue do not enter. The attendant must take whatever steps possible to prevent the situation from becoming worse, such as securing the entrants lifeline.

The local fire department must be contacted to respond. Emergency phone numbers will be written on the permit.

The facility manager or his designee will respond to the location and call for all available hands. The facility manager or his designee will then assign personal based on level of training to perform rescue tasks.

22-8. Training

The Rescue Supervisor shall train affected employees to perform assigned rescue duties. The employer must ensure that such employees successfully complete the training required to establish proficiency as an authorized entrant.

- Training Frequency

The Facility Manager shall provide training to each affected associates:

- before the associate is first assigned duties within a confined space
- before there is a change in assigned duties
- when there is a change in permit space operations that presents. a hazard for which an associate has not been trained
- when the facility manager has reason to believe that there are deviations from the confined space entry procedures required in this program, or that there are inadequacies in the associate' s knowledge or use of these procedures.

The training shall establish associate proficiency in the duties required in this program, and shall introduce new or revised procedures, as necessary, for compliance with this program.

Verification of Training

Periodic assessment of the effectiveness of associate training shall be conducted by the facility manager. Training sessions shall be repeated as often as necessary to maintain an acceptable level of personnel competence.

The complete policy and definitions are described here:

https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9797

SECTION 23 FIRE PROTECTION AND SAFETY

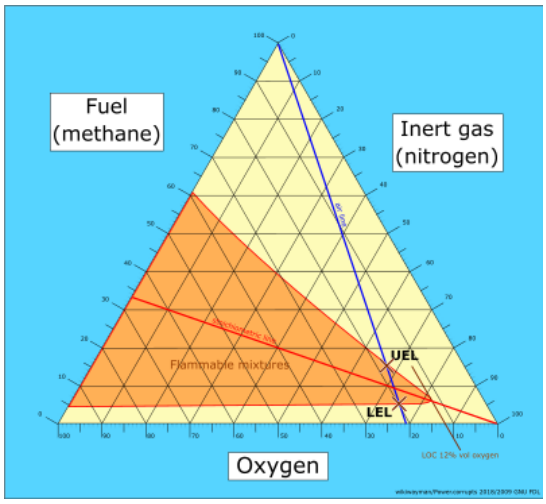
23-1. Fire prevention monitoring

The following statements are from the BDG Compost Permit:

- BDG shall conduct and record daily temperature monitoring for all Aerated Static Piles (ASPs) and windrows in the composting process. If routine temperature monitoring shows a location in a windrow where temperatures are greater than 160F, then employees shall flag the location and report it to the Facility Manager immediately.
- BDG shall conduct and record weekly temperature monitoring for all windrows in the curing phase and feedstock piles provided that the conditions set forth in Permit Section III.E.4 are met.
- If smoke is detected, employees shall flag the location and report it to the Facility Manager immediately
- The Facility Manager shall act promptly to investigate all issues related to fire safety. Employees shall be trained in the proper procedures for fighting a compost fire.
- If a fire is detected, BDG shall call 911 to request assistance from the local firefighting agency. BDG shall notify the Compliance and Permitting Section (CAPS) of the Delaware Department of Natural resources and Environmental Control (DNREC) at (302) 739-9403 ext. 8 of any fire within 24 hours of detection.
- BDG management shall meet with the representatives from the Blades Volunteer Fire Department

23-2. Flash point

23-3. LEL/ UEL



LEL is monitored around the biogas facility. We monitor CH4 levels through LEL monitors. We have chosen a CH4 monitoring system over an O2 monitoring system, because our concern is combustible gases being emitted and creating an explosive environment. The locations that have LEL sensors are also well ventilated, emphasizing the need to monitor CH4 versus O2. The lower explosive limit (LEL) is the minimal amount of concentration needed of a particular chemical to cause an explosion. The LEL is determined empirically for each pure chemical and air mixture at a given temperature. If more than than one chemical is dispersed in the air, as is normally the case, then LeChatelier's mixing rule can be applied to get the cumulative LEL for the mixture. Concentrations lower than the Lower Explosive Limit are 'too lean' to burn; those above the Upper Explosive Limit (UEL) are too rich to burn.The amount of gas present is specified as a percentage (%) of LEL. Zero percent Lower

Explosive Limit (0% LEL) denotes a combustible gas-free
atmosphere. One hundred percent lower explosive limit (100% LEL) denotes an atmosphere in which gas is at its lower flammable limit. The relationship between percent LEL and percent by volume differs from gas to gas. In concentrations of 0-5% Methane in air, the mixture is too lean to ignite or burn. Methane

concentrations between 5% and 17% will support ignition and are considered highly flammable. At levels above 17%, the atmosphere is too rich for the methane to ignite.

23-4. Fire extinguisher Safety

If fire extinguishers are available for employee use, it is the employer's responsibility to educate employees on the principles and practices of using a fire extinguisher and the hazards associated with fighting small or developing fires. [29 CFR 1910.157(g)(1)] This education must be provided annually and when a new employee is first hired. [29 CFR 1910.157(g)(2)]

Employees who have been designated to use fire extinguishers as part of the emergency action plan, must be trained on how to use the fire extinguishers appropriately in the workplace. [29 CFR 1910.157(g)(3)] This training is a specialized form of education that focuses on developing or improving skills and it must be provided annually and when employees are first assigned these duties. [29 CFR 1910.157(g)(4)]

Using a Fire Extinguisher

The following steps should be followed when responding to incipient stage fire:

- Sound the fire alarm and call the fire department, if appropriate.
- Identify a safe evacuation path before approaching the fire. Do not allow the fire, heat, or smoke to come between you and your evacuation path.
- Select the appropriate type of fire extinguisher.
- Discharge the extinguisher within its effective range using the P.A.S.S. technique (pull, aim, squeeze, sweep).
- Back away from an extinguished fire in case it flames up again.
- Evacuate immediately if the extinguisher is empty and the fire is not out.
- Evacuate immediately if the fire progresses beyond the incipient stage.
- Pull Pin, Tamper Seal, Aim, Sweep, Squeeze

Most fire extinguishers operate using the following P.A.S.S. technique:

- PULL... Pull the pin. This will also break the tamper seal.
- AIM... Aim low, pointing the extinguisher nozzle (or its horn or hose) at the base of the fire.
    - NOTE: Do not touch the plastic discharge horn on CO2 extinguishers, it gets very cold and may damage skin.
- SQUEEZE... Squeeze the handle to release the extinguishing agent.
- SWEEP... Sweep from side to side at the base of the fire until it appears to be out. Watch the area. If the fire re-ignites, repeat steps 2 - 4.

If you have the slightest doubt about your ability to fight a fire. .. EVACUATE IMMEDIATELY!

23-5. Fuel and gas cylinder storage

All flammable materials such as, but not limited to, gas, paints, thinners, etc. shall be stored in fireproof cabinets.

Hundreds of different materials are packaged in compressed gas cylinders—atmospheric gases, fuel gases, refrigerant gases, poison gases, etc. The hazards associated with these gases include oxygen displacement, explosion hazards, toxic effects and the physical hazards of a ruptured cylinder. The Occupational Safety and Health Administration (OSHA) references general requirements for compressed gases in 29 Code of Federal Regulations (CFR) 1910.101 and specific gas requirements are found in:

29 CFR 1910.102 – Acetylene

29 CFR 1910.103 – Hydrogen

29 CFR 1910.104 – Oxygen

29 CFR 1910.105 – Nitrous Oxide

29 CFR 1910.110 – Storage and Handling of Liquefied Petroleum Gases (LPG)

29 CFR 1910.111 – Storage and Handling of Anhydrous Ammonia

Gas Cylinder Inspection: General Requirements

29 CFR 1910.101(a) states employers must visually inspect compressed gas cylinders to ensure that they are in a "safe condition." Visual cylinder inspections should look for leaks, bulging, defective valves, evidence of physical abuse, fire or heat damage, pitting, rusting or corrosion. If cylinders do not pass a visual inspection they need to be repaired and re-qualified per Department of Transportation (DOT) regulations.

Visual and other inspections must be conducted as described in the DOT Hazardous Materials Regulations (49 CFR 171 - 180).

Where the DOT regulations are not applicable, visual and other inspections must be conducted as prescribed in the Compressed Gas Association's (CGA) C-6 Standard for Visual Inspection of Steel Compressed Gas Cylinders (revised June 28, 2013) and C-8 Standard for Requalification of DOT-3HT, CTC-3HT and TC-3HTM Seamless Steel Cylinders (revised November 6, 2017) pamphlets.

Gas Cylinder Storage and Handling: General Requirements

Per 29 CFR 1910.101(b), the in-plant handling, storage and utilization of all compressed gas cylinders must be in accordance with CGA Pamphlet P-1 Standard for Safe Handling of Compressed Gases in Containers (revised March 23, 2015).

Gas cylinders should always be properly secured to prevent tipping, falling or rolling. They can be secured with straps or chains connected to a wall bracket or other fixed surface, or by use of a cylinder stand.

The gas cylinders should be stored in a cool, dry, well-ventilated, fire-resistant area that meets all applicable federal, state and local regulations.

When a gas cylinder is empty or not being used, ensure that the valve is closed, the regulator removed and the valve protector cap is secured in place.

Gas cylinders should be transported using hand trucks designed for that purpose and the cylinders should be secured so that they do not tip, fall or roll.

Appropriate lifting devices, such as cradles or nets, are required when a crane, hoist or derrick is used to transport gas cylinders. Do not use magnets or slings to lift gas cylinders. Do not use the valve protection cap for lifting a gas cylinder.

It is necessary to take precautions so that gas cylinders are not dropped or allowed to strike each other or other objects. Dropping or striking may damage the gas cylinder valve, which could turn the gas cylinder into a dangerous torpedo with the potential to destroy property and/or injure personnel.

Consult the appropriate safety data sheet (SDS) for detailed information on the chemical contained in the gas cylinder. Specific chemical handling and storage precautions will be outlined in the SDS. The SDS will also have specifications for appropriate personal protective equipment (PPE) for worker protection.

Always reference the OSHA specific requirements highlighted earlier if handling or storing Acetylene, Hydrogen, Oxygen, Nitrous Oxide, LPG, or Anhydrous Ammonia in your facility.

23-6. Housekeeping

A key factor in fire prevention is good housekeeping or controlling accumulations of flammable and combustible waste materials. The following procedures will be followed to ensure that good housekeeping is in order.

No items will be stored in the electrical rooms, except that which is used in the control circuits such as fuses, heaters, etc. The electrical rooms shall always be kept neat and clean.

SECTION 24 EQUIPMENT TRAINING

Training according to OEM will be required before a new hire may operate a piece of heavy equipment or utility vehicle. Each subsection is specific to the make/ model to be operated.

24-1. Forklift

Forklift training

BTSNA is obligated by Occupational Safety and Health Administration (OSHA) to provide heavy equipment operators with the proper safety and skills training. Operators at BIC AD facility may be required to operate electric or internal combustion lift trucks. Forklift operators must be trained to safely operate and maintain forklifts through a certification program as required by OSHA Powered Industrial Truck requirements [29 CFR 1910.178] and industry best practices. No operator will be assigned to operate a forklift or other rolling stock such as front-end or skid-steer loader or tele-handler until completing a thorough training and maintenance program for the specific unit to be assigned. The training will combine written instruction with hands-on skill building and assessment. The heavy equipment training will cover operating conditions and tasks relevant to material handling in organic waste and compost facilities.

Training program topics involve the environment around the forklift and operating hazards. The instructor will cover how to maintain stability on different surfaces, ramps, slopes and in tight workplaces or near pedestrians and clients' vehicles. The goal is to teach operators to identify potential dangers for reducing workplace accidents.

OSHA Publication 3949 Safe Forklift Operation

Forklift operators and employees working around these operations are at risk of hazards such as collisions, falls, tip-overs, and struck-by conditions. Ways to prevent these hazards include:

Forklift Operations

- Always operate the vehicle according to the manufacturer's instructions.
- Always wear a seatbelt when the forklift has one.
- Never exceed the rated load and ensure it is stable and balanced.
- Do not raise or lower the load while traveling.
- Keep a safe distance from platform and ramp edges.
- Be aware of other vehicles in the work area.
- Have clear visibility of the work area and ensure you have enough clearance when raising, loading, and operating a forklift.
- Use proper footing and the handhold, if available, when entering the lift.
- Use horns at cross aisles and obstructed areas.
- Watch for pedestrians and observe the speed limit.
- Do not give rides or use the forks to lift people.

Safety Training

- Only trained and certified workers may operate a forklift.
- Ensure operators are trained on types of trucks in use.

Forklift Maintenance

- Remove from service any forklift found to be in unsafe operating condition.
- Keep forklifts in clean condition, free of excess oil and grease.
- Repair and maintain according to the manufacturer's recommendations.

24-2. Windrow turner

24-3. Skid- steer loader w/ implements

24-4.

24-5. Heading level 2

Body

- Heading level 3

SECTION 25 CRITICAL SAFETY DEVICES

25-1. Policy

This section is to prevent the personal injury, environmental impact, or financial loss due to property damage, product loss, business interruption caused by the failure of Critical Control Devices (CSD).

A Critical Safety Device (CSD) is defined as any device used to mitigate the consequences of a significant undesirable process incident. Consequences include risk to plant personnel, the community, assets, property, or the environment.

Each location is required to evaluate its facility and develop an inventory/metrics of all Critical Safety Devices or equipment and the equipment or process they affect. This inventory must be reviewed annually and updated as changes occur in the facility. Examples of CSD may include:

- Pressure detection and release
  - Boiler pressure
  - Methane pressure
  - Digestate or liquid feed line pressure
- Emergency Stop system
- Alarm system
- Gas leak detection
- Fire Detection/ Suppression
- Safety Interlocks; feedback signals
- Flare optical sensor
- Conveyor Zero Speed sensor
- Machine guards
- Moisture leak sensors
- Emergency lighting and power back-up
- Safety Shower/ eye wash

An inspection and testing program must be developed to confirm Critical Safety Devices are functioning as required.

The frequency of inspection/testing will be dependent upon manufacturer's recommendation, local/state/federal requirements, and assessment from engineering/safety.

If a CSD is removed during maintenance or repair procedures the device will be tested after reinstallation to confirm proper operation. Documentation of the inspection and testing will be maintained in facility files. Inspections/testing must be kept on file for a minimum of 2 years plus current year.

The installation of new equipment and/or process changes will include an evaluation of potential hazards that could occur to determine the need for CSD. Any new devices will be added to the inventory of Critical Safety Devices and the inspection/testing frequency must be identified prior to putting the equipment or process change into operation.

Changes to existing CSD will be reviewed utilizing Management of Change procedures (PSM Facilities) or utilizing hazard assessment. (See Attachment)

Equipment shall not be operated with nonfunctioning CSD unless a By-Pass Permit has been issued. (See Attachment)

25-2. Training

All affected associates shall be trained on the presence of CSD in the facility. Training is required at initial hire, whenever there is a change and/or every 3 years. The training shall include, at a minimum, the:

- Review of the CSD Policy
- Purpose of CSD
- Type of CSD utilized at the facility and their control function
- Prohibition of altering or disabling a CSD
- Immediate reporting of non-operating or malfunctioning devices
- By-Pass Permit procedures

25-3. Critical Safety By-Pass Permit

The permit provides the Facility Manager or Superintendent permission to operate this process or piece of equipment without the associated CSD for a specific period identified. The permit is designed to be used as a temporary measure until the affected CSD is repaired or replaced. Operation under this permit is not allowed as a usual/continuous condition. The permit has a maximum life of seven days from the date of issuance and must be replaced by a new permit at the end of the seven-day period.

Permits are required to be kept on file for 2 years plus current year.

Permits will be uploaded as an incident

SECTION 26 HOUSEKEEPING

A clean and organized workspace is the first step toward a safe, efficient, and pleasant working environment. An organized, clean workspace is an indication to inspectors that the crew is conscientious and compliant.

What is the purpose of workplace housekeeping?

26-1. Purpose

Effective housekeeping can help control or eliminate workplace hazards. Poor housekeeping practices frequently contribute to incidents. If the sight of paper, debris, clutter, and spills is accepted as normal, then other more serious hazards may be taken for granted.

Housekeeping is more than cleanliness. It includes keeping work areas neat and orderly, maintaining halls and floors free of slip and trip hazards, and removing of waste materials (e.g., paper, cardboard) and other fire hazards from work areas. It also requires paying attention to important details such as the layout of the whole workplace, aisle marking, the adequacy of storage facilities, and maintenance. Good housekeeping is also a basic part of incident and fire prevention.

Effective housekeeping is an ongoing operation: it is not a one-time or hit-and-miss cleanup done occasionally. Periodic "panic" cleanups are costly and ineffective in reducing incidents.

Poor housekeeping can be a cause of incidents, such as:

- tripping over loose objects on floors, stairs and platforms
- being hit by falling objects
- slipping on greasy, wet or dirty surfaces
- striking against projecting, poorly stacked items or misplaced material
- cutting, puncturing, or tearing the skin of hands or other parts of the body on projecting nails, wire or steel strapping

To avoid these hazards, a workplace must "maintain" order throughout a workday. Although this effort requires a great deal of management and planning, the benefits are many.

26-2. Benefits

Copy Effective housekeeping results in:

- reduced handling to ease the flow of materials
- fewer tripping and slipping incidents in clutter-free and spill-free work areas
- decreased fire hazards
- lower worker exposures to hazardous products (e.g. dusts, vapors)
- better control of tools and materials, including inventory and supplies
- more efficient equipment cleanup and maintenance
- better hygienic conditions leading to improved health
- more effective use of space
- reduced property damage by improving preventive maintenance
  less janitorial work
  improved morale

improved productivity (tools and materials will be easy to find)

Maintenance

The maintenance of buildings and equipment may be the most important element of good housekeeping. Maintenance involves keeping buildings, equipment and machinery in safe, efficient working order and in good repair. It includes maintaining sanitary facilities and regularly painting and cleaning walls. Broken windows, damaged doors, defective plumbing and broken floor surfaces can make a workplace look neglected; these conditions can cause incidents and affect work practices. So it is important to replace or fix broken or damaged items as quickly as possible. A good maintenance program provides for the inspection, maintenance, upkeep and repair of tools, equipment, machines and processes.

Dust and Dirt Removal

Enclosures and exhaust ventilation systems may fail to collect dust, dirt and chips adequately. Vacuum cleaners are suitable for removing light dust and dirt that is not otherwise hazardous. Industrial models have special fittings for cleaning walls, ceilings, ledges, machinery, and other hard-to-reach places where dust and dirt may accumulate.

Special-purpose vacuums are useful for removing hazardous products. For example, vacuum cleaners fitted with HEPA (high efficiency particulate air) filters may be used to capture fine particles of asbestos or fiberglass

Dampening (wetting) floors or using sweeping compounds before sweeping reduces the amount of airborne dust. The dust and grime that collect in places like shelves, piping, conduits, light fixtures, reflectors, windows, cupboards, and lockers may require manual cleaning.

Compressed air should not be used for removing dust, dirt or chips from equipment or work surfaces.

Employee Facilities

Employee facilities need to be adequate, clean and well maintained. Lockers may be necessary for storing employees' personal belongings. Washroom facilities require cleaning once or more each shift. They also need to have a good supply of soap, towels plus disinfectants, if needed.

If workers are using hazardous products, employee facilities should provide special precautions as needed such as showers, washing facilities and change rooms. Some facilities may require two locker rooms with showers between. Using such double locker rooms allows workers to shower off workplace contaminants and reduces the chance of contaminating their "street clothes" by keeping their work clothes separated from the clothing that they wear home.

Smoking, eating or drinking in the work area should be prohibited where hazardous products are handled. The eating area should be separate from the work area and should be cleaned properly each shift.

Surfaces

Floors: Poor floor conditions are a leading cause of incidents so cleaning up spilled oil and other liquids at once is important. Allowing chips, shavings and dust to accumulate can also cause incidents. Trapping chips, shavings and dust before they reach the floor or cleaning them up regularly can prevent their accumulation. Areas that cannot be cleaned continuously, such as entrance ways, should have anti-slip flooring. Keeping floors in good order also means replacing any worn, ripped, or damaged flooring that poses a tripping hazard.

Walls: Light-colored walls reflect light while dirty or dark-colored walls absorb light. Contrasting colors warn of physical hazards and mark obstructions such as pillars. Paint can highlight railings, guards and other safety equipment, but should never be used as a substitute for guarding. The program should outline the regulations and standards for colors.

Maintain Light Fixtures

Dirty light fixtures reduce essential light levels. Clean light fixtures can improve lighting efficiency significantly.

Aisles and Stairways

Aisles should be wide enough to accommodate people and vehicles comfortably and safely. Aisle space allows for the movement of people, products and materials. Warning signs and mirrors can improve sight-lines in blind corners. Arranging aisles properly encourages people to use them so that they do not take shortcuts through hazardous areas.

Keeping aisles and stairways clear is important. They should not be used for temporary "overflow" or "bottleneck" storage. Stairways and aisles also require adequate lighting.

Spill Control

The best way to control spills is to stop them before they happen. Regularly cleaning and maintaining machines and equipment is one way. Another is to use drip pans and guards where possible spills might occur. When spills do occur, it is important to clean them up immediately. Absorbent materials are useful for wiping up greasy, oily or other liquid spills. Used absorbents must be disposed of properly and safely.

Tools and Equipment

Tool housekeeping is very important, whether in the tool room, on the rack, in the yard, or on the bench. Tools require suitable fixtures with marked locations to provide an orderly arrangement. Returning tools promptly after use reduces the chance of it being misplaced or lost. Workers should regularly inspect, clean and repair all tools and take any damaged or worn tools out of service.

Waste Disposal

The regular collection, grading and sorting of scrap contribute to good housekeeping practices. It also makes it possible to separate materials that can be recycled from those going to waste disposal facilities.

Allowing material to build up on the floor wastes time and energy since additional time is required for cleaning it up. Placing scrap containers near where the waste is produced encourages orderly waste disposal and makes collection easier. All waste receptacles should be clearly labelled (e.g., recyclable glass, plastic, scrap metal, etc.).

Heading level 2

Body

- Heading level 3
    - Heading level 4

26-3. Equipment and Tool Storage

Picking up tools, parts and debris is required before closing out a work plan. Tools must be returned to their proper storage location.

Good organization of stored materials is essential for overcoming material storage problems whether on a temporary or permanent basis. There will also be fewer strain injuries if the amount of handling is reduced, especially if less manual material handling is required. The location of the stockpiles should not

interfere with work, but they should still be readily available when required. Stored materials should allow at least three feet of clear space under sprinkler heads.

Stacking cartons and drums on a firm foundation and cross tying them, where necessary, reduces the chance of their movement. Stored materials should not obstruct aisles, stairs, exits, fire equipment, emergency eyewash fountains, emergency showers, or first aid stations. All storage areas should be clearly marked.

Flammable, combustible, toxic and other hazardous materials should be stored in approved containers in designated areas that are appropriate for the different hazards that they pose. Storage of materials should meet all requirements specified in the fire codes and the regulations of environmental and occupational health and safety agencies in your jurisdiction.

SECTION 27 MACHINE GUARDING

Machine Guarding is included in the list Of Critical Safety Devices. The policy of BDC is to permit only trained and authorized associates to operate machinery, tools, or equipment at any time. This written Machine/Equipment Safety and Guarding Plan describes methods and practices for care and use of machines, equipment, and tools that can be read and understood by all managers, supervisors, and BDC associates.

No associate shall operate and/or cause to be operated any machinery without proper protective guards in place or modify/disable any protective guards on machinery without contacting a supervisor or implementing the lockout/tagout policy.

27-1. Definitions

Guards: Barriers that prevent Associates from contacting any moving portions or parts of exposed machinery or equipment that could cause physical harm to them.

Enclosures: Mounted physical barriers which prevent access to moving parts of machinery or equipment.

Point-of-Operation: The. area on a machine or item of equipment, where work is being done and material is positioned for processing or change by the machine.

Power Transmission: Any mechanical parts which transmit energy and motion from a power source to the point-of-operation. Example: Gear and chain drives, cams, shafts, belt and pulley drives and rods. NOTE: Components which are (7) feet or less from the floor or working platform shall be guarded.

Nip Points: Running Machine or equipment parts, which rotate towards each other, or where one part rotates towards stationery objects.

Shear points: The reciprocal (back and forth) movement of a mechanical part, past a fixed point on a machine.

Rotating Motions and exposed mechanism are dangerous unless guarded. Even a smooth, slowly rotating shaft or coupling can grasp clothing or hair upon contact with the skin and force an arm or hand into a dangerous position. Affixed or hinged guard enclosure protects against this exposure.

Reciprocating: Reciprocating motions are produced by the back and forth movements of certain machine or equipment parts. This motion is hazardous, when exposed, offering pinch or shear points to an Associate. A fixed enclosure such as a barrier guard is an effective method against this exposure.

Transverse Motions: Transverse motions are hazardous due to straight line action and in-running nip points. Pinch and shear points also are created with exposed machinery and equipment parts operating between a fixed or other moving object. A fixed or hinged guard enclosure provides protection against this exposure.

Cutting Actions: Cutting action results when rotating, reciprocating, or transverse motion is imparted to a tool so that material being removed is in the form of chips. Exposed points of operation· must be guarded to protect the operator from contact with cutting hazards, being caught between the operating parts and from flying particles and sparks.

Shearing Action: The danger of this type of action lies at the point of operation where materials are actually inserted, maintained and withdrawn. Guarding is accomplished through fixed barriers, interlocks, remote control placement (2 hand operation controls), feeding or ejection.

Interlocking Guard: A guard equipped with a safety switch so that when the guard is opened or removed, it automatically shuts off the moving parts.

Shaft: A device that transmits movement to an object. Shafts are used frequently to attach a roller to a conveyor.

Keyway: A notch in a shaft to attach a roller, spindle, bearing, etc.

Guards must prevent hands, arms or any part of an associate's body from making contact with hazardous moving parts. A good safeguarding system eliminates the possibility of the operator or other associates from placing parts of their bodies near hazardous moving parts.

Associates should not be able to easily remove or tamper with guards. Guards and safety devices should be made of durable material that will withstand the conditions of normal use and must be firmly secured to the machine.

Guards should ensure that no objects can fall into moving parts. An example would be a small tool which is dropped into a cycling machine could easily become a projectile that could and injure others.

Guard edges should be rolled or bolted in such a way to eliminate sharp or jagged edges.

Guard should not create interference which would hamper associates from performing their assigned tasks quickly and comfortably.

Lubrication points and feeds should be placed outside the guarded area to eliminate the need for guard removal.

Fan blades, chain or belt drives less than 7 feet above the floor or working level shall be guarded. Fan guards shall have no openings larger than 1/2 inch.

27-2. Operating Procedures

Associates may not remove a guard for any reason while operating any piece of machinery or equipment. All necessary personal protective equipment (PPE) is worn while the machinery or equipment is running.

If an associate is distracted or unable to focus on the work with the machinery or equipment, they must stop work with that machinery or equipment.

Upon finishing with a piece of equipment, tool, or machine, basic maintenance must be performed. It should be kept sharp, oiled, and stored per manufactures recommendations

Problem equipment must be immediately reported to your supervisor so it can be repaired or replaced. Associates must always use the proper piece of machinery or equipment for the job, Requirements for Safeguards

Safeguards shall meet these minimum general requirements:

Prevent contact: The safeguard shall prevent hands, arms, and any other part of a worker's body from contacting dangerous moving parts. An effective safeguarding system eliminates the possibility of the operator or another worker placing parts of their bodies near hazardous moving parts.

Secure: Workers should not be able to easily remove or tamper with the safeguard. Guards and safety devices shall be made of durable material that will withstand the conditions of normal use. Guards shall be affixed to the machine where possible and secured elsewhere if for any reason attachment to the machine is not possible.

Protect from falling objects: The safeguard shall ensure that no objects can fall into moving parts. A small tool which is dropped into a cycling machine could easily become a projectile that could strike and injure someone.

Create no new hazards: A safeguard defeats Its own purpose if it creates a hazard of its own

such as a shear point, a jagged edge, or an unfinished surface which can cause a laceration. The edges of guards, for instance, should be rolled or bolted In such a way that they eliminate sharp edges

Create no interference: Any safeguard which impedes a worker from performing the job quickly and comfortably might soon be overridden or disregarded. Proper safeguarding can enhance efficiency since It can relieve the worker's apprehensions about injury.

Allow safe lubrication: If possible, one should be able to lubricate the machine without removing the safeguards. Locating oil reservoirs outside the guard, with a line leading to the lubrication point, will reduce the need for the operator or maintenance worker to enter the hazardous area.

27-3. Shafts and Keyways

Rotating exposed shafts shall not protrude through a bearing, power transmission etc. longer than ½ the shaft's diameter (the width of the shaft). For example, if a shaft is 2 inches wide, it can only protrude 1 inch. If the shaft cannot be cut, then a non-rotating cap must be used.

All keyways must be covered with a non-rotating cap or ground smooth.

Powered Hand Tool Guards

Hazardous moving parts of a power tool need to be safeguarded. For example, belts, gears, shafts, pulleys, sprockets, spindles, drums, fly wheels, chains, or other reciprocating, rotating, or moving parts of equipment shall be guarded if such parts are exposed to contact by employees. Safety guards shall never be removed when a tool is being used.

27-4. New Equipment Start-up Inspection Procedures

Before operation of the equipment in the workplace, all specialty departments must signify that the equipment meets all expectations in their area of concern. The facility manager is accountable for all phases of installation and for making sure equipment is safe and efficient to run before letting associates operate it.

Bench Grinders

Fixed Bench Grinders shall be securely anchored to prevent movement or designed in such a manner that in normal operation they will not move.

The tongue guard is the adjustable metal guard that reaches from the outer diameter of the abrasive wheel to the guard that encloses the upper part of the abrasive wheel. The tongue guard should be adjusted to be within ¼" of the diameter of the wheel. Because the wheel wears down with use, the tongue guard is to deflect pieces of an exploding grinding wheel away from the user. Grinding wheels can fail when either a work piece has been caught between the work rest and the wheel, or when a crack has developed in the abrasive wheel.

Work rests provide support to the work piece during an offhand grinding operation. By supporting the work piece, they allow the operator to better control the grinding operation. They also help prevent gouges into the wheel itself by the work piece.

However, to be effective, they must be properly adjusted (i.e. Less than 1/8" from the outer diameter of the wheel). If the gap between the rest and the wheel .is too wide, a work piece can be trapped between the abrasive wheel and the work rest. Since any abrasive wheel wears with use, work rests must be periodically adjusted.

Portable Hand Grinders-

Safety guards used on right angle head or vertical portable grinders shall have a maximum exposure angle of 180 degrees. The guard shall be located so that it is between the operator and the wheel during use. Adjustment of the guard shall be such that pieces of an accidentally broken wheel will be deflected away from the operator.

Mounting and Inspection of Abrasive Wheels

All abrasive wheels will be inspected before mounting them. A ring test or other manufactures recommendations needs to be completed at this time. Wheels must be dry and free of all dust when applying the ring test. It should be noted that organic bonded wheels do not emit the same clear metallic ring as do vitrified and silicate wheels.

Tap wheels about 95 degrees each side of the vertical centerline and about 1 or 2 inches from the periphery. Then rotate the wheel 45 -degrees and repeat the test. A sound and undamaged wheel will give a clear metallic tone. If cracked, there will be a dead sound, not a clear "ring". Grinding wheels shall fit freely on the spindle and remain free under all grinding conditions.

Anchoring Grinders and other Fixed Machinery

Grinders and other fixed machinery must be properly anchored. The intent is to prevent machinery from moving or "walking" during use. Grinders can be dangerous equipment if used improperly.

27-5. Disciplinary Procedures

Constant awareness of and respect for machine, tool, and equipment safety procedures and compliance. with all safety rules are considered conditions of employment. Supervisors and individuals in the Safety and Personnel Department reserve the right to issue disciplinary warnings to associates, up to and including termination, for failure to follow the guidelines of this machine, tool, and equipment safety program.

Walking On Conveyors (Screws, Drag, and Belts)

The practice of stepping, climbing, or walking on or over conveyors (including screws, drags, or belt type conveyors) is forbidden except for the following:

- Approved designated crossover walkways, and diamond plated areas covering conveyors, may be used to cross over ground level or elevated conveyors when designed for this purpose.
- Ground level conveyors in the normal path of walking must be designed for crossover with appropriate diamond plate or step over engineering controls. If not, you must walk around.
- Conveyors, which are not designed to be used as walkways, must be locked out and tagged out by the associates, prior to walking on the conveyor(s).

Note: Conveyors which are designed as walkways do not require lockout.

27-6. Training Sign-off

I,_____certify that I have been trained by my employer, Bioenergy DevCo, on the Machine Guarding Policy. The following have been covered and I understand the basic knowledge in each topic.

Removing machine guards.

Proper replacement of machine guards.

Reporting of machine guard problems.

Not operating equipment unless guards are in place.

The practice of stepping, climbing, or walking on or over conveyors (including screws, drags, or belt type conveyors) is forbidden except for the following:

Approved designated crossover walkways, and diamond plated areas covering conveyors, may be used to cross over ground level or elevated conveyors when designed for this purpose.

Ground level conveyors in the normal path of walking must be designed for crossover with appropriate diamond plate or step over engineering controls. If not, you must walk around.

Conveyors, which are not designed to be used as walkways, must be locked out and tagged out by the associates, prior to walking on the _conveyor(s).

SECTION 28 HAND TOOL SAFETY

Use of tools makes many tasks easier. However, the same tools that assist us, if improperly used or maintained, can create significant hazards in our work areas. Associates who use tools must be properly trained to use, adjust, store, and maintain tools properly. This program covers hand, electrical, pneumatic, powder driven, and hydraulic tool safety.

28-1. General Safety Precautions

Associates who use hand and power tools and who are exposed to the hazards of falling, flying, abrasive and splashing objects, or exposed to harmful dusts, fumes, mists, vapors, or gases must be provided with the particular personal equipment necessary to protect them from the hazard.

All hazards involved in the use of tools can be prevented by following five basic safety rules:

- Keep all tools in good condition with regular maintenance.
- Use the right tool for the job.
- Examine each tool for damage before use.
- Operate according to the manufacturer's instructions,
- Provide and use the proper protective equipment.
- Hand Tools

Hand tools are non-powered. They include anything from axes to wrenches. The greatest hazards posed by hand tools result from misuse and improper maintenance.

Some examples:

Using a screwdriver as a chisel may cause the tip of the screwdriver to break and fly, hitting the user or other associates.

If a wooden handle on a tool such as a hammer or an axe is loose, splintered, or cracked, the head of the tool may fly off and strike the user or another worker.

A wrench must not be used if its jaws are sprung, because it might slip.

Impact tools such as chisels, wedges, or drift pins are unsafe if they have mushroomed heads. The heads might shatter on impact, sending sharp fragments flying.

28-2. Guards

Hazardous moving parts of a power tool need to be safeguarded. For example, belts, gears, shafts, pulleys, sprockets, spindles, drums, fly wheels, chains, or other reciprocating, rotating, or moving parts of equipment must be guarded.

Guards, as necessary, should be provided to protect the operator and others from the following:

- Point of operation
- Nip points
- Rotating parts
- Flying chips and sparks

Safety guards must never be removed when a tool is being used. For example, p01iable circular saws must be equipped with guards. An upper guard must cover the entire blade of the saw. A retractable lower

guard must cover the teeth of the saw, except when it contacts the work material. The lower guard must automatically return to the covering position when the tool is withdrawn from the work.

28-3. Safety switches

The following handheld powered tools are to be equipped with a momentary contact "on-off'' control switch:

Drills, tappers, fastener drivers, horizontal, vertical and angle grinders with wheels larger than 2 inches in diameter, disc and belt sanders, reciprocating saws, saber saws, and other similar tools. These tools also may be equipped with a lock-on control if turnoff can be accomplished by a single motion of the same finger or fingers that tum it on.

The following handheld powered tools may be equipped with only a positive "on/off' control switch:

Plate sanders, disc sanders with discs 2-inches or less in diameter; grinders with wheels 2-inches or less in diameter; routers, planers, laminate trinm1ers, nibblers, shears, scroll saws and jigsaws with blade shanks ¼-inch wide or less.

Other handheld powered tools such as circular saws having a blade diameter greater than 2 inches, chain saws, and percussion tools without positive accessory holding means must be equipped with a constant pressure switch that will shut off the power when the pressure is released.

Due to the possibility of a wheel disintegrating (exploding) during start-up, the associate should never stand directly in front of the wheel as it accelerates to full operating speed.

Portable grinding tools need to be equipped with safety guards to protect workers not only from the moving wheel surface, but also from flying fragments in case of breakage.

28-4. Power Grinder Safety Precautions

- Always use eye protection.
- Turn off the power when not in use.
- Never clamp a handheld grinder in a vise.

28-5. Pneumatic Tools

Pneumatic tools are powered by compressed air and include chippers, drills, hammers, and sanders. There are several dangers encountered in the use of pneumatic tools. The main one is the danger of getting hit by one of the tool's attachments or by fastener the worker is using with the tool. Eye protection is required, and face protection is recommended for associates working with pneumatic tools. Working with noisy tools such as jackhammers requires proper, effective use of hearing protection.

When using pneumatic tools, associates are to check to see that they are fastened securely to the hose to prevent them from becoming disconnected. A short wire or positive locking device attaching the air hose to the tool will serve as an added safeguard.

A safety clip or retainer must be installed to prevent attachments, such as chisels on a chipping hammer, from being unintentionally shot from the barrel.

Screens must be set up to protect nearby workers from being struck by flying fragments around chippers, riveting guns, staplers, or air drills.

Compressed air guns should never be pointed toward anyone. Users should never "dead-end" it against themselves or anyone else.

28-6. Powder-actuated Tools

Powder-actuated tools operate like a loaded gun and should be treated with the same respect and precautions. In fact, they are so dangerous that they must be operated only by specially trained associates.

Hydraulic Power Tools

The fluid used in hydraulic power tools must be an approved fire-resistant fluid and must retain its operating characteristics at the most extreme temperatures to which it will be exposed. The manufacturer's recommended safe operating pressure for hoses, valves, pipes, filters, and other fittings must not be exceeded.

28-7. Jacks

All jacks - lever and ratchet jacks, screw jacks, and hydraulic jacks - must have a device that stops them from jacking up too high. Also, the manufacturer's load limit must be permanently marked in a prominent place on the jack and should not be exceeded.

A jack should never be used to support a lifted load. Once the load has been lifted, it must immediately be blocked up.

Use wooden blocking under the base, if necessary, to make the jack level and secure. If the lift surface is metal, place a I-inch-thick hardwood block or equivalent between it and the metal jack head to reduce the danger of slippage.

To set up a jack, make certain of the following:

- The base rests on a firm level surface.
- The jack is correctly centered.
- The jack head bears against a level surface, and the lift force is applied evenly.

Proper maintenance of jacks is essential for safety. All jacks must be inspected before each use and lubricated regularly. If a jack is subjected to an abnom1al load or shock, it should be thoroughly examined to make sure it has not been damaged.

Hydraulic jacks exposed to freezing temperatures must be filled with adequate antifreeze liquid.

SECTION 29 HOT WORK

The Hot Work procedures define a system of control that will allow work involving possible sources of ignition to be carried out safely to minimize or eliminate fire hazards associated with hot work operations. Hot work permits (see Appendix A) are to be completed and filed for any work that can generate sparks or flame. Hot work requirements are specific to the classification of the work zones.

A hot work permit will be required for any activity that requires the use of a flame or generates sufficient heat or sparks that might serve as a source of ignition. Persons performing hot work and signing permits must have completed training and approved by the regional manager. The person conducting the hot work will complete a permit and meet all the requirements of this policy.

The hot work policy and permit process applies to contractors as well as Perdue associates. Permits will be issued to the contractor by the authorized person on the site prior to any hot work starting.

29-1. Definitions

Hot Work - any activity that results in sparks, fire, molten slag, or hot material that has the potential to cause fires or explosions. Examples of Hot Works:

- Cutting
- Brazing
- Soldering
- Thawing Pipes
- Torch Applied Roofing
- Grinding and Welding.

Special Hazard Occupancies - Any area containing Flammable Liquids, Dust Accumulation, Gases, Plastics, Rubber and Paper Products.

Combustible - a material capable of sustained burning when ignited and in the presence of air.
Flammable - a liquid having a flashpoint below 100 degrees Fahrenheit.

Fire Watch- a trained individual stationed in the hot work area that monitors the work area for the beginnings of potential, unwanted fires both during and after the hot work for at least 4 hours. Individuals must be trained and familiar with the operation of portable fire extinguishers and methods to activate building fire alarm systems. Fire watch can have other assigned duties if these do not prevent him/her from being an effective fire watch.

Special attention should be paid to weather conditions. If there is wind or the potential for wind is present, then extra precautions should be taken to avoid hot slag from blowing beyond the protection zone.

Cutting or welding shall not be permitted in the following situations:

- In areas not authorized by management.
- In sprinkled buildings while such protection is impaired.
- In the presence of potentially explosive atmospheres, e.g... an NFPA classified flammable area.

- In areas near the storage of large quantities of exposed, readily ignitable materials.
- In areas where there is dust accumulation within 3 5 feet of the area where welding/hot work will be conducted. All dust accumulation should be cleaned up following the housekeeping program of the facility before welding/hot works are permitted.

Suitable extinguishers shall be provided and maintained ready for instant use.

A fire watch person shall be provided during and at least 4 hours past the completion of the hot work project. The facility manager may add additional time.

A hot work permit will be issued on all welding or cutting outside of the designated welding area.

SECTION 30 BLOOD-BORNE PATHOGENS

PURPOSE:

Blood borne pathogens, especially hepatitis and human Immune deficiency virus (which causes AIDS), can rarely be transmitted in the workplace during an associate's duties. To prevent this from occurring, and in accordance with 29 CFR 1910.1030, BDC is implementing this policy.

A "Potentially Infectious Materials" means:

- Blood
- The following human body fluids: semen, vaginal secretions, cerebrospinal fluid, synovial fluid, pleural fluid, pericardia! fluid, peritoneal fluid, amniotic fluid, saliva In dental procedures, any body fluid that Is visibly contaminated with blood and all body fluids In situations where it Is difficult or impossible to differentiate between body fluids.

EXPOSURE CONTROL PLAN:

Exposure Determination:

The following job classifications convey occupation exposure:

- All nurse positions (Lead, Head, Charge, Day, Night, etc.)
- Non-nurse positions in medical departments who have hands-on contact with patients.
- All physician positions

The following job classifications may convey occupational exposure to some associates in those jobs:

- Designated first responder to accident scenes

Note that associates responding to an accident, as "Good Samaritans'' are not Included as being at risk.

Tasks In which occupational exposure may occur Include:

- Injections into patients (vaccines, tuberculin tests, allergy tests, etc.)
- Saliva exposure (during alcohol breath tests, pulmonary function tests, resuscitation, etc.)
- First aid post laceration or other trauma.
- Examination and treatment of broken skin (allergies, rashes, dermatitis, infections, etc.)

Methods of Compliance:

Universal blood and body fluid precautions shall be used in the care of all patients.

Work Practice Controls

All associates shall routinely use appropriate barrier precautions to prevent skin and mucous- membrane exposure when contact with blood _or other body fluids of any-patient is anticipated. Gloves shall be worn for touching blood and body fluids, mucous membranes, or non-Intact skin of all patients, for handling items or surfaces soiled with blood or body fluids and for performing vein puncture and other vascular access procedures. Gloves shall be changed after contact with each patient. Masks and protective eyewear shall be worn during procedures that are likely to generate droplets of blood or other body fluids

to prevent exposure of mucous membranes of the mouth, nose, and eyes. Gowns shall be worn during procedures that are likely to generate splashes of blood or other body fluids.

Hands and other skin surfaces shall be washed Immediately and thoroughly if contaminated with blood or other body fluids. Hands shall be washed immediately after gloves are removed.

Needles and Other Sharps:

All associates shall take precautions to prevent injuries caused by needles, scalpels, and other sharp instruments or devices during procedures, when cleaning up after procedures, during disposal of used needles, and when handling sharp instruments after procedures. To prevent Needle-stick injuries, needles shall not be recapped, purposely bent or broken by hand, removed from disposable syringes or otherwise manipulated by hand. Rather the syringes with uncapped needles shall be placed directly In appropriate containers for subsequent disposal.

These containers shall be:

- Puncture resistant
- Labeled or color coded with the universal "Biohazard" label, the label to be fluorescent orange or orange-red with lettering or symbols in a contrasting color.
- Leakproof on sides and bottom.

To minimize the need for emergency mouth-to-mouth resuscitation, mouthpieces, resuscitation bags, or other ventilation devices shall be available for use in areas in which the need for resuscitation is predictable.

Healthcare workers who have exudative lesions or weeping dermatitis shall refrain from all direct patient care and from handling patient care equipment until the condition resolves.

All waste contaminated with blood or body fluids will be placed in red trash bags to Identify it for proper disposal.

Eating, drinking, smoking, applying cosmetics or lip balm and handling contact lenses are prohibited in the part of medical departments whose patients are treated and in any other work areas where there is reasonable likelihood of occupational exposure.

All procedures Involving blood or other potentially Infectious materials shall be performed in such a manner as to minimize splashing, spraying, spattering and generation of droplets of these substances.

Personal Protective Equipment

When there Is occupational exposure, Perdue Farms Inc. provides, at no cost to the associate, appropriate personal protective equipment such as, but not limited to gloves, gowns, laboratory coats, masks, eye protection and mouthpieces, resuscitation bags or other protection devices. Personal protective equipment Is deemed "appropriate" only If It does not permit blood or other potentially infectious materials to pass through to associates' work clothes, street clothes, skin, eyes, mouth-or other mucous membranes under normal conditions of use.

When there-is occupational exposure, the associates shall use the appropriate equipment as outlined above. Failure to do so will result in disciplinary action unless rare circumstances occurred ln which, in the associate's professional judgment, the use of such equipment would have prevented the delivery of health care or would have posed a hazard to the associate or to the injured Individual. When the associate makes that judgment, the circumstances shall .be investigated and documented In order to determine whether changes can be Instituted to prevent such occurrences in the future.

Accessibility:

All appropriate personal protective equipment shall be readily accessible and in good repair.

Soiled Garments:

When a garment is penetrated by blood or other infectious material, the garment shall be removed immediately or as soon as feasible.

When personal protective equipment shall be removed prior to leaving the work area.

When personal protective equipment Is removed, it shall be placed in an appropriately designated area or container for storage, washing, decontamination or disposal.

Gloves shall be worn when It can be reasonably anticipated that the associate may have hand contact with blood, other potentially infectious materials, mucous membranes, and non-intact skin; when performing vascular access procedures and when handling or touching contaminated items or surfaces.

Disposable (single use) gloves such as surgical or examination gloves, shall be replaced as soon as practical when contaminated or as soon as feasible if they are torn, punctured, or when their ability to function as a barrier is compromised; they shall not be washed or decontaminated for re-use.

Utility gloves may be decontaminated for re-use if the integrity of the glove Is not compromised. However, they must be discarded if they are cracked, peeling, torn, punctured, or exhibits other signs of deterioration or when their ability to function as a barrier is compromised.

Masks, Eye Protection, and Face Shields

Masks In combination with eye protection devices, such as goggles or glasses with solid side shield, or chin-length face shield, shall be worn whenever splashed, spray, splatter, or droplets of blood or other potentially infectious materials may be generated and eye, nose, or mouth contamination can be reasonably anticipated.

Housekeeping

All equipment and environmental and work surfaces shall be cleaned and decontaminated with an appropriate disinfectant immediately or as soon as feasible after any spill of blood or other potentially infectious materials.

Regulated Waste

Contaminated Sharps Discarding and Containment

Used syringes and other contaminated sharps shall be discarded immediately or as soon as feasible in containers that are:

- Closable
- Puncture resistant
- Leak proof on sides and bottom
- Labeled on color-coded

During use, containers for contaminated sharps shall be:

- Easily accessible to personnel and located as close as is feasible to the immediate area where sharps are used or can be reasonably anticipated to be found;
- Maintained upright throughout use; and replaced routinely and not be allowed to overfill.

When moving containers of contaminated sharps from the area of use, the containers shall be:

- closed Immediately prior to removal or replacement to prevent spu1age or protrusion or contents during handling, storage, transport or shipping;
- Placed in a secondary container If leakage is possible.

The second container shall be:

- Closable
- Constructed to contain all contents and prevent leakage during handling, storage, transport, or shipping; and Labeled or color-coded.
- Reusable containers shall not be opened, emptied, or cleaned manually or In any other manner, which would expose associates to the risk of percutaneous injury.

Other Regulated Waste Containment

Regulated waste (defined as waste containing potentially infectious material) shall be placed In containers which are:

- Closable
- Constructed to contain all contents and prevent leakage of fluids during handling, storage, transport, or shipping
- Labeled or color-coded; and
- Closed prior to removal to prevent spillage or protrusion of contents during handling, storage, transport, or shipping.

Disposal of all regulated waste shall be in accordance with applicable Regulations of the United States, States and Territories, and political subdivisions of States and Territories.

Laundry

Contaminated laundry shall be handled as little as possible with a minimum of agitation.

Contaminated laundry shall be bagged or containerized at the location where it was used and.shall not be sorted or rinsed in the location of use.

Contaminated laundry shall be placed and transported In bags or containers labeled or color-

Associates who have contact with contaminated laundry shall wear protective gloves and other appropriate personal protective equipment.

When a facility ships contaminated laundry off-site to a second facility which does not utilize Universal Precautions in the handling of all laundry, the facility generating the contaminated laundry must place such laundry in bags or containers which are labeled or color-coded as contaminated.

Hepatitis B vaccination and post-exposure evaluation and follow-up:

- BDC makes available the hepatitis B vaccine and vaccination series for all associates who have occupational exposure and for all associates who have had an exposure Incident.
- Appropriate evaluations and vaccination policies are performed by licensed health care professionals under the supervision of a licensed physician and are available at no cost to the associate.
- Vaccination regimens are to be performed In accordance with current US Public Health Service recommendations.

The vaccination series Is available to all associates with occupational exposure within ten (10) days of Initial assignment unless:

- The vaccination series has previously been received, or
- Antibody testing h8s revealed that the associate Is immune (defined as anti HBs greater than 10 mIU/ml) or,
- The vaccine ls contraindicated for medical reasons.

The vaccination series consists of one (1) dose (20 mcg of plasma-derived vaccine {Heptavax and others] or 10 mcg of recombinant vaccine (Recombivax and others] given initially, followed by the same dose at one (1) month and at six (6) months, a vaccine must be given in deltoid muscle, not in hip.

If an associate has previously received vaccination series In other than deltoid muscle (e.g. hip), antibody status

check is available to associate, and vaccination series is available (but only recommended after checking antibody level and finding it to be anti HBs less than 10 mIU/ml).

If an associate with occupational exposure declines the vaccine, then that associate must sign the following statement (Included as Appendix A):

I understand that due to my occupational exposure to blood or other potentially

Infectious materials I may be at risk of acquiring hepatitis B virus (HBV) Infection. I have been given the opportunity to be vaccinated with hepatitis B vaccine, at no charge to myself. However, I decline hepatitis B vaccination currently. I understand that by declining this vaccine, l continue to be at risk of acquiring hepatitis B, a serious disease.

If, in the future, I continue to have occupational exposure to blood or other potentially infectious materials and I want to be vaccinated with hepatitis B vaccine, I can receive the vaccination series at no charge to me.

The vaccination series continues to be availab1e to that associate if later and still subject to occupational exposure, the associate desires it.

Post exposure evaluation and follow-up:

Following a report of an exposure Incident, an Immediate medical evaluation shall be carried out by the BDC Medical Department, to include:

- Documentation of the routes of exposure and the circumstances.
- Identification and documentation of the source individual, unless the employer can establish that Identification Is infeasible or prohibited by state or local law

The source individual’s blood shall be tested as soon as feasible and after consent is obtained to determine HBV and HIV infectivity. If consent Is not obtained, II shall be documented that legally required consent cannot be obtained. When the source individual’s consent Is not required by law, the source individual’s blood, if available, shall be tested and the results documented.

When the source individual is already known to be infected with HBV or HIV, testing for the source Individual's known HBV or HIV status need not be repeated.

Results of the source individual's testing shall be made available to the exposed associate and the associate shall be Informed of applicable laws and regulations concerning disclosure of the Identity and Infectious status of the source individual.

Collection and testing of blood for HBV and HIV serological status:

- The exposed associate's blood shall be collected as soon as feasible and tested after consent Is obtained.
- If the associate consents to baseline blood collection but does not give consent at that time for HIV serologic testing, the sample shall be preserved for at least 90-days. If, within 90- days of the exposure incident, the associate elects to have the baseline sample tested, such testing shall be done as soon as feasible.

Serologic testing includes:

- HIV
- HBs Antigen
- Anti-HBs
- Anti-HCV

Post-exposure prophylaxis - As recommended by the US Public Health Service, and under the direction of a local physician:

Following an occupational exposure to potentially infectious material (as defined in part "II" of this policy)

2.
3. if source hepatitis B status Is. positive for HBs Antigen or Is unknown.
4. If exposed associate’s antibody levels are protective (anti HBs greater than 10 mlU/ml) no further Immunization is necessary.
5. If exposed associate's antibody levels are not protective or not available within 24-hours, Hepatitis B Immune Globulin .06mllkg intramuscularly (hip or deltoid) shall be administered as soon as possible, preferable with 24-hours, and
6. If exposed associate's hepatitis B antibody levels are not protective, primary immunization shall be carried out in accordance with III-C-1-b of this policy (including signed statement if associate declines).
7. If source hepatitis Bs Antigen is negative, no further Intervention is necessary. HIV post-exposure treatment.

*Note: Prophylaxis must begin immediately. Begin treatment, then call corporate medical department for guidance.

-Highest risk: both larger blood volume (greater than a simple Needle stick) and blood containing high titer of HIV.

Treatment: Zidovudine, '300 mg., 2 x a day; Lamlvudlne, 150 mg., 2 x a day; + lndinavir, 800 mg., 3 x a day; all for 4 weeks.

-Increased risk: either exposure larger blood volume (not simple Needle stick) Q[blood with high HIV titer.

Treatment: Zidovudine, *300 mg., 2 x a day; Lamivudine, 150 mg., 2 x

No increased risk neither exposure to high volume of blood or blood with high HIV titer.

Treatment: Offer Zidovudine, *300 mg., 2 x a day; and Lamlvudine, 150 mg., 2 x a day; all for 4 weeks.

-Fluids containing visible blood or other potential infectious fluids such as semen, vaginal secretions, synovial fluid, spinal fluids, etc., or tissue.

Treatment: Offer Zidovudine, *300 mg., 2 x a day; and Lamivudine, 150 mg., 2 x a day; for 4 weeks.

- other body fluid - urine, stool, etc.

Treatment: None.

The evaluating physician shall send a written report to the local Medical Department within 15-days. This report will be shared with the exposed associate and must Include

Whether Hepatitis Immune Globulin and/or Hepatitis B Vaccine ls/are indicated and whether they were given.

That the associate was Informed of the results of the evaluation.

That the associate has been told about any medical conditions resulting from exposure to blood or other potentially Infectious materials which require further evaluation or treatment.

All other findings or diagnoses shall remain confidential and shall not be included in the written report.

The treating physician will be provided with:

- A copy of Federal Register, Vol. 56, No. 235
- A copy of this policy
- A description of the exposed associates' duties as they relate to the exposure
- A copy of the BDC evaluation.

Communication of Hazards

Signs and Labels

Warning labels shall be affixed to containers of regulated waste and other containers used to store, transport, or ship potentially Infectious material.

Labels shall be fluorescent orange or orange-red with "BIOHAZARD" notation and standard biohazard symbols.

Red bags or red containers may be used in lieu of labels.

Information and Training

All associates with occupational exposure must participate In training programs at the time of initial assignment to tasks conveying occupational exposure, and annually thereafter.

Training Includes:

Availability of a copy of the Federal Register, Vol. 56, No. 235

General discussion of epidemiology and symptoms of blood-borne pathogens:

These pathogens are not spread through casual, household or workplace contact or in urine.

These pathogens spread through Needle stick from one Infected person to another through intimate sexual contact, and through exposure to body fluids (oozing from .skin, sores, transfusions, etc.)

Explanation of this policy; availability of this policy for review.

Explanation of methods for recognizing tasks that may involve exposure to blood and other potentially Infectious

An explanation of the use and limitations of methods that will prevent or reduce exposure including appropriate engineering controls, work practices, and personal protective equipment

Information on the types, proper use, location, removal, handling, decontamination and disposal of personal protective equipment

An explanation of the basis for selection of personal protective equipment

Information on the hepatitis B vaccine, Including Information on its efficacy, safety, method of administration, the benefits of being vaccinated, and that the vaccine and vaccination will be offered free of charge

Information on the appropriate actions to take and persons to contact in an emergency involving blood or other potentially Infectious materials

An explanation of the procedure to follow if an exposure Incident occurs, including the method of reporting the incident and the medical follow-up that will be made available

Information on the post-exposure evaluation and follow-up that the employer is required to provide for the associate following an exposure incident

An explanation of the signs and labels and/or color-coding required

An opportunity for Interactive questions and answers with the person conducting the training session.

Recordkeeping

Medical records:

The medical record of each associate with occupational exposure will include evidence of hepatitis B vaccine status and related documentation, per I11-C of this policy. This record will be kept for the duration of employment plus 30 years.

Associate medical records required by this paragraph shall be provided upon request for examination and copying to the subject associate, to anyone having written consent, of the subject associate, to the Director, and to the Assistant Secretary.

Training records shall be maintained for at least 3-years from the date of the training session and shall include:

- The dates of the training sessions
- The contents or a summary of the training sessions:
- The names and qualifications of persons conducting the training; and
- The names and job titles of all persons attending the training sessions.

Associate's training records shall be provided upon request for examination and copying to associates, to associate representatives, to the Director, and to the Assistant Secretary.

BDC shall comply with the requirements Involving transfer of records set forth In 29 CFR 1910.20

SECTION 31 SLIP, TRIP AND FALL PROTECTION

31-1. Site inspection

A site inspection for potential slip, trip or fall hazards is part of operator daily checks and to be included in the work plan

OSHA maintains general industry regulations on walking/working surfaces that guard against hazards including clutter, protruding objects and wet conditions. These hazards can harm everyone in a facility, regardless of title or job responsibilities. Slips, trips, and falls cause nearly 700 fatalities per year and many more injurious accidents in the workplace according to the Bureau of Labor Statistics. There are three physical factors involved in slips, trips, and falls: friction, momentum, and gravity. Each one plays a role. Friction is the resistance between objects, momentum is affected by the speed and mass of an object, and gravity is the force exerted on an object by the Earth.

SLIPS

Slips are a loss of balance cause by too little friction between your feet and the surface you walk or work on. Loss of traction is the leading cause of workplace slips. Slips can be caused by wet surfaces, spills, or weather hazards like ice or snow. Slips are more likely to occur when you hurry or run, wear the wrong kind of shoes, or don't pay attention to where you're walking.

You can help avoid slips by following these safety precautions:

• Practice safe walking skills. Take short steps on slippery surfaces to keep your center of balance under you and point your feet slightly outward.

• Clean up or report spills right away. Even minor spills can be very dangerous.

• Don't let grease accumulate at your workplace.

• Be extra cautious on smooth surfaces such as newly waxed floors. Also be careful walking on loose carpeting.

Trips

Trips occur whenever your foot hits an object, and you are moving with enough momentum to be thrown off TRIPS balance. Trips are more likely to happen when you are in a hurry and don't pay attention to where you're going.

To prevent trip hazards:

• Make sure you can see where you are walking. Do not carry loads that you cannot see over.

• Keep walking and working areas well lit, especially at night.

• Keep the workplace clean and tidy. Store materials and supplies in the appropriate storage areas.

• Arrange furniture and office equipment so that it does not interfere with walkways or pedestrian traffic in your area.

• Properly maintain walking areas, and alert appropriate authorities regarding potential maintenance related hazards.

Falls

Falls occur whenever you move too far off your center of FALLS balance. Falls account for more workplace fatalities than any other reason. Employee Training There are no formal training requirements for slips,

trips, and falls. However, employees are to be trained to recognize and avoid unsafe conditions, which could include the hazards listed here.

To avoid falls consider the following measures:

• Don't jump off landings or loading docks. Use the stairs

• Repair or replace stairs or handrails that are loose or broken

• Keep passageways and aisles clear of clutter and well lit.

• Wear shoes with appropriate non-slip soles

Training Tips

Use the employee handout to explain the hazards of slips, trips and falls with the employees.

Review OSHA 1910.22 Walking/Working Surfaces and explain to your employees what is expected of them to prevent accidents.

Review ways that your employees can protect themselves from slip, trip and fall hazards.

Based upon your workplace, discuss how to right choice of shoe can help prevent slips, trips, and falls. Show new employees areas that might create slip, trip or fall hazards.

Discuss any company programs for shoe purchase or reimbursement.

Show new employees areas that might create slip, trip or fall hazards.

For more information see: • 29 CFR 1910.22-.30 Walking/working surfaces.

31-2. Fall Protective Equipment

lanyards, harnesses. Falls from heights or same level

SECTION 32 SAFE LIFTING PROCEDURES

Bioenergy DevCo requires the procedures in this plan to be followed to provide a safe working environment. We have implemented these procedures on safe lifting practices to ensure that associates are trained to protect themselves from the hazards of improper lifting practices.

It is the responsibility of management at BDC to ensure that these policies are implemented. It is the responsibility of management to ensure that this policy and the information necessary to carry out these polices is communicated to associates. It is the responsibility of all associates to follow safe work practices and comply with these rules regarding work practices.

The effectiveness of the back-safety plan depends upon the active support and involvement of all affected associates. Associates in the Operations and Maintenance departments have job duties that require lifting or materials handling. These associates are to be trained on and follow the rules of this back-safety plan.

32-1. Safe Lifting Techniques

The following points outline good lifting practices and procedures, safe lifting techniques that may be taught to associates to minimize their risk of back injury and pain. These practices are written with the lifter in mind. Lifting remains an important function despite the level of mechanization found in the workplace today, so attention must be directed toward safe lifting practices. The basics of good lifting are:

S- Straight back

A- Approach the object

F - Feet flat

E - Enter the squat position

L - Lift with the legs

I - Improve lift with proper breathing

F - Firmly hold the object

T - Turn with the feet

Material handling is an important part of our day-to-day jobs, whether it is manual or mechanical.

Back support belts do not substitute for proper lifting technique and will not prevent back injuries. If not used correctly back belts can be of more harm than good. Only the medical department can issue back belts.

32-2. Alternative Materials Handling Techniques

Alternative materials-handling techniques for carrying or moving loads are to be used whenever possible to minimize manual lifting and bending requirements. These alternative materials-handling techniques include use of:

- Hoists
- Forklifts
- Dollies
- Carts

32-3. Other Safe Work Techniques

Work issues other than lifting are related to back pain or injury. You can avoid them or improve work techniques related to them.

- Catching objects and working low

When catching falling or tossed objects, feet should be firmly planted, with the back straight and knees slightly bent. Legs should absorb the impact, not the back. When working on something low, bend at the knees, keeping the back as straight as possible. Bending from the waist can lead to back pain.

- Other Material Handling Tasks

Tasks such as lowering, pushing, pulling, and carrying can create hazards to the back as well. If the task feels uncomfortable or unnatural, utilize the alternative materials-handling techniques listed in this Back-Safety Plan. "

SECTION 33 LINE BREAKING

This policy establishes a procedure to minimize the risk of injury to associates engaged in the breaking or disconnecting of a line or hose that has contained hazardous substances.

- Hazardous Substances Include:
- Mineral Oil
- Steam
- Compressed Air
- Fats, Oils, Grease (FOG)
- Hydraulic Oil
- Hazardous Chemicals
- Liquid AD feedstock

This policy does not apply to any Propane, Natural Gas or Hexane lines. You are to follow the PAB Policy for Line Breaking of Propane, Natural Gas or Hexane.

Examples of operations, which could be considered, line breaking:

- Removing a strainer basket.
- Working on a transfer pump seal.
- Removing a valve from a line to replace or repair.

This policy covers all emergency situations where it is necessary to break into a closed system containing a hazardous material. It does not apply to planned shutdowns or plant purge outs.

Policy:

Breaking Lines

Whether a line currently contains or did contain the above listed hazardous materials, the line break policy is to be followed. For such work, a line-breaking permit must be completed. Procedures for issuance of line breaking permits are as follows:

This procedure applies to jobs requiring the opening, or working on any line, connecting fitting, valve, pump, filter, temperature wells, pressure gauges, flow meter, hose fitting, sight gauge or level device which have contained a hazardous substance, flammable material is not limited to compressed gas, steam, air or liquid is present.

A properly completed line-breaking permit must be displayed at the job site. The line-breaking permit must always be posted until the work is completed and restored to service. Any associate or contractor assigned to the job must sign off on the permit. Permits apply to contractors, service workers and employees

If it is a normal routine to disconnect and connect mechanical equipment such as Chicago fittings, Dixon Fitting, or check valve quick couplings will not require a line breaking permit. Example (Compressors,

sand pots, PTO hydraulics) When using Chicago fittings, it will require a line bleed off fitting before disconnecting.

Protective Equipment, Staff, and Procedures

In addition to the standard personnel protective equipment required, the following may be required:

- Rubber Boots
- Coveralls- Cloth, Tyvek, or Chemical.
- Gloves - Leather, Long, or Rubber.
- Goggles
- Acid Hood
- Respirator - Full Face, Half Face, Air Supplied, or SCBA
- Shield - Face or Special Shielding
- Suit - Acid, Hot, or Rain
- Spill Containment
- Barricades
- Blank flanges may need to be installed
- Fire Extinguishers
- Grating, floor opening covered
- Lock/Tag/Verify Plan Required
- Atmospheric monitoring
- Non-sparking Tools
- Piping Support – straps, rigging
- Pump Locked Out
- Standby Person
- System Flush
- System temperature less than 100 degrees C
- Ventilation - Exhaust or Dilution
- Water Hose

Precaution in Breaking Lines

Breaking a line is, in essence, breaking into a closed system. Regardless of the checking done or the instruments employed, it must be assumed that, at the point where the line is to be broken, there is an extremely hazardous substance liquid or off-gas which (if released) could present a hazard to associates.

The following precautions are to be taken in line breaking operations:

If pumps, motors, or automatic valves are present, they must be locked out and danger tags applied. Push buttons to operate pumps or valves must be tried to ensure the system is locked out.

The portion of the line being worked on shall be isolated from those preceding and following it in the most effective way. This will usually consist of shutting valves and locking them out. This guards against confusion arising out of the use of non-rising stem valves, quick opening valves, and other valves which are peculiar to the unit, or which have their own peculiarities, perhaps known only to the plant personnel. The person in charge of the operation will verify that the correct valves are closed and locked out.

Before the breaking occurs, the immediate area shall be set up for maximum protection to near-by persons. Barriers shall be employed where applicable.

Ensure that when work is performed on elevated piping or equipment and there is potential for liquids to fall, the area below the work is barricaded and posted, as needed, with suitable containment when applicable. Prevention of hazardous liquid from entering drains must be taken.

The line shall be drained completely, making sure that vents are opened to prevent the possibility of an air lock.

The following steps shall be followed to ensure actual dismantling of the line:

- Loosen the bolts of a flange which are farthest away from the worker
- Shield whenever possible. Stand aside to avoid any spray
- Prepare the lines for additional work by purging or rinsing out the line.

Responsibilities:

The person in charge of the operation and associates/contractor assigned to task is responsible for declaring the equipment safe to be opened. They will take any steps to prevent any violations of safeguards covered in this policy. Line breaking jobs within a department must be approved and continually observed for concurrence with this policy until the work is complete. All openings made during the job shall be documented and individual permit(s) closed out before completion of the job and all danger tags removed before the equipment is restored to service.

SECTION 34 LINE BREAKING- FUEL OR GAS

The Maintenance Supervisor/Facility Manager will determine the scope of work that can be performed by BDC Associates/Contractors based on their work experience or qualifications.

Prior to approving work that falls within the scope of this procedure, as applicable to the job, Operations personnel shall:

- Ensure that, to the extent possible, the lines or equipment has been emptied, purged, flushed, drained, vented, isolated (including flow and pressure) and tested to ensure the system is free from recognized hazards.
- Ensure that lockout tagout procedures have been used to isolate equipment that may have contained hazardous material or may have been used under pressure prior to line breaking activities.
- When possible, verify de-pressurization of lines or equipment and absence of material has been accomplished by opening vents and/or drains and ensure they are cleared. Where present, pressure gauges will be checked for pressure reading and bleeders will be opened and cleared.
- Issue proper line breaking and hot work permits.

Gas line purging

To prevent an explosive environment within the gas line or area near the opening, the gas line must be purged with an inert gas such as nitrogen or CO2 prior to line breaking. Purge inlets and outlets have been designed into each gas line. Purging will continue until the gas concentration is less than 20% of the LEL.

Prior to performing work that falls within the scope of this procedure Maintenance/Contractor shall:

- Ensure that the lines or equipment have been properly prepared.
- Ensure that when work is performed on elevated piping or equipment and there is potential for liquids to fall, the area below the work is barricaded and posted, as needed.
- Ensure that all applicable permits have been obtained and that all the requirements have been met.
- Ensure that the appropriate level of personal protective equipment is clearly defined and available for use.
- Ensure that personnel are in a defensive position to avoid a spray or release when attempting the initial opening. (Flanges will be cracked open on the opposite side of the line from the employee.)
- Consider means of egress and location of eyewash/safety shower before commencing work.

Personal Protective Equipment

The appropriate type of personal protective equipment given in any line breaking situation will vary with the hazards associated with the material, equipment, location, and the ability to verify that the equipment/line is clear. The minimum protective equipment in any line-breaking situation shall be:

- Hardhat
- Gloves

- Face shield
- Goggles or safety glasses as determined by the hazard.
- Appropriate chemical protective clothing as needed.
- Personal gas monitors

Additional PPE may be required, depending upon the job. After the line break is completed and hazards have been identified, PPE may be downgraded per job requirements.

Additional Safe Practices

All piping systems will be considered pressurized until line breaking is complete.

When opening a flanged pipe, maintain a safe position, loosen bolts farthest away from yourself (to avoid a spray) then loosen bolts on either side and pry open side farthest away from yourself cautiously until there is obviously no pressure in the line.

In breaking a union joint, loosen cautiously and flex the joint away from yourself (to avoid spray) making certain all pressure is relieved.

Be aware of pinch points due to spring back, shrinkage, or expansion.

Be aware of the potential for flow to resume when working on systems that contain highly viscous or frozen liquids. Close valves and use blind flanges to isolate the area being serviced.

Use a box wrench instead of an open-end wrench whenever possible.

Tighten all bolts to the required torque specification and certify all welds prior to pressure testing.

Testing Requirements

Low pressure line test (< 1psig) may be tested with a solution of mild soap and water spray. Do not attempt to locate leaks with open flames or other methods that provide a source of ignition.

High Pressure line test- conduct a visual examination of the system prior to pressure test. The test medium shall be nitrogen or carbon dioxide. Oxygen or air shall never be used. The test must meet municipal requirements but shall be no less than 1 ½ times the maximum working pressure, but not less than 3 psig (20 kPa gauge). Where the test exceeds 125 psig {862 kPa gauge) care should be taken to not exceed the strength of the pipe. The test duration shall be ½ hour for each 500 ft^3 of pipe volume, but not less than 10 minutes or more than 24 hours. Any reduction of test pressure shall be deemed to indicate the presence of a leak unless such reduction can be readily attributed to some other cause. Any pressure testing should be done with the proper range gage that has been certified through a lab. Documents of certification should be filed on site.

Underground lines

BDC requires that all underground biogas, natural or LP gas lines be pressure tested using the following intervals of frequency:

- Metal gas lines will be tested every five years unless the age of the piping is greater than 25 years. Then testing will occur annually.
- Poly gas lines will be tested every five years regardless of service life.

Above ground lines

BDC requires that all above ground natural or LP gas lines be tested for leaks annually.

Calibrated Gas Indicator Test- Sniff test exposed above ground lines. If Gas Indicator sniff test is not available a leak detection solution can be used and applied over the joints to see if bubbling occurs.

Training

Operations, Maintenance and Contractor personnel who engage in line breaking activities must be trained in safe line breaking procedures prior to participating in line breaking activities. Refresher training must be provided a minimum of every three years.

SECTION 35 FACILITY INSPECTION PROGRAM

35-1. Internal Inspection

Inspection of work areas and audits of safety programs are tools that can be used to identify problems and hazards before these conditions result in accidents or injuries. Audits also help to identify the effectiveness of safety program management and can be used as a guide to assure regulatory compliance and a safe workplace.

- Responsibilities of Management
    1. Schedule audit and inspection procedures for all work areas, processes and procedures.
    2. Conduct routine audits and inspections using the monthly inspection checklist.
    3. Ensure audits are conducted by associates who understand the various safety programs and policies.
- Responsibilities of Supervisors
    1. Conduct informal daily safety inspections and ensure all unsafe conditions are corrected.
    2. Conduct documented monthly inspections and ensure all unsafe conditions are corrected.
- Corrections

All safety deficiencies found during audits and inspections should be corrected as soon as possible.

Documentation of corrections should be made on the audit or inspection sheet, and conditions that present a hazard are to be corrected or controlled immediately. This will be done by using a work order.

- Types of Inspections

Supervisor & Management Daily Walk-through: this is an undocumented inspection that is made daily prior to startup and shift change to ensure the facility and equipment are in safe conditions for Associates. All noted unsafe areas are placed in a safe condition prior to Associates working in the area.

Monthly Safety Team Inspection: Each month members of the Safety Team will tour the entire facility with the Facility Manager. This tour is to ensure Safety Team Members are familiar with all areas of the operation. Record of problem areas, committee recommendations and deficiencies will be recorded and provided to management.

35-2. Government Inspections

It is the policy of BDC to permit inspections by representatives of the Occupational Safety and Health Agency (OSHA). Such inspections shall be accomplished in accordance with the following procedures.

- Greeting the Inspector

Refer the OSHA compliance officer arriving on the premises to the designated production area of the facility. No associates other than the facility manager or his designated person should communicate with the OSHA compliance officer prior to the opening conference. If the facility manager or his designated person is not available, then the inspector is to wait for the facility manager or designated person. If the facility manager or the designated person will not be available within a reasonable time, (30 to 60 minutes) the inspector is to be informed of the fact. Do not let the OSHA compliance officer wander around.

The facility manager should review the OSHA compliance officer's credentials as well as obtain his or her business card with an address and phone number to ensure that the compliance officer is on an official inspection. Photocopy and give back to the inspector.

Determine from the OSHA compliance officer the purpose, scope, and the circumstances of the visit to the facility. If the inspection is based on a compliant, obtain a copy of the complaint. Photocopy and give back to the inspector.

Determine if the compliance officer has a warrant to conduct the inspection. If yes, find out the scope of the warrant. Photocopy and give back to the inspector.

Notify the designated Perdue representatives of OSHA's presence. At a minimum, the Regional Manager and Safety Manager must be contacted prior to beginning the opening conference. Fax all copies (credentials, compliant, and warrant if it applies) to Human Resources before the opening conference.

- Opening Conference

Have an opening conference with the OSHA compliance officer to establish:

- The focus areas of the inspection.
- The scope and route of the walk-around inspection.
- The designated trade-secret areas or processes.
- The procedure for conducting associate interviews and producing documents.
- The schedule of interviews.
- The documents for review by OSHA. The compliance officer should be asked to put all requests for company information and/or documents in writing. Inform the OSHA compliance officer that all documents will be controlled though the senior management and the safety manager.
- The facility's rules and procedures OSHA will be expected to follow.

Conduct all necessary safety and health advising/training of OSHA compliance officers prior to access to restricted areas. Ensure that the OSHA compliance officer wears all necessary personal protective equipment and follow all company safety and health policies.

The facility manager or his designated person shall always stay with the OSHA compliance officer during the inspection except during hourly associate interviews. If the hourly associate request that the facility manager or his designated person stay with them during the interview this is approved by BDC. All salaried management must not in any way be interviewed by themselves. Perdue policy requires that another salaried manager be present during the interview.

The facility manager or his designated person should take detailed notes, including date(s) of inspection, areas inspected, pictures taken, measurements taken, associates interviewed, and any items discussed during the visit.

If the compliance officer deviates from the focused area(s) discussed during the opening conference, then the facility manager of his designated person should inquire as for the reason for the deviation.

When appropriate, photographs should be taken of areas inspected by the OSHA compliance officer as well as all items photographed by the compliance officer. Video also should be utilized, if used by the compliance officer. Duplicate pictures or video should be taken at the same angle as the inspector took. This also applies for any measurements taken.

The facility manager or his designated person should immediately have corrected any alleged violations identified by the OSHA compliance officer to the extent possible but should not acknowledge that a citation is appropriate. Do not verbally admit to any alleged violation during the inspection. If the OSHA complianc1: officer ask about what it would require to correct an alleged violation the response should be to have the OSHA compliance officer state what the violation is and what corrective action the OSHA compliance officer recommends.

All work rules and safety procedures should be enforced and applicable to the OSHA compliance officer and walk-around team during the inspection.

Document all samples or monitoring test taken by the OSHA compliance officer and request copies of all sampling and monitoring results as well as all photographs and videos taken. The company should request the OSHA compliance officer to schedule sampling and monitoring at a time when the company can conduct its own sampling and monitoring.

- Closing Conference

Primarily listen to the OSHA compliance officer's proposal, and do not argue or debate the initial proposed findings.

Provide information and documentation relevant and supportive of the company's position as well as any information which shows abatement of any alleged violation(s).

Take detailed notes on the alleged hazards identified and the problem areas indicated by the OSHA compliance officer

35-3. Insurance Inspections/ Audits

35-4. Conducting Safety Audits

Records

Records of audits and inspection will be maintained in accordance with the requirements of the specific programs. As a minimum, the last two program audits will be kept on record. Routine inspection records will be maintained on a most current basis. Records of deficiency corrections will be maintained for one calendar year from date of correction.

There are four basic questions an audit should answer. The persons or team designated to conduct the audits should take a fact-finding approach to gather data. These auditors should be familiar with both the company program and the various local, state, and federal requirements. All audit comments, recommendations and corrective actions should focus on these four questions:

- Does the program cover all regulatory and best industry practice requirements?
- Are the program requirements being met?
- Is there documented proof of compliance?
- Is associate training effective?

SECTION 36 MANAGEMENT OF CHANGE (MOC)

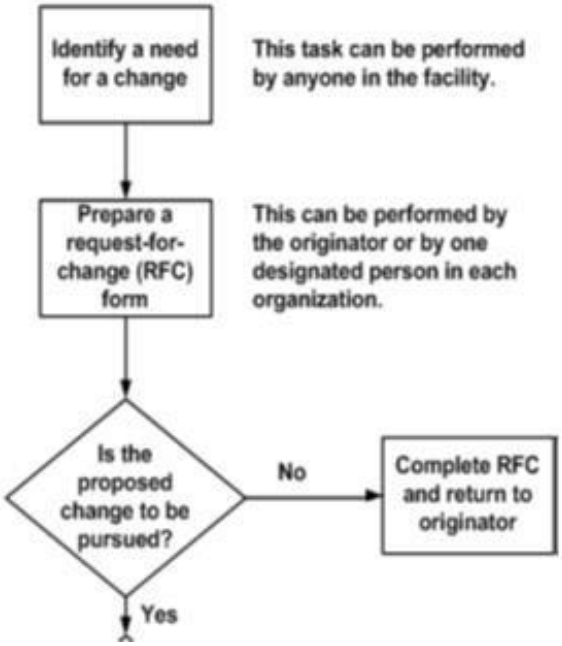
A management system is established for ensuring that changes to processes are properly analyzed, documented, and communicated to affected personnel. MOC is a written structured program that reviews and obtains approval for any change that could affect safety. Examples at BIC include changes in process setpoints, change in equipment operation, change in operating procedures or other facility operations

Types of System Design MOC:

- Process chemicals
- Technology
- Equipment
- Procedures
- Facilities

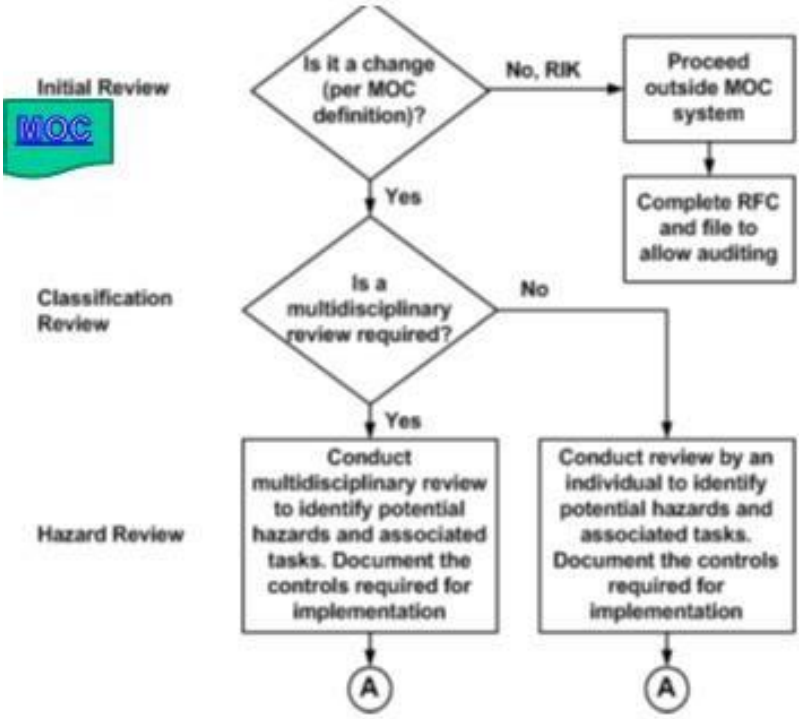
36-1. Analysis

The first step in the Management of Change process is to fill out a "Request For Change" form. This form would describe the proposed change and the reason for the change. (An example RFC form can be seen by clicking on the RFC icon.) The RFC form would then be approved by the originator's manager and forwarded to the Management of Change manager. At smaller facilities this position is not a full time position. The MOC manager would consult the originator and the affected party to determine if the change should be pursued.



Once the decision has been made to pursue the change, the determination is then made if the change is a Replacement in Kind (RIK) or a Management of Change (MOC). If the change is a replacement in kind, then that should be noted on the Request For Change and the RFC forwarded to the maintenance/production scheduler. A "Replacement in Kind" is a replacement that meets the original design specifications of the item being replaced and will be discussed in more detail in the next slide.

If the change to be considered is not a Replacement in Kind, then it enters the MOC system. An MOC form, task review, and hazard review need to be completed. This is often a multidisciplinary review. The outcome of this review is MOC documentation of the controls needed in order to implement the Management of Change in a safe manner.



Replacement-in-kind

If an item is replaced with a similar item that meets the original design specification, then the replacement item is a **replacement in kind**.

As an example, a piping specification may call for a threaded 1-1/2" stainless steel ball valve. A 1-1/2" stainless ball valve by any manufacturer of such a valve, such as Apollo or Jamesbury, would be a replacement in kind.

A threaded brass ball valve by American Valve or by Watts would not be a replacement in kind since the material of construction is different.

A gate valve by Apollo or by Jamesbury also would not be a replacement in kind since the type of valve has changed.

Pre-implementation requirements

36-2. Documentation

The MOC system should also include:

Maintaining a Management of Change log of every approved change for the past two years.

A Management of Change form with approval signatures must be used. Design calculations should be attached. A Readiness checklist (PSSR) should be used for the startup after the Management of Change.

Conducting periodic monitoring (field checks) of the Management of Change procedures.

The Management of Change system should be audited with the annual Process Safety Audit.

36-3. Communication

APPENDIX A – HOT WORK PERMIT

APPENDIX B – TITLE

APPENDIX A

HOT WORK PERMIT

Can this job be performed in a designated Hot Work area? ☐ **Yes** ☐ **No**

Print all information, must be legible and complete

Supervisor/ project leader: Douglas Renk		***Hot work done by:*** ☐ Contractor ☐ Employee
Issue date	**Issue time**	**Contractor Name:**
Expiration Date	**Expiration time**	**Permit is valid for one shift- not to exceed 12 hours**
Name of person doing Hot Work (not to exceed 6 per permit)		

IN CASE OF EMERGENCY:

DIAL: (321)- 863-8055

or 911

Hot Work start time: Finish time:

Is there another way to do this job which would eliminate the fire potential? Yes ☐ No ☐ If yes, Why not use the alternative method?

Are there hazardous or flammable substances within 35 feet? Yes ☐ No ☐ If yes, is fire extinguisher designed for metal?
Yes ☐ No ☐ If yes, how will they be removed or protected?

Where is the closest fire extinguisher? Inspection date:

Location of the nearest phone Phone number

Will any other individuals be exposed to flash, sparks or slag? Yes ☐ No ☐ If Yes, How are they protected?

What PPE is being used? (circle) Gloves Welding shield Goggles Helmet Face shield Jacket

Are there open pits or drains that will be exposed to sparks or slag? Yes ☐ No ☐

What Hot Work equipment will be used? **Equipment is inspected by:**

LEL level

I verify that the location has been examined and prepared. The precautions noted have been taken and permission is authorized for this work. Signed: (Operator trained on the Hot Work Policy)

Work are and all adjacent areas to which sparks and heat might have spread were inspected during the fire watch period and were found safe. Signed: (Fire watch attendant trained in Hot Work Policy)

APPENDIX B

Fire Extinguisher locations

Ext. #		Location	Type
1		Office/Breakroom	ABC
2		Office/ Entrance	ABC
3		Plant/ Mixing Room-Northeast corner	ABC
4		Plant/ Mixing Room- Middle	ABC
5		Plant/ Mixing Room- Middle	ABC
6		Plant/ Mixing Room- Southeast corner	ABC
7		Plant/Breakroom- North wall	ABC
8		Plant/ Breakroom- South wall	ABC
9		Plant/ Bio Fan Room- South wall	ABC
10		Plant/ Electrical Room- West wall	CO2
11		Plant/ Electrical Room- East wall	CO2
12		Plant/ Fire Pump Room- Southwest wall	ABC
13		Plant/ PLC Master Control Room	ABC
14		Compost Turner	ABC
15		Compost Turner	ABC
16		Front end loader 20405	ABC
17		Front end loader 20406	ABC
18		John Deer Tractor	ABC

APPENDIX C

Fire Extinguisher locations

TRUE OR CALLED NORTH

LEGEND

EXIST. ELECTRIC	E
EXIST. NAT. GAS	G
EXIST. TELECOM	T
EXIST. WATER	W
EXIST. LIGHTING	SL
NAT. GAS	G
HOT WATER	HW
WASTE WATER	WW
BIOGAS	DG
ELECTRIC	E
NAT. GAS	G
PROCESS PIPE	
NON-POTABLE WATER	NPW
INSTRUMENT AIR	A
FORCE MAIN	FM
CONDENSATE	C
UNLOADING TRUCKS	

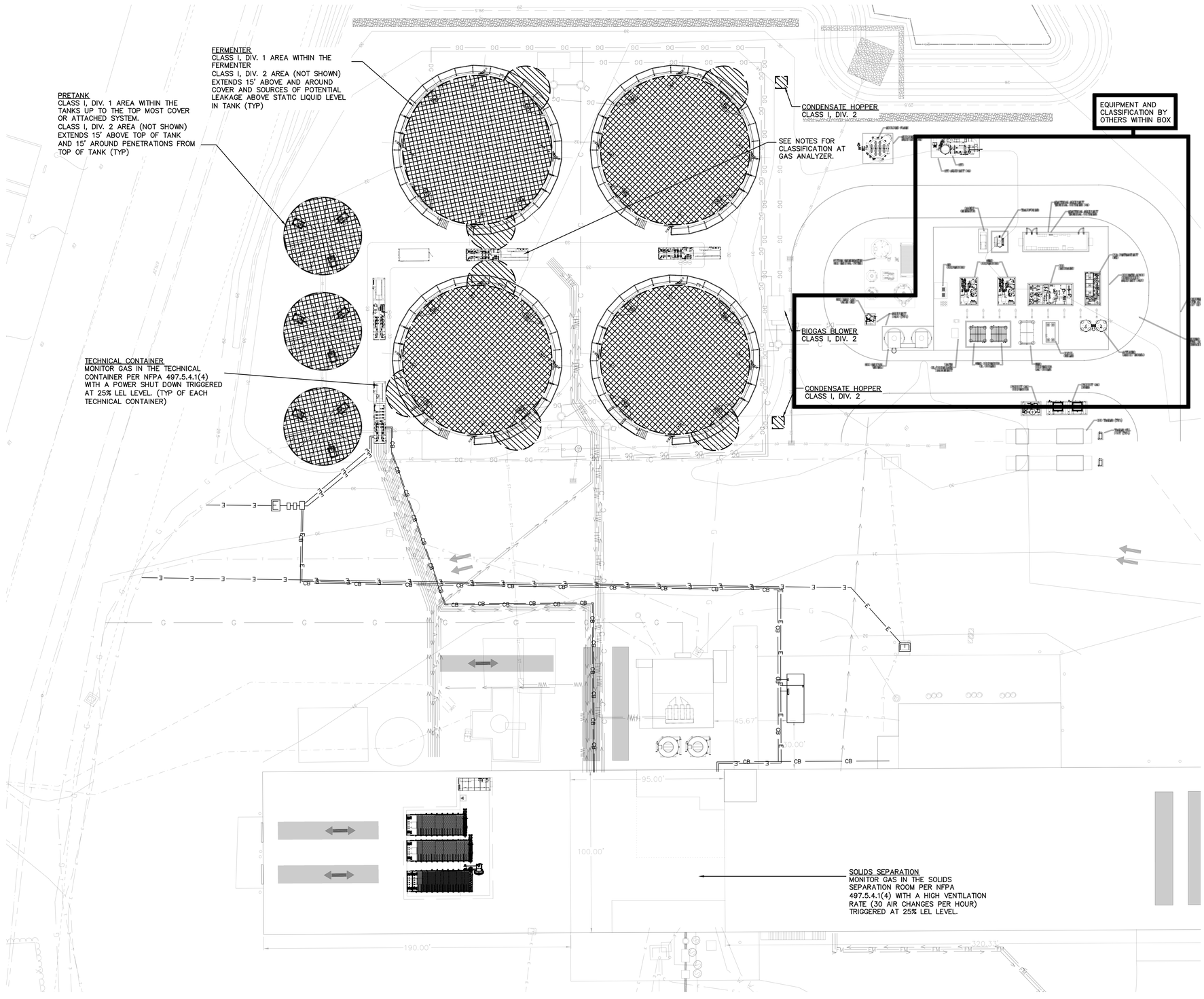
ELECTRICAL AREA CLASSIFICATION LEGEND

DENOTES CLASS I, DIV. 1 HAZARDOUS LOCATION PER NFPA 497

DENOTES CLASS I, DIV. 2 HAZARDOUS LOCATION PER NFPA 497

ELECTRICAL AREA CLASSIFICATION NOTES

1. DESIGN FOLLOWS GUIDELINES OF NFPA 497.
2. BASIS OF DESIGN FOR BIOGAS CONSTITUENT TYPES, AMOUNTS AND PERCENT/PPM LEVELS BASED ON:
   - 2.1. DMT CLEAR GAS SOLUTIONS REPORT, DATED 08/14/2020, TABLE 1.1 OPERATIONAL DATA
   - 2.2. MARYLAND FOOD CENTER AUTHORITY DESIGN REPORT, DATED MARCH 2020, TABLE 5-3 – QUALITY STANDARDS FROM COLUMBIA GAS TRANSMISSION OF NATURAL GAS
3. BUILDING INTERIORS ARE UNCLASSIFIED PER NFPA 497 PER THE FOLLOWING:
   - 3.1. NOT AN ANEROBIC ENVIRONMENT
   - 3.2. BIOGAS GENERATION BELOW 25% OF LEL
   - 3.3. AREAS ARE ABOVE GRADE (EXCEPT FOR RECEIVING PIT)
   - 3.4. ALL AREAS ARE VENTILATED
4. H2S CONCENTRATIONS ABOVE 25% OF LEL ARE NOT POSSIBLE.
5. ALL AREAS WITHIN CONDENSATE PIPE ARE CLASS I, DIV. 2.
6. DIGESTER GAS ANALYZER IS LOCATED IN TECHNICAL CONTAINER 4. CLASS I, DIV. 1 LOCATION WITHIN 3' ABOVE AND AROUND THE VENT (VENT LOCATED ABOVE THE CONTAINER). CLASS I, DIV. 2 LOCATION EXTENDING 15' ABOVE AND AROUND THE VENT AND DIGESTER GAS ANALYZER.
7. STATIC WATER LEVEL ASSUMED TO BE 3' FROM THE TOP OF FERMENTERS. IF THE FERMENTERS ARE DRAWN DOWN BELOW THIS LEVEL FOR MAINTENANCE, IT IS ASSUMED THE MIXERS WILL BE DE-ENERGIZED AND THE HEAD SPACE WILL BE MECHANICALLY VENTILATED TO PREVENT A COMBUSTIBLE ENVIRONMENT.
8. BIOGAS IS LIGHTER THAN AIR AND THERFORE CLASS I, DIV. 2 AREAS ARE OUT HORIZONTALLY AND UP VERTICALLY FROM ANY LEAK SOURCE. LOW PRESSURE PORTIONS OF THE BIOGAS SYSTEM WILL BE LESS THAN 2 PSIG AND ANY LEAK FROM THESE AREAS WILL EASILY BE DILUTED IF VENTED TO THE OPEN ATMOSHERE AND WILL RISE FROM THE POINT OF LEAKAGE.



PLAN

SCALE: 1" = 30'

FIGURE 1A

1"=30' 30' 0 30' 60'

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REVISIONS

B	

BIOENERGY DEVCO – BIOENERGY INNOVATION CENTER
ANAEROBIC DIGESTION
AND BIOGAS IMPROVEMENTS

ELECTRICAL AREA CLASSIFICATION PLAN

SUSSEX COUNTY, DELAWARE

SEAFORD

Barton & Loguidice

Date
APRIL 2021

Scale
AS SHOWN

Sheet Number
BIC-0000-E-111

File Number
2163.001.001

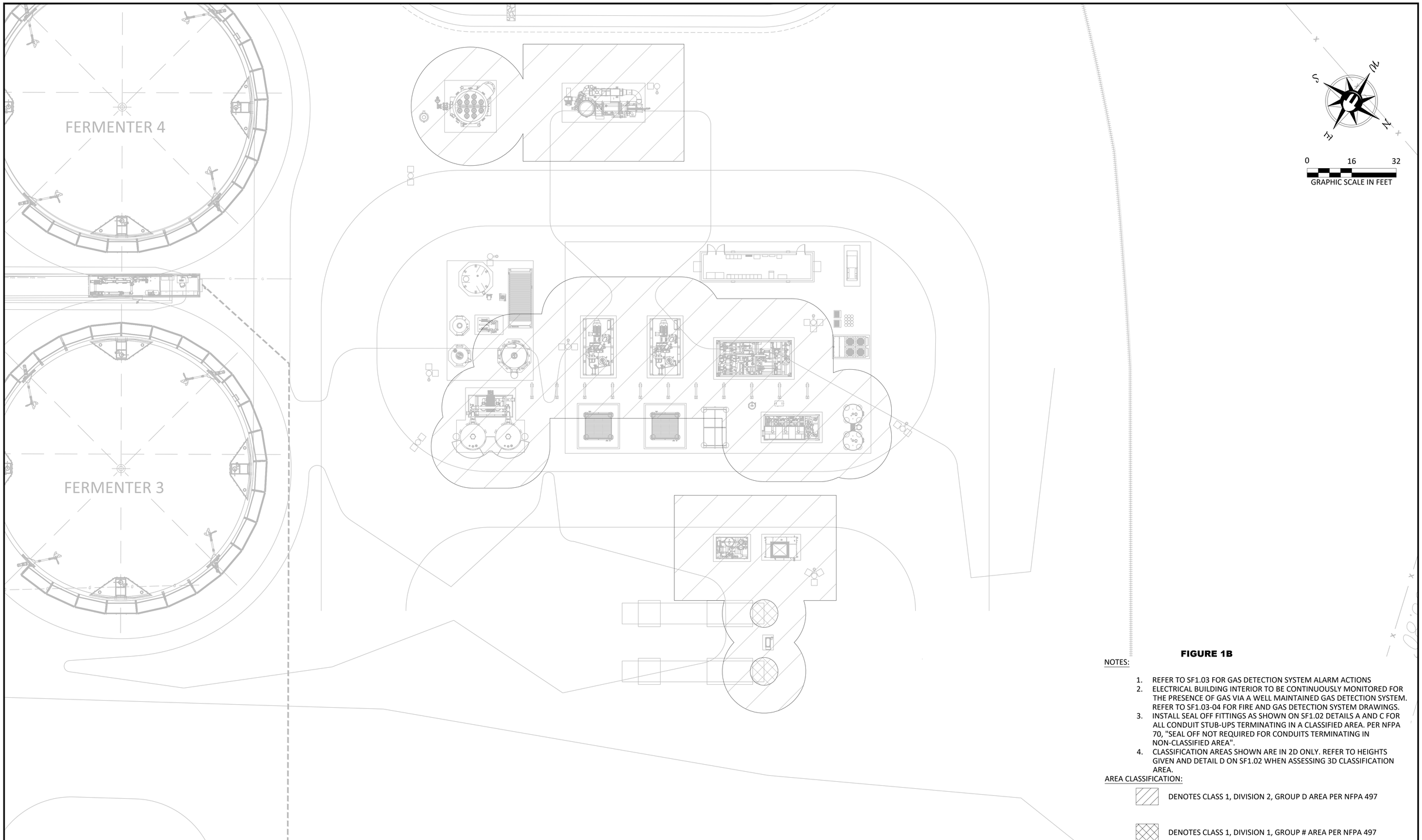


FIGURE 1B

NOTES:

1. REFER TO SF1.03 FOR GAS DETECTION SYSTEM ALARM ACTIONS
2. ELECTRICAL BUILDING INTERIOR TO BE CONTINUOUSLY MONITORED FOR THE PRESENCE OF GAS VIA A WELL MAINTAINED GAS DETECTION SYSTEM. REFER TO SF1.03-04 FOR FIRE AND GAS DETECTION SYSTEM DRAWINGS.
3. INSTALL SEAL OFF FITTINGS AS SHOWN ON SF1.02 DETAILS A AND C FOR ALL CONDUIT STUB-UPS TERMINATING IN A CLASSIFIED AREA. PER NFPA 70, "SEAL OFF NOT REQUIRED FOR CONDUITS TERMINATING IN NON-CLASSIFIED AREA".
4. CLASSIFICATION AREAS SHOWN ARE IN 2D ONLY. REFER TO HEIGHTS GIVEN AND DETAIL D ON SF1.02 WHEN ASSESSING 3D CLASSIFICATION AREA.

AREA CLASSIFICATION:

DENOTES CLASS 1, DIVISION 2, GROUP D AREA PER NFPA 497

DENOTES CLASS 1, DIVISION 1, GROUP # AREA PER NFPA 497

REV	DATE	DESCRIPTION	DRN BY	DSN BY	CHK BY
0	3/12/21	ISSUED FOR PRELIMINARY BUDGETING	JH	JH	SH

BIOENERGY DEVCO - BIOENERGY INOVATION CENTER

ANAEROBIC DIGESTION AND BIOGAS IMPROVEMENTS

ENERGYNEERING® SOLUTIONS INC
15820 BARCLAY DRIVE SISTERS, OR 97759
PHONE: (541) 549-8766
FAX: (541) 549-1901

AREA CLASSIFICATION PLAN

BIC BIOGAS FACILITY
28338 ENVIRO WAY SEAFORD, DE 19973

DRAWING NO.
SF1.01

PROJECT NO.
194.501

APPENDIX G

CITY OF SEAFORD WASTEWATER COMMITMENT LETTER

City of Seaford DELAWARE

414 High Street | PO BOX 1100
Seaford, DE 19973
302.629.9173
302.629.9307 fax
www.seafordde.com

October 27, 2021

Bioenergy DEVCO LLC
Peter Ettinger
50 State Circle
Annapolis, MD 24101

REF: BIOENERGY DEVELOPMENT CORPORATION
CAPACITY AVAILIBILITY

Dear Mr. Ettinger:

We are providing this response for the construction of wastewater collection conveyance system for the proposed Bioenergy Development Corporation (BDC). The project is approximately 200 Existing Equivalent Dwelling Units (EDU). Based on 300 gallons per day (gpd) / per EDU the project would require an estimated treatment capacity of 60,000 gpd when fully built out. The City of Seaford has sufficient capacity to treat and dispose of this additional flow at our Seaford Wastewater Facility. The NPDES permit for City of Seaford is DE0020265. This capacity is in reserve for BDC, but no wastewater will be accepted until a mutual agreement between both parties has been approved.

If you have questions or need additional information, please do not hesitate to contact me at 302-629-8340.

Sincerely,

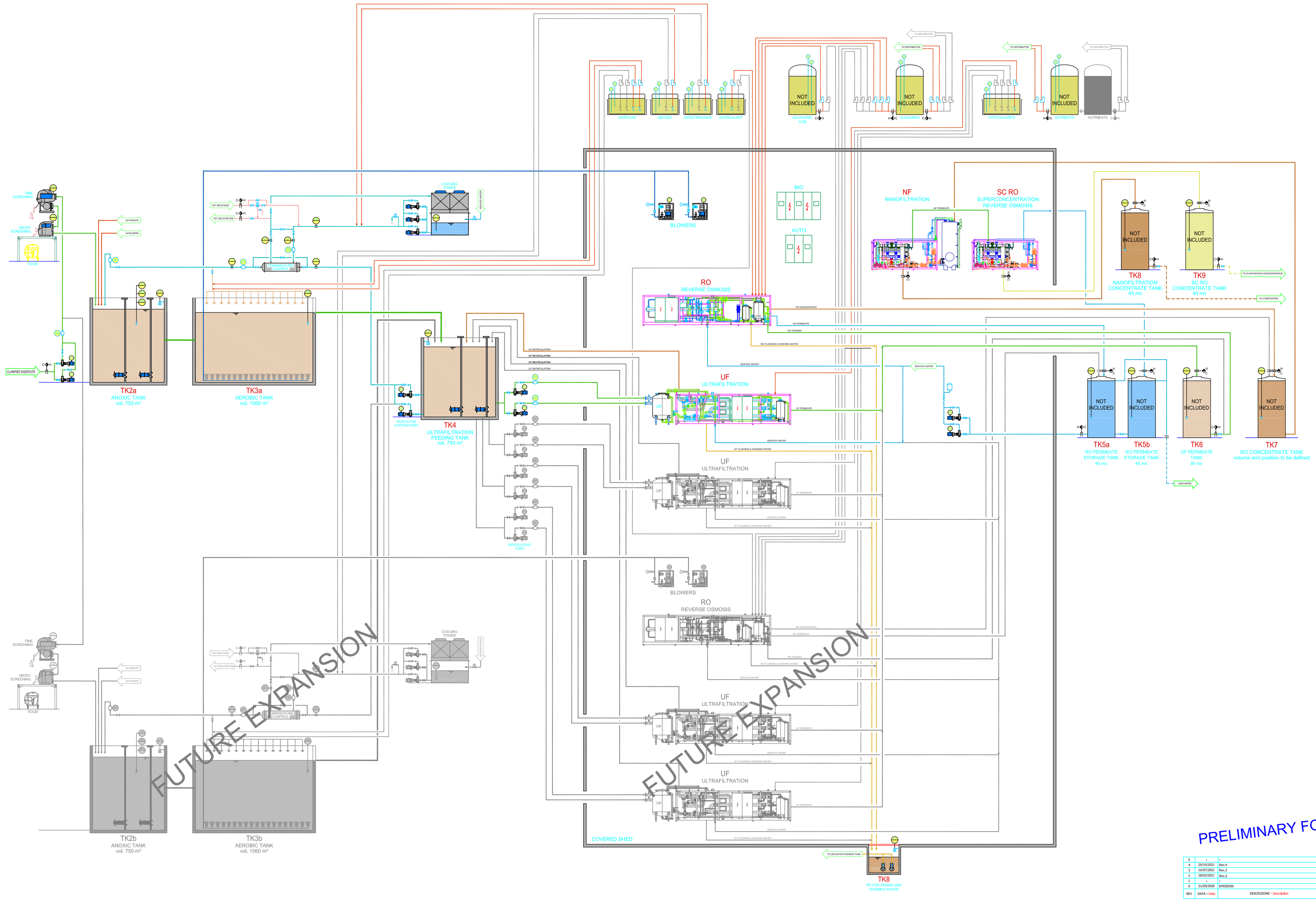
City of Seaford

Berley Mears
Director of Public Works

Cc: Charles Anderson, CM
Bryant Tifft, WWOC
Chris Derbyshire, P.E.

APPENDIX H

WASTEWATER TREATMENT PROCESS FLOW DIAGRAM



PRELIMINARY FOR OFFER

REV.	DATA • Date	DESCRIZIONE • Description	DISEGN. Drawn	CONTR. Checked	VERIFIC. Verified	APPROV. Approved
5	-	-	-	-	-	-
4	20/10/2021	Rev.4	PEGORARO	BIASIN	BIASIN	BRIANI
3	16/07/2021	Rev.3	POLATO	BIASIN	BIASIN	BRIANI
2	18/03/2021	Rev.2	PEGORARO	ARESU	ARESU	BRIANI
1	-	-	-	-	-	-
0	21/09/2020	EMISSION	PEGORARO	ARESU	ARESU	BRIANI

HYDROTECH ENGINEERING
Advanced water Technologies

DISEGNO N° / Drawing-N° HT-20-203-0-1-R4

Foglio / Sheet 1 / 1

Title: ANAEROBIC DIGESTATE TREATMENT

Oggetto / Object: PRELIMINARY FLOW-SHEET STANDARD VERSION - COVERED EQUIPMENTS

Committente / Customer: BIO ENERGY DEVCO (BIC)

Disegnato / Drawn	PEGORARO	20/10/2021
Controllato / Checked	ARESU	20/10/2021
Verificato / Verified	ARESU	20/10/2021
Approvato / Approved	BRIANI	20/10/2021

Commessa / Job n° -

Formato / Size A0

Scala / Scale 1:1

This drawing is property of HYDROTECH ENGINEERING s.r.l. company. All rights reserved.

DATE / FILE NAME: HT-20-203-0-1-R4 | HT-20-203-0-1-R3

units of measurement in: mm

scale plotting 1:1

HYDROTECH ENGINEERING

APPENDIX I

WASTEWATER TREATMENT SYSTEM MASS BALANCE

2		DIGESTATE
Q	t/d	209,0
TSS	%	<2.5
TDS	%	<2.0
COD	ppm	<10,500
		>4,900
Nt	ppm	3150

CHEMICALS CONSUMPTION		
Antifoam (*)	g/t	--
Nutrients	g/t	3400
Sodium hydroxide [30%]	g/t	--
* per Start-up		
ENERGY CONSUMPTION		
Installed power	kW	230
Specif.Energ.Cons.	kWh/t	21.0-25.0

CHEMICALS CONSUMPTION		
Acid cleaner	g/t	10
Alkaline cleaner	g/t	30
Sodium hypochlorite	g/t	50
ENERGY CONSUMPTION		
Installed power	kW	95
Specif.Energ.Cons.	kWh/t	5.0-7.0

BIOREACTOR DEN/OX

UF - MBR

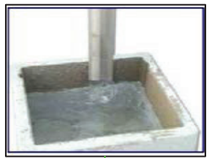
EXCESS SLUDGE

Q	t/d	14 approx
TSS	%	2.0-2.2

RECYCLE TO AD SYSTEM

3		
Q	t/d	195
TS	%	<2,0
TDS	%	<2,0
TSS	%	0
COD	ppm	<2000
Nt	ppm	<500

CHEMICALS CONSUMPTION		
Acid cleaner	g/t	10
Alkaline cleaner	g/t	20
Antiscalant	g/t	10
Sulphuric acid [50%]	g/t	5250
Sodium hydroxide [30%]	g/t	100
ENERGY CONSUMPTION		
Installed power	kW	95
Specif.Energ.Cons.	kWh/t	6.0-8.0



4		
Q	t/d	145
TS	%	<0,03
TDS	%	<0,03
TSS	%	0
COD	ppm	<100
Nt	ppm	<40

TO CITY OF SEAFORD

RO PERMEATE

RO

CHEMICALS CONSUMPTION		
Acid cleaner	g/t	3
Alkaline cleaner	g/t	5
Antiscalant	g/t	3
Sulphuric acid [50%]	g/t	2250
ENERGY CONSUMPTION		
Installed power	kW	50
Specif.Energ.Cons.	kWh/t	2.5-4.5

RO CONCENTRATE

5		
Q	t/d	50
TS	%	<8
TDS	%	<8
TSS	%	0
COD	ppm	<8000
Nt	ppm	<2000

RO SC PERMEATE

RO SC

NF PERMEATE

NF

RO SC CONCENTRATE

7		
Q	t/d	22
TS	%	<11
TDS	%	<11
TSS	%	0,0
COD	ppm	1800,0
Nt	ppm	5000,0

TO OFFSITE DIPOSAL (DELCORA)

NF CONCENTRATE

6		
Q	t/d	12
TS	%	<12
TDS	%	<12
TSS	%	0,0
COD	ppm	29600,0
Nt	ppm	2400,0

TO COMPOST

REV.	DATA Date	DESCRIZIONE Description	DISEGN. Drawn	CONTR. Checked	VERIF. Verified	APPROV. APPROVED
3	15/07/2021	--	BIASIN	--	BRIANI	BRIANI
0	15/06/2021	Rev.0	BIASIN	--	BRIANI	BRIANI

Hydrotech Advanced water Technologies Engineering

DISEGNO N° – Drawing N° HT-2020-203 1-2 R3+NF+ROSC

REV. 3

TITOLO Title: ANAEROBIC DIGESTATE TREATMENT

DISEGN. Drawn. BIASIN DATA Date 15/06/2021

CONTR. Checked -- DATA Date

VERIF. Verified BRIANI DATA Date

APPROV. Approved BRIANI DATA Date

OGGETTO Object: PRELIMINARY MASS BALANCE NF ROSC

COMMESSA N° – Job N°

FG. – Sh. / SG. – Nu. 1 / 1

SCALA – Scale –

PROJECTION ISO – Method E

DIMENSION mm

FORMATO/SIZE A0 A1 A2 A3 A4

COMMITTENTE Customer: BIOENERGY DEVCO (BIC)

SOSTITUISCE IL Substitutes

QUESTO DISEGNO E' DI PROPRIETA' DELLA SOCIETA' HYDROTECH ENGINEERING s.r.l. ED E' TUTELATO A NORMA DI LEGGE
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HYDROTECH ENGINEERING

nome file HT-2021-138 0-2 Rev.0 unita' di misura cm scala di plottaggio 1:1

TYPICAL DIGESTER OPERATING PARAMETERS

TYPICAL DIGESTER OPERATING PARAMETERS

		Standard operating practice values
Total solids	% FM	6-14
Volatile solids	% DM	65-95
Ash	% DM	35-5
Fat	% DM	>25
Starch	% DM	>40
Sugar	% DM	no limit
NFC	% DM	>40
NDF	% DM	>50
ADF	% DM	>50
ADL	% DM	>25
pH		7.2-8.5
Total nitrogen	mg/l	2000-9000
Ammonium	mg/l	1500-6000
Acetic acid/propionic acid	Ratio	>1/2
Proprionic acid		>300
Sulfur as H2S	mg/l	50
Sulfur as S2-	mg/l	100
Sulfur as Na2S	mg/l	160
Sodium	g/l	>30
Calcium	g/l	>2.8 CaCl2
Potassium	g/l	>3
Phosphor	g/l	n.a.
Magnesium	g/l	>2.4 MgCl2
Ni (free ions)	mg/l	>10
Cu (free ions)	mg/l	>40
Cr (free ions)	mg/l	>130
Pb (free ions)	mg/l	>340
Zn (free ions)	mg/l	>400

H2S FILTERS

Adsorption Equipment Application

If you are using this form electronically, press F1 at any time for help

General Information	
1.	Facility Name: **Bioenergy Innovation Center**
2.	Equipment ID Number:
3.	Manufacturer: **Biospark**
4.	Model: **Custom**
5.	Serial Number:
Attach the Manufacturer's Specification Sheet for the Adsorption Equipment.	

Adsorbent Information	
6.	Describe Adsorbent Type and Physical Properties: Fixed Non-Regenerative
7.	Breakthrough Capacity (pounds contaminant/100 pounds adsorbent): **40lbs H2S/100 lbs adsorbent**
8.	Operating Temperature Range of Adsorbent: from **100 °F** to **120 °F**
9.	Life Expectancy of Adsorbent: **6 months**
10.	Provide Any Necessary Additional Information Regarding the Adsorbent: **Two configured as lead-lag, each 9' diameter by 36.5' tall**

Adsorber Bed Information	
11.	Adsorbent Charge per Adsorber Vessel:
12.	Number of Adsorber Vessels: **2**
13.	Configuration of Adsorber Vessels: ☒ Series ☐ Parallel ☐ Other (Specify):
14.	Length of Mass Transfer Zone: **26.5 feet**
Attach Basis of Design for the Length of the Mass Transfer Zone calculation.	
15.	Adsorber Bed Cross Sectional Area: **63.6 square feet**
16.	Adsorption Bed Depth: **36.5 feet**
17.	Working Capacity of Adsorbent: **45** %

Regeneration Information

18. Is the Adsorbent Regenerated? ☐ YES ☒ NO

If the Adsorbent is Regenerated, complete the rest of Question 18. If not, proceed to Question 19.

18.1. Predicted Regeneration Cycle:

18.2. Describe Regeneration Trigger:

18.3. Predicted Number of Times Adsorbent Will be Regenerated Before Replacement:

18.4. Regeneration Location: ☐ On-Site ☐ Off-Site

If Regeneration Is conducted On-Site, complete the rest of Question 18. If it is conducted Off Site, proceed to Question 19.

18.5. Type of Regeneration: ☐ Steam ☐ Electric ☐ Hot Air ☐ Other (Specify):

If Steam Regeneration is used, complete the rest of Question 18. If not, proceed to Question 19.

18.6. Available Steam for Regeneration: **pounds of steam**

18.7. Describe How the Regeneration Liquid is Treated or Disposed Of:

Gas Stream Information

19. Maximum Inlet Volumetric Gas Flow Rate: **1500 acfm** at **105 °F** and **70** % moisture

20. Maximum Outlet Volumetric Gas Flow Rate: **1500 acfm** at **100 °F** and **70** % moisture

21. Design Range of Pressure Drop Across Bed: **33-63 inches water**

22. Residence Time: **>10 seconds**

Contaminant Information

23. Will Heat of Adsorption Potentially Lead to Temperature Excursions? ☒ YES ☐ NO

If Yes, Complete the Rest of Question 23, If No, Proceed to Question 24.

23.1. Describe How Temperature Excursions Will Be Handled: **There is a small temperature excursion when the medias has gas first introduced. The excursion is <50F and is managed through temperature control upstream and downstream. The excusrsion is approximately a few hours.**

24. Percent Relative Saturation, Vapor Pressure at the Inlet Temperature, and Removal Efficiency of Each Contaminant

If more than five Contaminants will be removed, attach additional copies of this page as needed.

	Contaminant Name	CAS Number	Percent Relative Saturation	Vapor Pressure	Removal Efficiency
24.1.	**H2S**	**7783-06-4**	**0.35%**	**8 psi**	**95-100** %

Contaminant Information

24.2.			**atm**	%
24.3.			**atm**	%
24.4.			**atm**	%
24.5.			**atm**	%

Stack Information

25.	Emission Point Name: **NA**
25.1.	Stack Height Above Grade: **feet**
25.2.	Stack Exit Diameter: **feet** *(Provide Stack Dimensions If Rectangular Stack)*
25.3.	Is a Stack Cap Present? ☐ YES ☐ NO
25.4.	Stack Configuration: ☐ Vertical ☐ Horizontal ☐ Downward-Venting *(check all that apply)* ☐ Other (Specify):
25.5.	Stack Exit Gas Temperature: **°F**
25.6.	Stack Exit Gas Flow Rate: **ACFM**
25.7.	Distance to Nearest Property Line: **feet**
25.8.	Describe Nearest Obstruction:
25.9.	Height of Nearest Obstruction: **feet**
25.10.	Distance to Nearest Obstruction: **feet**
25.11.	Are Stack Sampling Ports Provided? ☐ YES ☐ NO

Monitoring and Alarm Information

26. Are There Any Alarms You Would Like the Department to Consider When Drafting the Permit? ☐ YES ☐ NO

If YES, complete the rest of Question 26. If NO, proceed to Question 27.

26.1. Describe the System Alarm(s):

If there are more than five alarms, attach additional copies of this page as needed.

	Operating Parameter Monitored	**Describe Alarm Trigger**	**Monitoring Device or Alarm Type**	**Does the Alarm Initiate an Automated Response?**
26.1.1.	**Pressure Drop**	**Increase in Pressure drop idicates the filters need to be changed**	☒ Visual ☐ Auditory ☐ Automatic (Remote Monitoring) ☐ Other	☒ NO ☐ YES Describe:

Monitoring and Alarm Information

26.1.2.	**H2S Concentration**	**Increased Concentration between vessels indicates need for a changeout**	☒ Visual ☐ Auditory ☒ Automatic (Remote Monitoring) ☐ Other	☐ NO ☒ YES Describe: **can be monitored with the H2S analyzer or via draeger tubes manually**
26.1.3.			☐ Visual ☐ Auditory ☐ Automatic (Remote Monitoring) ☐ Other	☐ NO ☐ YES Describe:
26.1.4.			☐ Visual ☐ Auditory ☐ Automatic (Remote Monitoring) ☐ Other	☐ NO ☐ YES Describe:
26.1.5.			☐ Visual ☐ Auditory ☐ Automatic (Remote Monitoring) ☐ Other	☐ NO ☐ YES Describe:

Additional Information

27. Is There Any Additional Information Pertinent to this Application? ☐ YES ☒ NO

If YES, complete the rest of Question 27.

27.1. Describe:

PSA VESSELS

Adsorption Equipment Application

If you are using this form electronically, press F1 at any time for help

General Information

1.	Facility Name: **Bioenergy Innovation Center**
2.	Equipment ID Number:
3.	Manufacturer: **Global Welding Services**
4.	Model:
5.	Serial Number:
Attach the Manufacturer's Specification Sheet for the Adsorption Equipment.	

Adsorbent Information

6.	Describe Adsorbent Type and Physical Properties: mixture of activated alumina media, molecular seive media, polymer based media
7.	Breakthrough Capacity (pounds contaminant/100 pounds adsorbent): **N/A**
8.	Operating Temperature Range of Adsorbent: from **40 °F** to **110 °F**
9.	Life Expectancy of Adsorbent: **3-5 years**
10.	Provide Any Necessary Additional Information Regarding the Adsorbent: **Regarding breakthrough capacity - the media is regenerated every 10 minutes to its full capacity. Working capacity varies with each media, average is 90% (stated below).**

Adsorber Bed Information

11.	Adsorbent Charge per Adsorber Vessel: **3233 lb media per vessel**
12.	Number of Adsorber Vessels: **3**
13.	Configuration of Adsorber Vessels: ☐ Series ☒ Parallel ☐ Other (Specify):
14.	Length of Mass Transfer Zone: **78 inches**
Attach Basis of Design for the Length of the Mass Transfer Zone calculation.	
15.	Adsorber Bed Cross Sectional Area: **1,520 square inches**
16.	Adsorption Bed Depth: **78 inches**
17.	Working Capacity of Adsorbent: **90** %

Regeneration Information

18. Is the Adsorbent Regenerated? ☒ YES ☐ NO

If the Adsorbent is Regenerated, complete the rest of Question 18. If not, proceed to Question 19.

18.1. Predicted Regeneration Cycle: **10 minutes**

18.2. Describe Regeneration Trigger: **Time based**

18.3. Predicted Number of Times Adsorbent Will be Regenerated Before Replacement: **157,700 (every 10 minutes for 3 years)**

18.4. Regeneration Location: ☒ On-Site ☐ Off-Site

If Regeneration Is conducted On-Site, complete the rest of Question 18. If it is conducted Off Site, proceed to Question 19.

18.5. Type of Regeneration: ☐ Steam ☐ Electric ☐ Hot Air ☒ Other (Specify): **CO2-rich gas stream**

If Steam Regeneration is used, complete the rest of Question 18. If not, proceed to Question 19.

18.6. Available Steam for Regeneration: **pounds of steam**

18.7. Describe How the Regeneration Liquid is Treated or Disposed Of:

Gas Stream Information

19. Maximum Inlet Volumetric Gas Flow Rate: **1200 acfm** at **86 °F** and **0.5** % moisture

20. Maximum Outlet Volumetric Gas Flow Rate: **1200 acfm** at **86 °F** and **0.1** % moisture

21. Design Range of Pressure Drop Across Bed: **28 inches water**

22. Residence Time: **10 seconds**

Contaminant Information

23. Will Heat of Adsorption Potentially Lead to Temperature Excursions? ☐ YES ☒ NO

If Yes, Complete the Rest of Question 23, If No, Proceed to Question 24.

23.1. Describe How Temperature Excursions Will Be Handled:

24. Percent Relative Saturation, Vapor Pressure at the Inlet Temperature, and Removal Efficiency of Each Contaminant

If more than five Contaminants will be removed, attach additional copies of this page as needed.

	Contaminant Name	CAS Number	Percent Relative Saturation	Vapor Pressure	Removal Efficiency
24.1.	**VOC**		**0.02%**	**10 psi**	**90** %

Contaminant Information

24.2.			**atm**	%
24.3.			**atm**	%
24.4.			**atm**	%
24.5.			**atm**	%

Stack Information

25.	Emission Point Name: **NA**
25.1.	Stack Height Above Grade: **feet**
25.2.	Stack Exit Diameter: **feet** *(Provide Stack Dimensions If Rectangular Stack)*
25.3.	Is a Stack Cap Present? ☐ YES ☐ NO
25.4.	Stack Configuration: ☐ Vertical ☐ Horizontal ☐ Downward-Venting *(check all that apply)* ☐ Other (Specify):
25.5.	Stack Exit Gas Temperature: **°F**
25.6.	Stack Exit Gas Flow Rate: **ACFM**
25.7.	Distance to Nearest Property Line: **feet**
25.8.	Describe Nearest Obstruction:
25.9.	Height of Nearest Obstruction: **feet**
25.10.	Distance to Nearest Obstruction: **feet**
25.11.	Are Stack Sampling Ports Provided? ☐ YES ☐ NO

Monitoring and Alarm Information

26. Are There Any Alarms You Would Like the Department to Consider When Drafting the Permit? ☐ YES ☐ NO

If YES, complete the rest of Question 26. If NO, proceed to Question 27.

26.1. Describe the System Alarm(s):

If there are more than five alarms, attach additional copies of this page as needed.

	Operating Parameter Monitored	Describe Alarm Trigger	Monitoring Device or Alarm Type	Does the Alarm Initiate an Automated Response?
26.1.1.	**visual monitoring system using draeger tubes**	**trigger level of 30ppm**	☒ Visual ☐ Auditory ☐ Automatic (Remote Monitoring) ☐ Other	☒ NO ☐ YES Describe: **Operator will take action when the draeger tube reads >30ppm**

Monitoring and Alarm Information

26.1.2.			☐ Visual ☐ Auditory ☐ Automatic (Remote Monitoring) ☐ Other	☐ NO ☐ YES Describe:
26.1.3.			☐ Visual ☐ Auditory ☐ Automatic (Remote Monitoring) ☐ Other	☐ NO ☐ YES Describe:
26.1.4.			☐ Visual ☐ Auditory ☐ Automatic (Remote Monitoring) ☐ Other	☐ NO ☐ YES Describe:
26.1.5.			☐ Visual ☐ Auditory ☐ Automatic (Remote Monitoring) ☐ Other	☐ NO ☐ YES Describe:

Additional Information

27. Is There Any Additional Information Pertinent to this Application? ☐ YES ☒ NO

If YES, complete the rest of Question 27.

27.1. Describe:

POLISHING FILTERS

Adsorption Equipment Application

If you are using this form electronically, press F1 at any time for help

General Information

1.	Facility Name: **Bioenergy Innovation Center**
2.	Equipment ID Number:
3.	Manufacturer: **Global Welding Services (GWS)**
4.	Model: **Custom**
5.	Serial Number:
Attach the Manufacturer's Specification Sheet for the Adsorption Equipment.	

Adsorbent Information

6.	Describe Adsorbent Type and Physical Properties: Fixed non-regenerative
7.	Breakthrough Capacity (pounds contaminant/100 pounds adsorbent): **40 lbs VOC/100 lbs adsorbent**
8.	Operating Temperature Range of Adsorbent: from **50 °F** to **60 °F**
9.	Life Expectancy of Adsorbent: **6 months**
10.	Provide Any Necessary Additional Information Regarding the Adsorbent:

Adsorber Bed Information

11.	Adsorbent Charge per Adsorber Vessel:
12.	Number of Adsorber Vessels: **2**
13.	Configuration of Adsorber Vessels: ☒ Series ☐ Parallel ☐ Other (Specify):
14.	Length of Mass Transfer Zone: **12.5 feet**
Attach Basis of Design for the Length of the Mass Transfer Zone calculation.	
15.	Adsorber Bed Cross Sectional Area: **38.5 square feet**
16.	Adsorption Bed Depth: **19.4 feet**
17.	Working Capacity of Adsorbent: **25** %

Regeneration Information

18. Is the Adsorbent Regenerated? ☐ YES ☒ NO

If the Adsorbent is Regenerated, complete the rest of Question 18. If not, proceed to Question 19.

18.1. Predicted Regeneration Cycle:

18.2. Describe Regeneration Trigger:

18.3. Predicted Number of Times Adsorbent Will be Regenerated Before Replacement:

18.4. Regeneration Location: ☐ On-Site ☐ Off-Site

If Regeneration Is conducted On-Site, complete the rest of Question 18. If it is conducted Off Site, proceed to Question 19.

18.5. Type of Regeneration: ☐ Steam ☐ Electric ☐ Hot Air ☐ Other (Specify):

If Steam Regeneration is used, complete the rest of Question 18. If not, proceed to Question 19.

18.6. Available Steam for Regeneration: **pounds of steam**

18.7. Describe How the Regeneration Liquid is Treated or Disposed Of:

Gas Stream Information

19. Maximum Inlet Volumetric Gas Flow Rate: **1500 acfm** at **60 °F** and **5** % moisture

20. Maximum Outlet Volumetric Gas Flow Rate: **1500 acfm** at **60 °F** and **5** % moisture

21. Design Range of Pressure Drop Across Bed: **16-30 inches water**

22. Residence Time: **>10 seconds**

Contaminant Information

23. Will Heat of Adsorption Potentially Lead to Temperature Excursions? ☒ YES ☐ NO

If Yes, Complete the Rest of Question 23, If No, Proceed to Question 24.

23.1. Describe How Temperature Excursions Will Be Handled: **There is a small temperature excursion when the medias has gas first introduced. The excursion is <50F and is managed through temperature control upstream and downstream. The excusrsion is approximately a few hours.**

24. Percent Relative Saturation, Vapor Pressure at the Inlet Temperature, and Removal Efficiency of Each Contaminant

If more than five Contaminants will be removed, attach additional copies of this page as needed.

	Contaminant Name	CAS Number	Percent Relative Saturation	Vapor Pressure	Removal Efficiency
24.1.	**VOC**		**0.02%**	**4.5 psi**	**90-100** %

Contaminant Information

24.2.	**H2S**	**7783-06-4**	**.35%**	**8 psi**	**95-100** %
24.3.				**atm**	%
24.4.				**atm**	%
24.5.				**atm**	%

Stack Information

25. Emission Point Name: **NA**

25.1. Stack Height Above Grade: **feet**

25.2. Stack Exit Diameter: **feet**
(Provide Stack Dimensions If Rectangular Stack)

25.3. Is a Stack Cap Present? ☐ YES ☐ NO

25.4. Stack Configuration: ☐ Vertical ☐ Horizontal ☐ Downward-Venting
(check all that apply) ☐ Other (Specify):

25.5. Stack Exit Gas Temperature: **°F**

25.6. Stack Exit Gas Flow Rate: **ACFM**

25.7. Distance to Nearest Property Line: **feet**

25.8. Describe Nearest Obstruction:

25.9. Height of Nearest Obstruction: **feet**

25.10. Distance to Nearest Obstruction: **feet**

25.11. Are Stack Sampling Ports Provided? ☐ YES ☐ NO

Monitoring and Alarm Information

26. Are There Any Alarms You Would Like the Department to Consider When Drafting the Permit? ☐ YES ☐ NO

If YES, complete the rest of Question 26. If NO, proceed to Question 27.

26.1. Describe the System Alarm(s):

If there are more than five alarms, attach additional copies of this page as needed.

	Operating Parameter Monitored	**Describe Alarm Trigger**	**Monitoring Device or Alarm Type**	**Does the Alarm Initiate an Automated Response?**
26.1.1.	**Pressure Drop**	**Increase in pressure drop across vessel indicates media needs to be changed**	☒ Visual ☐ Auditory ☒ Automatic (Remote Monitoring) ☐ Other	☒ NO ☒ YES Describe:

Monitoring and Alarm Information

26.1.2.	**H2S/VOC Concentration**	**increased concentration between vessels indicates need for media changeout**	☒ Visual ☐ Auditory ☐ Automatic (Remote Monitoring) ☐ Other	☒ NO ☐ YES Describe: **monitored manually via draeger tube**
26.1.3.			☐ Visual ☐ Auditory ☐ Automatic (Remote Monitoring) ☐ Other	☐ NO ☐ YES Describe:
26.1.4.			☐ Visual ☐ Auditory ☐ Automatic (Remote Monitoring) ☐ Other	☐ NO ☐ YES Describe:
26.1.5.			☐ Visual ☐ Auditory ☐ Automatic (Remote Monitoring) ☐ Other	☐ NO ☐ YES Describe:

Additional Information

27. Is There Any Additional Information Pertinent to this Application? ☐ YES ☒ NO

If YES, complete the rest of Question 27.

27.1. Describe:

SILOXANE FILTERS

Adsorption Equipment Application

If you are using this form electronically, press F1 at any time for help

General Information

1.	Facility Name: **Bioenergy Innovation Center**
2.	Equipment ID Number:
3.	Manufacturer:
4.	Model:
5.	Serial Number:
Attach the Manufacturer's Specification Sheet for the Adsorption Equipment.	

Adsorbent Information

6.	Describe Adsorbent Type and Physical Properties: Activated Carbon
7.	Breakthrough Capacity (pounds contaminant/100 pounds adsorbent): **40 lbs**
8.	Operating Temperature Range of Adsorbent: from **60 °F** to **110 °F**
9.	Life Expectancy of Adsorbent: **6 months**
10.	Provide Any Necessary Additional Information Regarding the Adsorbent:

Adsorber Bed Information

11.	Adsorbent Charge per Adsorber Vessel: **37400 lbs**
12.	Number of Adsorber Vessels: **2**
13.	Configuration of Adsorber Vessels: ☒ Series ☐ Parallel ☐ Other (Specify):
14.	Length of Mass Transfer Zone: **24 feet**
Attach Basis of Design for the Length of the Mass Transfer Zone calculation.	
15.	Adsorber Bed Cross Sectional Area: **59 square feet**
16.	Adsorption Bed Depth: **12 feet**
17.	Working Capacity of Adsorbent: **35-40** %

Regeneration Information

18. Is the Adsorbent Regenerated? ☐ YES ☒ NO

If the Adsorbent is Regenerated, complete the rest of Question 18. If not, proceed to Question 19.

18.1. Predicted Regeneration Cycle:

18.2. Describe Regeneration Trigger:

18.3. Predicted Number of Times Adsorbent Will be Regenerated Before Replacement:

18.4. Regeneration Location: ☐ On-Site ☐ Off-Site

If Regeneration Is conducted On-Site, complete the rest of Question 18. If it is conducted Off Site, proceed to Question 19.

18.5. Type of Regeneration: ☐ Steam ☐ Electric ☐ Hot Air ☐ Other (Specify):

If Steam Regeneration is used, complete the rest of Question 18. If not, proceed to Question 19.

18.6. Available Steam for Regeneration: **pounds of steam**

18.7. Describe How the Regeneration Liquid is Treated or Disposed Of:

Gas Stream Information

19. Maximum Inlet Volumetric Gas Flow Rate: **1500 acfm** at **110 °F** and **80** % moisture

20. Maximum Outlet Volumetric Gas Flow Rate: **1500 acfm** at **110 °F** and **80** % moisture

21. Design Range of Pressure Drop Across Bed: **40-60 inches water**

22. Residence Time: **0.2 minutes**

Contaminant Information

23. Will Heat of Adsorption Potentially Lead to Temperature Excursions? ☒ YES ☐ NO

If Yes, Complete the Rest of Question 23, If No, Proceed to Question 24.

23.1. Describe How Temperature Excursions Will Be Handled: **Temperature excursion will only occur during start up period when gas is introduced. Temperature rise expected to be <50 F**

24. Percent Relative Saturation, Vapor Pressure at the Inlet Temperature, and Removal Efficiency of Each Contaminant

If more than five Contaminants will be removed, attach additional copies of this page as needed.

	Contaminant Name	CAS Number	Percent Relative Saturation	Vapor Pressure	Removal Efficiency
24.1.	**Siloxanes**	**556-67-2**	**0.002**	**0.03 psi**	**100** %

Contaminant Information

24.2.			**atm**	%
24.3.			**atm**	%
24.4.			**atm**	%
24.5.			**atm**	%

Stack Information

25.	Emission Point Name: **NA**
25.1.	Stack Height Above Grade: **feet**
25.2.	Stack Exit Diameter: **feet** *(Provide Stack Dimensions If Rectangular Stack)*
25.3.	Is a Stack Cap Present? ☐ YES ☐ NO
25.4.	Stack Configuration: ☐ Vertical ☐ Horizontal ☐ Downward-Venting *(check all that apply)* ☐ Other (Specify):
25.5.	Stack Exit Gas Temperature: **°F**
25.6.	Stack Exit Gas Flow Rate: **ACFM**
25.7.	Distance to Nearest Property Line: **feet**
25.8.	Describe Nearest Obstruction:
25.9.	Height of Nearest Obstruction: **feet**
25.10.	Distance to Nearest Obstruction: **feet**
25.11.	Are Stack Sampling Ports Provided? ☐ YES ☐ NO

Monitoring and Alarm Information

26. Are There Any Alarms You Would Like the Department to Consider When Drafting the Permit? ☐ YES ☐ NO

If YES, complete the rest of Question 26. If NO, proceed to Question 27.

26.1. Describe the System Alarm(s):

If there are more than five alarms, attach additional copies of this page as needed.

	Operating Parameter Monitored	**Describe Alarm Trigger**	**Monitoring Device or Alarm Type**	**Does the Alarm Initiate an Automated Response?**
26.1.1.	**Siloxane Sorbent Tube**	**Lab Sample**	☒ Visual ☐ Auditory ☐ Automatic (Remote Monitoring) ☐ Other	☒ NO ☐ YES Describe:

Monitoring and Alarm Information

26.1.2.			☐ Visual ☐ Auditory ☐ Automatic (Remote Monitoring) ☐ Other	☐ NO ☐ YES Describe:
26.1.3.			☐ Visual ☐ Auditory ☐ Automatic (Remote Monitoring) ☐ Other	☐ NO ☐ YES Describe:
26.1.4.			☐ Visual ☐ Auditory ☐ Automatic (Remote Monitoring) ☐ Other	☐ NO ☐ YES Describe:
26.1.5.			☐ Visual ☐ Auditory ☐ Automatic (Remote Monitoring) ☐ Other	☐ NO ☐ YES Describe:

Additional Information

27. Is There Any Additional Information Pertinent to this Application? ☐ YES ☒ NO

If YES, complete the rest of Question 27.

27.1. Describe:

FILTER OPERATIONS

Filter Operations

For monitoring H2S levels:

The H2S removal vessels are filled with an activated carbon. The adsorption is based on a conversion reaction that requires the presence of O2 in the gas. The vessels are designed in a lead-lag configuration to maximize carbon utilization, and can be operated in parallel or as single vessels (one online, one offline – i.e. in the event of a changeout). The first vessel in the series is used as bulk removal, and the second vessel acts as a polishing vessel to remove any trace amounts of H2S from the gas. The H2S concentration of the gas is monitored between the vessels, either by a permanent gas analyzer, or by an operator using a draeger tube. The concentration of H2S between the vessels should be 0 ppm, so any value above this would indicate that the media is saturated. Increased pressure drop across the vessels can also be an indication that the media needs to be changed. The maximum pressure drop is 63 in. water column. Operators will record the pressure drop daily, and closely monitor as the value increases toward the maximum. When a changeout is required, the vessels will switch which is lead and which is lag, so that the process does not require a shutdown, and the gas can flow through the unused media in the second bed. The estimated bed lifetime is 6 months.

For monitoring Siloxane levels:

VOCs and siloxanes are removed via Pressure Swing Adsorption (PSA). The VOCs are adsorbed in these vessels, and then the media is regenerated by the tailgas from the membrane system. During regeneration, the contaminants desorb from the media and the stream of gas with the contaminants goes to two lead-lag vessels through a layer of activated carbon, where physical (not chemical) removal occurs. The concentration of siloxanes is measured daily via a VOC analyzer or from a draeger tube sample between the vessels, and should be 0 ppm when the system is functioning properly. Increased pressure drop across the carbon vessels can also be an indication that the media needs to be changed. The maximum pressure drop is 60 in. water column. Operators will record the pressure drop daily, and closely monitor as the value increases toward the maximum. When breakthrough is detected, the media will be changed. Since the PSA media is regenerated, the lifetime of the media is anywhere from 3-5 years. The concentration of VOCs can be monitored quarterly (due to the extended lifetime of this media) at the outlet of the PSA vessels by the operators to determine if the media in the PSAs needs to be replaced.

***Activated Carbon Polishing Vessels**:*

The polishing vessels contain a mixture of H2S and VOC removal media. The vessels are designed in a lead-lag configuration. The first vessel in the series is used as bulk removal, and the second vessel acts as a polishing vessel to remove any trace amounts of H2S or VOCs from the gas. The concentration of contaminants between vessels can be determined using a draeger tube. The concentration of contaminants between the polishing vessels should be 0 ppm, so any value above this would indicate that the media needs to be changed out. Increased pressure drop across the vessels can also be an indication that the media needs to be replaced. The maximum pressure drop is 30 in. water column. Operators will record the pressure drop daily, and closely monitor as the value increases toward the maximum. The estimated bed lifetime is 6 months.

Untreated biogas Characteristics:

All feedstocks are analyzed repeatedly for a number of parameters (this data was previously provided to DNREC). This data is combined with BTS experience, including 200+ existing plants built in the last 25 years. The combined data is used in the modeling of the project and in estimating biogas quantity and characteristics.

EMERGENCY GENERATOR

Administrative Information

One original and one copy of All Application Forms Should Be Mailed To:
Division of Air Quality
100 West Water Street, Suite 6A
Dover, DE 19904

All Checks Should Be Made Payable To:
State of Delaware

Company and Site Information

1.	Company Name: **Bioenergy Devco**
2.	Company Mailing Address: **50 State Circle** City: **Annapolis** State: **Maryland** Zip Code: **21401**
3.	Site Name: **Bioenergy Innovation Center**
4.	Site Mailing Address: **28338 Enviro Way** *(if different from above)* City: **Seaford** State: **Delaware** Zip Code: **19973**
5.	Physical Location of Site: **28338 Enviro Way** *(if different from above)* City: **Seaford** State: **Delaware** Zip Code: **19973**
6.	Site Billing Address: **50 State Circle** *(if different from above)* City: **Annapolis** State: **Maryland** Zip Code: **21401**
7.	Air Quality Management Facility ID Number: **1000500281**
8.	Site NAICS Code): **221210, 325314** *(list all that apply*
9.	Site SIC Code: **4925, 2875** *(list all that apply)*
10.	Site Location Coordinates: Latitude: 38 ° 36’ 12” Longitude: -75 ° 36’ 16”
11.	Is the Facility New or Existing? ☐ NEW ☒ EXISTING
If the Facility is an Existing Facility, Complete the Rest of Question 11. If Not, Proceed to Question 12.	
11.1.	Does the Facility Have Active Air Permits? ☒ YES ☐ NO
12.	Is this Application For New Equipment or a Modification to Existing Equipment? ☒ New Equipment ☐ Modification of Existing Equipment ☐ Other (Specify):
If the application is for the modification of existing equipment, complete the rest of Question 12. If not, proceed to Question 13.	

Company and Site Information

12.1.	Does the Equipment Have an Active Air Permit? ☐ YES ☐ NO
If the equipment has an active air permit, complete the rest of Question 12. If not, proceed to Question 13.	
12.2.	Permit Number of Existing Equipment:
13.	Status of Equipment Being Applied For: ☒ Natural Minor Source ☐ Synthetic Minor Source ☐ Major Source ☐ Federally Enforceable Restrictions
14.	Facility Status: ☒ Natural Minor Facility ☐ Synthetic Minor Facility ☐ Major Facility
If the facility is a Major Source, complete the rest of Question 14. If not, proceed to Question 15.	
14.1.	Responsible Official Name:
14.2.	Responsible Official Title:

Contact Information

15.	Name of Owner or Facility Manager: **Jeff Deats**
16.	Title of Owner or Facility Manager: **Facilty Manager**
17.	Permit Contact Name: **Christine McKiernan**
18.	Permit Contact Title: **Managing Director Engineering & Construction**
19.	Permit Contact Telephone Number: **(201) 779-1958**
20.	Permit Contact Fax Number: **NA**
21.	Permit Contact E-Mail Address: **cmckiernan@bioenergydevco.com**
22.	Billing Contact Name: **Dena Nolte**
23.	Billing Contact Title: **Controller**
24.	Billing Contact Telephone Number: **(443) 782-3384**
25.	Billing Contact Fax Number: **NA**
26.	Billing Contact E-Mail Address: **dnolte@bioenergydevco.com**

Proposed Construction and Operating Schedule

27.	When Will the Proposed Construction/Installation/Modification Occur: 04/01/2022
28.	Proposed Operating Schedule: **24** hours/day **7** days/week **52** weeks/year
28.1.	Is There Any Additional Information Regarding the Operating Schedule? ☒ YES ☐ NO
If YES, complete the rest of Question 28. If NO, proceed to Question 29.	

Proposed Construction and Operating Schedule

28.2. Describe the Additional Information: **Emergency generator would be limited to 500 hours per year per DNREC policy.**

Coastal Zone Information

29. Is the Facility Located in the Coastal Zone? ☐ YES ☒ NO

If the facility is located in the Coastal Zone complete the rest of Question 29. If not, proceed to Question 30.

29.1. Is a Coastal Zone Permit Required for Construction or Operation of the Source Being Applied for? ☐ YES ☐ NO

Attach a copy of the Coastal Zone Determination if it has not been previously submitted

If a Coastal Zone Permit is required complete the rest of Question 29. If not, proceed to Question 30.

29.2. Has a Coastal Zone Permit Been Issued? ☐ YES ☐ NO

Attach a copy of the Coastal Zone Permit if it has not been previously submitted

Local Zoning Information

30. Parcel Zoning: **Agricultural Residential (AR-1)**

Attach Proof of Local Zoning if it has not been previously submitted

Application Information

31. Is the Appropriate Application Fee Attached? ☒ YES ☐ NO

32. Is the Advertising Fee Attached? ☒ YES ☐ NO

For help determining your application and advertising fees see:
http://www.dnrec.state.de.us/DNREC2000/Library/Fees/DE%20Permit%20Fees.htm

Attach the appropriate fees. Note that your Application will not be considered complete if the appropriate fees are not included.

33. Is a Cover Letter Describing the Process Attached? ☒ YES ☐ NO

Attach a brief cover letter describing your Application.

If the Facility is a New Facility complete Question 34. If not, proceed to Question35.

34. Is a Copy of the Applicant Background Information Questionnaire on Record at the Department? ☐ YES ☐ NO

If NO, complete the rest of Question 34. If YES, process to Question 35.

34.1 Is a Copy of the Applicant Background Information Questionnaire Attached? ☐ YES ☐ NO

For a copy of the Applicant Background Information Questionnaire see
http://www.dnrec.delaware.gov/services/Documents/Chapter79Form.pdf

Attach a copy of the Applicant Background Information Questionnaire if applicable.

35. Check Which Application Forms are Attached:

Application Information

☒ AQM-1	☐ AQM-3.4	☐ AQM-3.9	☐ AQM-3.14	☐ AQM-4.4	☐ AQM-4.9	☐ AQM-6
☒ AQM-2	☐ AQM-3.5	☐ AQM-3.10	☐ AQM-3.15	☐ AQM-4.5	☐ AQM-4.10	
☐ AQM-3.1	☐ AQM-3.6	☐ AQM-3.11	☐ AQM-4.1	☐ AQM-4.6	☐ AQM-4.11	
☐ AQM-3.2	☐ AQM-3.7	☐ AQM-3.12	☐ AQM-4.2	☐ AQM-4.7	☐ AQM-4.12	
☒ AQM-3.3	☐ AQM-3.8	☐ AQM-3.13	☐ AQM-4.3	☐ AQM-4.8	☒ AQM-5	

36. Check Which Documents are Attached:

- ☐ Coastal Zone Determination
- ☐ Coastal Zone Permit
- ☒ Proof of Local Zoning
- ☐ Application Fee
- ☐ Advertising Fee
- ☐ Applicant Background Information Questionnaire
- ☐ Claim of Confidentiality
- ☒ Manufacturer Specification(s)
- ☐ Material Safety Data Sheets (MSDSs)
- ☒ Supporting Calculations
- ☒ Descriptive Cover Letter
- ☐ Other (Specify):

Confidentiality Information

37. Do You Consider Any of the Information Submitted With this Application Confidential? ☐ YES ☒ NO

For help on how to submit a confidentiality claim see http://regulations.delaware.gov/register/december2011/final/15%20DE%20Reg%20864%2012-01-11.htm

If a Claim of Confidentiality is made it MUST meet the requirements of Section 6 of DNREC's Freedom of Information ("FOIA") Regulation at the time the Application is submitted.

Signature Block

I, the undersigned, hereby certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all of its attachments as to the truth, accuracy, and completeness of this information. I certify based on information and belief formed after reasonable inquiry, the statements and information in this document are true, accurate, and complete. By signing this form, I certify that I have not changed, altered, or deleted any portions of this application. I acknowledge that I cannot commence construction, alteration, modification or initiate operation until I receive written approval (i.e. permit, registration, or exemption letter) from the Department. I acknowledge that I may be required to perform testing of the equipment to receive construction or operation approval, and that if I do not receive approval to construct or operate that I may appeal the decision.

Peter Ettinger
Owner or Operator

1/12/22
Date

Signature of Owner or Operator

One Original and One Copy of All Application Forms Should Be Mailed To:
Division of Air Quality
100 W. Water Street, Suite 6A
Dover, Delaware 19904

All Checks Should Be Made Payable To:
State of Delaware

JAMIE WHITEHOUSE, AICP
PLANNING & ZONING DIRECTOR
(302) 855-7878 T
(302) 854-5079 F
jamie.whitehouse@sussexcountyde.gov

Sussex County
DELAWARE
sussexcountyde.gov

March 19, 2021

Mr. Dennis Schrader, Esq.
P.O. Box 690
Georgetown, DE 19947

By e-mail to: dschrader@morrisjames.com

RE: Notice of Decision Letter for Conditional Use (CU 2258) Bioenergy Development Group, LLC to amend CU 1314 (as amended by CU's 1691 and 1962) to permit the processing and handling of poultry litter to include nutrient recovery for natural gas and electrical generation to be located at 28338 Enviro Way in Seaford, DE.
Tax Parcels: 132-6.00-88.01 & 95.00 and 132-11.00-41.00 & 41.02

Dear Mr. Schrader,

At their meeting of April 20, 2021, the Sussex County Council approved the Conditional Use application to amend CU 1314 (as amended by CU's 1691 and 1962) to permit the processing and handling of poultry litter to include nutrient recovery for natural gas and electrical generation at 28338 Enviro Way in Seaford subject to twelve (12) conditions. The Conditional Use shall be substantially underway within three (3) years of the County Council approval otherwise the Conditional Use shall expire. A Site Plan showing the conditions of approval shall be reviewed and approved by the Planning Commission prior to commencement of the use on the parcel. The following are the conditions:

A. Except as otherwise amended by this grant of conditional use, the conditions imposed by Conditional Use No. 1314 as amended by Conditional Use Nos. 1691 and 1962 shall remain in effect.
B. The proposed facility shall be subject to DNREC and other state and federal regulatory approvals.
C. The proposed facility shall only accept, process and handle poultry litter and DAF.
D. There shall not be any stockpiling of DAF, poultry litter, or wastewater on site.
E. This conditional use shall be valid concurrent with DNREC's permits for this use. If the DNREC permits shall be terminated or expire, this conditional use shall also terminate and expire.
F. The proposed facility, anerobic digesters, pretanks, and other equipment and structure related to this use shall be located behind the site of the existing pelletizing facility and the area of disturbance related to this new use shall be no greater than 11.3 acres.
G. As proposed by the Applicant, there will be no change to the wooded coverage on the property.

H. All stormwater management facilities shall be subject to the review and approval of the Sussex Conservation District. The Final Site Plan shall include the approval of the Sussex Conservation District for the design and locations of the stormwater management areas.
I. Prior to the submission of the Final Site Plan, the Applicant must provide copies of all active permits from DNREC demonstrating that the Applicant has received all necessary approvals and permits from DNREC to operate the proposed facility.
J. As proffered by the Applicant, the landscape buffer shall be installed at the front of the site. A landscape buffer plan shall be included as part of the Final Site Plan for the project.
K. The failure to abide by these conditions shall result in the termination of the conditional use approval.
L. The Applicant shall submit a Final Site Plan, which shall be subject to the review and approval of the Sussex County Planning and Zoning Commission.

The Final Site Plan shall be prepared by a licensed Delaware Surveyor or Engineer and shall contain the conditions of approval on the plan. The Final Site Plan shall be approved prior to the commencement of the use on the property. The Site Plan shall be reviewed and approved by the Planning Commission. Agency approvals include but are not limited to: DelDOT, Sussex Conservation District and the Office of the State Fire Marshal.

Please submit a minimum of two (2) full size paper copies and an electronic copy (PDF) of the Preliminary Site Plan to the Planning and Zoning Office a minimum of twenty (20) days prior to a Planning Commission meeting.

An approved copy of the Ordinance granting approval of the Conditional Use will be sent to you from the Clerk of Council.

Please feel free to contact the Planning and Zoning Department with any questions during business hours 8:30 am to 4:30 pm, Monday through Friday, at (302)-855-7878.

Sincerely,

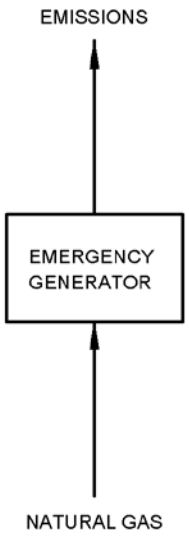
Christin Scott

Mrs. Christin Scott
Planner I

CC: Mr. Lester Shaffer, Chief Constable
Ms. Susan Isaacs, Public Works
Mr. Andy Wright, Building Code
Mr. John Ashman, Engineering

Process Flow Diagram

Sketch the Process Flow Diagram for the equipment or process being applied for. Include each emission unit and control device (even existing emission units that will not be modified by this application). You may identify each emission unit with a simple shape. Label each emission unit and control device with a unique identifier. Show the relationship between each emission unit and/or control device by drawing arrows between them to indicate the flow of air pollutants. List which application forms are included for each emission unit or control device below the shape representing each emission unit or control device . See http://www.delaware.gov/reg2/default.htm for example Process Flow Diagrams for common processes. If you already have a Process Flow Diagram for the equipment or process being applied for, you may attach it to the application instead of using this form.



Generator/Engine Application

If you are using this form electronically, press F1 at any time for help

General Information

1. Facility Name: **Bioenergy Innovation Center**
2. Equipment ID: **EGen**
3. Manufacturer: **Cummins**
4. Model: **C1000NC6**
5. Serial Number: **TBD**
6. Maximum Power Rating of Engine: **1,451** horsepower
7. Standby Power Rating of Generator: **1,082** kilowatt
8. Date of Manufacture: **2021**
9. Installation Date: **Planned February 2022**
10. Is the Equipment Being Applied For a Generator or an Engine? ☒ Generator ☐ Engine

If the equipment is a Generator, complete the rest of Question 10. If not, proceed to Question 11.

10.1. Is the Generator Existing or New? ☐ Existing ☒ New

10.2. Will the Generator Be Classified as an Emergency Generator or a Distributed Generator? ☒ Emergency ☐ Distributed

10.3. Has an Initial Notification Pursuant to 7 **DE Admin. Code** 1144 Been Submitted for this Generator? ☐ YES ☒ NO

If NO, include a copy of the Initial Notification with this application.

10.4. Have the Emissions From the Generator Been Certified to Meet the Currently Applicable US EPA Non-Road Emission Standards? ☒ YES ☐ NO

If YES, attach a copy of the Manufacturer's Certification. If NO, attach copies of any/all of the following: any maintenance or operating requirements/instructions provided by the generator manufacturer; the type, or a description, of any emission control equipment use; and/or emissions test data for the generator (such as a manufacturer's technical data sheet), any supporting documentation for any emission control equipment used, any supporting calculations, any quality control or assurance information, and any other information needed to demonstrate compliance with the requirements. Proceed to Question 11.

11. Primary Fuel: ☒ Natural Gas ☐ Diesel ☐ Propane ☐ Biodiesel ☐ Other (specify):

11.1. Maximum Annual Primary Fuel Consumption: **82.2 MMCF**

11.2. Heat Content of Primary Fuel: **1,050 BTU/CF**

11.3. Maximum Firing Rate: **0.00938 MMCF/hr**

11.4. Percent Sulfur of Primary Fuel: **NA** %

12. Secondary Fuel: ☐ Natural Gas ☐ Diesel ☐ Propane ☐ Biodiesel ☐ Other (specify): **NA**

General Information

12.1.	Maximum Annual Secondary Fuel Consumption: **MMCF**
12.2.	Heat Content of Secondary Fuel: **BTU/CF**
12.3.	Maximum Firing Rate: **MMCF/hr**
12.4.	Percent Sulfur of Secondary Fuel: %
13.	Is SCR/NSCR/SNCR/Ammonia Injection Used: ☐ YES ☒ NO

Stack Information

14.	How Does the Process Equipment Vent: *(check all that apply)* ☒ Directly to the Atmosphere ☐ Through a Control Device Covered by Forms AQM-4.1 through 4.12
If any of the process equipment vents directly to the atmosphere proceed to Question 15. If the process equipment vents through a control device, provide the stack parameters on the control device form and proceed to Question 16.	
15.	Emission Point Name: **EGen**
15.1.	Stack Height Above Grade: **21 feet**
15.2.	Stack Exit Diameter: **1.33 feet** *(Provide Stack Dimensions If Rectangular Stack)*
15.3.	Is a Stack Cap Present? ☒ YES ☐ NO
15.4.	Stack Configuration: ☒ Vertical ☐ Horizontal ☐ Downward-Venting *(check all that apply)* ☐ Other (Specify):
15.5.	Stack Exit Gas Temperature: **932 °F**
15.6.	Stack Exit Gas Flow Rate: **8790 ACFM**
15.7.	Distance to Nearest Property Line: **340 ft**
15.8.	Describe Nearest Obstruction: **Building**
15.9.	Height of Nearest Obstruction: **31 ft**
15.10.	Distance to Nearest Obstruction: **36 ft**
15.11.	Are Stack Sampling Ports Provided? ☒ YES ☐ NO

Monitoring Information

16.	Will Emissions Data be Recorded by a Continuous Emission Monitoring System? ☐ YES ☒ NO
If Yes, Attach a Copy of the Continuous Emission Monitoring System Manufacturer's Specification Sheets	
If YES, complete the rest of Question 16. If NO, proceed to Question 17.	
16.1.	Pollutants Monitored: ☐ VOCs ☐ HAPs ☐ PM ☐ PM_{10} ☐ $PM_{2.5}$ ☐ NO_X ☐ SO_X ☐ Metals ☐ Other (Specify):
16.2.	Describe the Continuous Emission Monitoring System:

Monitoring Information
16.3. Manufacturer:
16.4. Model:
16.5. Serial Number:
16.6. Will Multiple Emission Units Be Monitored at the Same Point? ☐ YES ☐ NO
If YES, complete the rest of Question 16. If NO, proceed to Question 17.
16.7. Emission Units Monitored:
16.8. Will More Than One Emission Unit be Emitting From the Combined Point At Any Time? ☐ YES ☐ NO
If YES, complete the rest of Question 15. If NO, proceed to Question 17.
16.9. Emission Units Emitting Simultaneously:

Visible Emissions Monitoring Information
For Primary Fuel
17. Proposed Technique Used to Monitor Visible Emissions: ☐ Opacity Monitor (COM) ☐ Manual (Method 9) ☒ Manual (Method 22) ☐ Other (Describe):
If an Opacity Monitor (COM) is used, complete the rest of Question 17. If not, proceed to Question 18.
17.1. Describe the Continuous Opacity Monitoring System:
17.2. Manufacturer:
17.3. Model:
17.4. Serial Number:
18. Proposed Frequency of Opacity Monitoring: **Monthly**
For Secondary Fuel. If no Secondary Fuel is used, proceed to Question 20.
19. Proposed Technique Used to Monitor Visible Emissions: ☐ Opacity Monitor (COMs) ☐ Manual (Method 9) ☐ Manual (Method 22) ☐ Other (Describe):
If an Opacity Monitor (COMs) is used, complete the rest of Question 19. If not, proceed to Question 20.
19.1. Describe the Continuous Opacity Monitoring System:
19.2. Manufacturer:
19.3. Model:
19.4. Serial Number:
20. Proposed Frequency of Opacity Monitoring:

Voluntary Emission Limitation Request Information

21.	Are You Requesting Any Voluntary Emission Limitations to Avoid Major Source Status, Minor New Source Review, MACT, NSPS, etc.?	☐ YES ☒ NO
If YES, complete the rest of Question 21. If NO, proceed to Question 22.		
21.1.	Describe Any Proposed Emission Limitations:	

Voluntary Operating Limitation Request Information

22.	Are You Requesting Any Voluntary Operating Limitations to Avoid Major Source Status, Minor New Source Review, MACT, NSPS, etc.?	☐ YES ☒ NO
If YES, complete the rest of Question 22. If NO, proceed to Question 23.		
22.1.	Describe Any Proposed Operating Limitations:	

Additional Information

23.	Is There Any Additional Information Pertinent to this Application?	☐ YES ☒ NO
If YES, complete the rest of Question 23.		
22.1.	Describe:	

Emissions Information Application

If you are using this form electronically, press F1 at any time for help

Process Information

1.	Number of Individual Pieces of Process Equipment in Process: **1**
2.	Number of Individual Control Devices in Process: **0**

Emissions Information for First Emission Point/Stack

3.	Emission Point Name: **EGen**
4.	Equipment ID Number for all Process Equipment and Control Devices Venting Through Emission Point/Stack: **EGen**
5.	Pollutant Emissions

If more than 15 pollutants are emitted at this Emission Point/Stack, attach additional copies of this page as needed.

	Pollutant Name (Specify VOCs and HAPs Individually in 5.10 through 5.18)	CAS Number (Not required for 5.1 through 5.10)	Maximum Uncontrolled Emission Rate at Design Capacity	Maximum Controlled Emission Rate at Design Capacity	Annual Potential to Emit (PTE)	Requested Permitted Annual Emissions
5.1.	Particulate Matter (PM)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
5.2.	PM_{10}		**0.000759 lbs/hour**	**0.000759 lbs/hour**	**0.00019** tons/year	**0.00019** tons/year
5.3.	$PM_{2.5}$		**lbs/hour**	**lbs/hour**	tons/year	tons/year
5.4.	Sulfur Oxides (SO_X)		**0.00579 lbs/hour**	**0.00579 lbs/hour**	**0.00145** tons/year	**0.00145** tons/year
5.5.	Nitrogen Oxides (NO_X)		**2.6 lbs/hour**	**2.6 lbs/hour**	**0.66** tons/year	**0.66** tons/year
5.6.	Carbon Monoxide (CO)		**6.4 lbs/hour**	**6.4 lbs/hour**	**1.6** tons/year	**1.6** tons/year
5.7.	Total Volatile Organic Compounds (VOCs)		**0.2 lbs/hour**	**0.2 lbs/hour**	**0.06** tons/year	**0.06** tons/year

Emissions Information for First Emission Point/Stack

5.8.	Total Hazardous Air Pollutants (HAPs)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
5.9.	CO_2		**1,084 lbs/hour**	**1,084 lbs/hour**	**271** tons/year	**271** tons/year
5.10.	CO_{2e}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
5.11.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
5.12.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
5.13.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
5.14.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
5.15.			**lbs/hour**	**lbs/hour**	tons/year	tons/year

6. Provide Any Additional Information Necessary to Understanding the Emission Rates Provided Above:

Attach the Basis of Determination or Calculations for each Emission Rate provided above.

Emissions Information for Second Emission Point/Stack

7. Emission Point Name:

8. Equipment ID Number for all Process Equipment and Control Devices Venting Through Emission Point/Stack:

9. Pollutant Emissions

If more than 15 pollutants are emitted at this Emission Point/Stack, attach additional copies of this page as needed.

	Pollutant Name (Specify VOCs and HAPs Individually in 9.10 through 9.18)	CAS Number (Not required for 9.1 through 9.10)	Maximum Uncontrolled Emission Rate at Design Capacity	Maximum Controlled Emission Rate at Design Capacity	Annual Potential to Emit (PTE)	Requested Permitted Annual Emissions
9.1.	Particulate Matter (PM)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.2.	PM_{10}		**lbs/hour**	**lbs/hour**	tons/year	tons/year

Emissions Information for Second Emission Point/Stack

9.3.	$PM_{2.5}$		**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.4.	Sulfur Oxides (SO_X)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.5.	Nitrogen Oxides (NO_X)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.6.	Carbon Monoxide (CO)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.7.	Total Volatile Organic Compounds (VOCs)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.8.	Total Hazardous Air Pollutants (HAPs)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.9.	CO_2		**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.10.	CO_{2e}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.11.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.12.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.13.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.14.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.15.			**lbs/hour**	**lbs/hour**	tons/year	tons/year

10. Provide Any Additional Information Necessary to Understanding the Emission Rates Provided Above:

Attach the Basis of Determination or Calculations for each Emission Rate provided above.

Emissions Information for Third Emission Point/Stack

11. Emission Point Name:

12. Equipment ID Number for all Process Equipment and Control Devices Venting Through Emission Point/Stack:

13. Pollutant Emissions

Emissions Information for Third Emission Point/Stack

If more than 15 pollutants are emitted at this Emission Point/Stack, attach additional copies of this page as needed.

	Pollutant Name (Specify VOCs and HAPs Individually in 13.10 through 13.18)	CAS Number (Not required for 13.1 through 13.10)	Maximum Uncontrolled Emission Rate at Design Capacity	Maximum Controlled Emission Rate at Design Capacity	Annual Potential to Emit (PTE)	Requested Permitted Annual Emissions
13.1.	Particulate Matter (PM)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.2.	PM_{10}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.3.	$PM_{2.5}$		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.4.	Sulfur Oxides (SO_X)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.5.	Nitrogen Oxides (NO_X)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.6.	Carbon Monoxide (CO)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.7.	Total Volatile Organic Compounds (VOCs)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.8.	Total Hazardous Air Pollutants (HAPs)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.9.	CO_2		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.10.	CO_{2e}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.11.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.12.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.13.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.14.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.15.			**lbs/hour**	**lbs/hour**	tons/year	tons/year

14. Provide Any Additional Information Necessary to Understanding the Emission Rates Provided Above:

Emissions Information for Third Emission Point/Stack

Attach the Basis of Determination or Calculations for each Emission Rate provided above.

Emissions Information for Fourth Emission Point/Stack

15. Emission Point Name:

16. Equipment ID Number for all Process Equipment and Control Devices Venting Through Emission Point/Stack:

17. Pollutant Emissions

If more than 15 pollutants are emitted at this Emission Point/Stack, attach additional copies of this page as needed.

	Pollutant Name (Specify VOCs and HAPs Individually in 17.10 through 17.18)	CAS Number (Not required for 17.1 through 17.10)	Maximum Uncontrolled Emission Rate at Design Capacity	Maximum Controlled Emission Rate at Design Capacity	Annual Potential to Emit (PTE)	Requested Permitted Annual Emissions
17.1.	Particulate Matter (PM)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.2.	PM_{10}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.3.	$PM_{2.5}$		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.4.	Sulfur Oxides (SO_X)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.5.	Nitrogen Oxides (NO_X)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.6.	Carbon Monoxide (CO)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.7.	Volatile Organic Compounds (VOCs)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.8.	Total Hazardous Air Pollutants (HAPs)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.9.	CO_2		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.10.	CO_{2e}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.11.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.12.			**lbs/hour**	**lbs/hour**	tons/year	tons/year

Emissions Information for Fourth Emission Point/Stack

17.13.		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.14.		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.15.		**lbs/hour**	**lbs/hour**	tons/year	tons/year

18. Provide Any Additional Information Necessary to Understanding the Emission Rates Provided Above:

Attach the Basis of Determination or Calculations for each Emission Rate provided above.

If there are more than four Emission Points/Stacks, attach additional copies of this form as needed.

Overall Process Emissions

19. Pollutant Emissions

If more than 15 pollutants are emitted from this Process, attach additional copies of this page as needed.

	Pollutant Name (Specify VOCs and HAPs Individually in 19.10 through 19.18)	CAS Number (Not required for 19.1 through 19.10)	Maximum Uncontrolled Emission Rate at Design Capacity	Maximum Controlled Emission Rate at Design Capacity	Annual Potential to Emit (PTE)	Requested Permitted Annual Emissions
19.1.	Particulate Matter (PM)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
19.2.	PM_{10}		**0.000759 lbs/hour**	**0.000759 lbs/hour**	**0.00019** tons/year	**0.00019** tons/year
19.3.	$PM_{2.5}$		**lbs/hour**	**lbs/hour**	tons/year	tons/year
19.4.	Sulfur Oxides (SO_X)		**0.00579 lbs/hour**	**0.00579 lbs/hour**	**0.00145** tons/year	**0.00145** tons/year
19.5.	Nitrogen Oxides (NO_X)		**2.6 lbs/hour**	**2.6 lbs/hour**	**0.66** tons/year	**0.66** tons/year
19.6.	Carbon Monoxide (CO)		**6.4 lbs/hour**	**6.4 lbs/hour**	**1.6** tons/year	**1.6** tons/year
19.7.	Total Volatile Organic Compounds (VOCs)		**0.2 lbs/hour**	**0.2 lbs/hour**	**0.06** tons/year	**0.06** tons/year
19.8.	Total Hazardous Air		**lbs/hour**	**lbs/hour**	tons/year	tons/year

Overall Process Emissions

	Pollutants (HAPs)					
19.9.	CO_2		**1,084 lbs/hour**	**1,084 lbs/hour**	**271** tons/year	**271** tons/year
19.10.	CO_{2e}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
19.12.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
19.13.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
19.14.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
19.15.			**lbs/hour**	**lbs/hour**	tons/year	tons/year

20. Provide Any Additional Information Necessary to Understanding the Emission Rates Provided Above:

Attach the Basis of Determination or Calculations for each Emission Rate provided above.

Minor New Source Review Information

21. Does the Process Have the Potential to Emit More Than Five Tons Per Year of Any Pollutant? ☐ YES ☒ NO

22. Is the Source New or Existing? ☒ NEW ☐ EXISTING
See Question 11 of AQM-1

If the Process has the Potential to Emit more than five tons per year of any pollutant, and is a New Source, a Control Technology Analysis pursuant to Regulation No. 1125 Section 4 must be conducted and attached to this application.

Major New Source Review Information

23. Does the Process Have the Potential to Emit More Than the Significance Level for Any Pollutant? *(Check All That Apply)*

- ☐ Greater Than 25 Tons Per Year of Particulate Matter (PM)
- ☐ Greater Than 15 Tons Per Year of PM_{10}
- ☐ Greater Than 10 Tons Per Year of $PM_{2.5}$
- ☐ Greater Than 40 Tons Per Year of Sulfur Dioxide(SO_2)
- ☐ Greater Than 25 Tons Per Year of Nitrogen Oxides (NO_X) in New Castle and Kent County
- ☐ Greater Than 100 Tons Per Year of Nitrogen Oxides (NO_X) in Sussex County
- ☐ Greater Than 100 Tons Per Year of Carbon Monoxide (CO)
- ☐ Greater Than 25 Tons Per Year of Total Volatile Organic Compounds (VOCs) in New Castle and Kent County
- ☐ Greater Than 50 Tons Per Year of Total Volatile Organic Compounds (VOCs) in Sussex County
- ☐ Greater Than 75,000 Tons Per Year of Equivalent Carbon Dioxide (CO_{2e})

If the Process has the Potential to Emit greater than any of the amounts listed above 7 DE Admin. Code 1125 Sections 2 and/or 3 apply. Contact the Department at (302) 323-4542 or (302) 739-9402 for additional information

Additional Information

24. Is There Any Additional Information Pertinent to this Application? ☐ YES ☒ NO

If YES, complete the rest of Question 24.

24.1. Describe:

Emergency Generator

Cummins model C1000N6

Power Rating	1,082	kW
	1,451	HP
	9.85	MMBTU/hr
Fuel BTU	1,050	BTU/CF

Fuel consumption	0.00938	CF/hr
Annual consumption	82.2	MMCF/yr

Emission factors

PM_{10}	0.0000771	lb/MMBTU	AP-42 Table 3.2-2
SOx	0.000588	lb/MMBTU	AP-42 Table 3.2-2
NOx	1.1	g/kWh	Manufacturer
CO	2.7	g/kWh	Manufacturer
VOC	0.1	g/kWh	Manufacturer
CO_2	110	lb/MMBTU	AP-42 Table 3.2-2

Emissions

			at 500 hours	
PM_{10}	0.000759	lb/hr	0.00019	ton/yr
SOx	0.00579	lb/hr	0.00145	ton/yr
NOx	2.6	lb/hr	0.66	ton/yr
CO	6.4	lb/hr	1.6	ton/yr
VOC	0.2	lb/hr	0.06	ton/yr
CO_2	1,084	lb/hr	271	ton/yr

3.2 Natural Gas-fired Reciprocating Engines

3.2.1 General[1-3]

Most natural gas-fired reciprocating engines are used in the natural gas industry at pipeline compressor and storage stations and at gas processing plants. These engines are used to provide mechanical shaft power for compressors and pumps. At pipeline compressor stations, engines are used to help move natural gas from station to station. At storage facilities, they are used to help inject the natural gas into high pressure natural gas storage fields. At processing plants, these engines are used to transmit fuel within a facility and for process compression needs (e.g., refrigeration cycles). The size of these engines ranges from 50 brake horsepower (bhp) to 11,000 bhp. In addition, some engines in service are 50 - 60 years old and consequently have significant differences in design compared to newer engines, resulting in differences in emissions and the ability to be retrofitted with new parts or controls.

At pipeline compressor stations, reciprocating engines are used to power reciprocating compressors that move compressed natural gas (500 - 2000 psig) in a pipeline. These stations are spaced approximately 50 to 100 miles apart along a pipeline that stretches from a gas supply area to the market area. The reciprocating compressors raise the discharge pressure of the gas in the pipeline to overcome the effect of frictional losses in the pipeline upstream of the station, in order to maintain the required suction pressure at the next station downstream or at various downstream delivery points. The volume of gas flowing and the amount of subsequent frictional losses in a pipeline are heavily dependent on the market conditions that vary with weather and industrial activity, causing wide pressure variations. The number of engines operating at a station, the speed of an individual engine, and the amount of individual engine horsepower (load) needed to compress the natural gas is dependent on the pressure of the compressed gas received by the station, the desired discharge pressure of the gas, and the amount of gas flowing in the pipeline. Reciprocating compressors have a wider operating bandwidth than centrifugal compressors, providing increased flexibility in varying flow conditions. Centrifugal compressors powered by natural gas turbines are also used in some stations and are discussed in another section of this document.

A compressor in storage service pumps gas from a low-pressure storage field (500 - 800 psig) to a higher pressure transmission pipeline (700 - 1000 psig) and/or pumps gas from a low-pressure transmission line (500 - 800 psig) to a higher pressure storage field (800 - 2000 psig).

Storage reciprocating compressors must be flexible enough to allow operation across a wide band of suction and discharge pressures and volume variations. The compressor must be able to compress at high compression ratios with low volumes and compress at low compression ratios with high volumes. These conditions require varying speeds and load (horsepower) conditions for the reciprocating engine powering the reciprocating compressor.

Reciprocating compressors are used at processing plants for process compression needs (e.g. refrigeration cycles). The volume of gas compressed varies, but the pressure needed for the process is more constant than the other two cases mentioned above.

3.2.2 Process Description[1-3]

Natural gas-fired reciprocating engines are separated into three design classes: 2-cycle (stroke) lean-burn, 4-stroke lean-burn, and 4-stroke rich-burn. Two-stroke engines complete the power cycle in a

single crankshaft revolution as compared to the two crankshaft revolutions required for 4-stroke engines. All engines in these categories are spark-ignited.

In a 2-stroke engine, the air-to-fuel charge is injected with the piston near the bottom of the power stroke. The intake ports are then covered or closed, and the piston moves to the top of the cylinder, compressing the charge. Following ignition and combustion, the power stroke starts with the downward movement of the piston. As the piston reaches the bottom of the power stroke, exhaust ports or valves are opened to exhaust, or scavenge, the combustion products, and a new air-to-fuel charge is injected. Two-stroke engines may be turbocharged using an exhaust-powered turbine to pressurize the charge for injection into the cylinder and to increase cylinder scavenging. Non-turbocharged engines may be either blower scavenged or piston scavenged to improve removal of combustion products. Historically, 2-stroke designs have been widely used in pipeline applications. However, current industry practices reflect a decline in the usage of new 2-stroke engines for stationary applications.

Four-stroke engines use a separate engine revolution for the intake/compression cycle and the power/exhaust cycle. These engines may be either naturally aspirated, using the suction from the piston to entrain the air charge, or turbocharged, using an exhaust-driven turbine to pressurize the charge. Turbocharged units produce a higher power output for a given engine displacement, whereas naturally aspirated units have lower initial costs and require less maintenance.

Rich-burn engines operate near the stoichiometric air-to-fuel ratio (16:1) with exhaust excess oxygen levels less than 4 percent (typically closer to 1 percent). Additionally, it is likely that the emissions profile will be considerably different for a rich-burn engine at 4 percent oxygen than when operated closer to stoichiometric conditions. Considerations such as these can impact the quantitative value of the emission factor presented. It is also important to note that while rich-burn engines may operate, by definition, with exhaust oxygen levels as high as 4 percent, in reality, most will operate within plus or minus 1 air-to-fuel ratio of stoichiometry. Even across this narrow range, emissions will vary considerably, sometimes by more than an order of magnitude. Air-to-fuel ratios were not provided in the gathered emissions data used to develop the presented factors.

Lean-burn engines may operate up to the lean flame extinction limit, with exhaust oxygen levels of 12 percent or greater. The air to fuel ratios of lean-burn engines range from 20:1 to 50:1 and are typically higher than 24:1. The exhaust excess oxygen levels of lean-burn engines are typically around 8 percent, ranging from 4 to 17 percent. Some lean-burn engines are characterized as clean-burn engines. The term “clean-burn” technology is a registered trademark of Cooper Energy Systems and refers to engines designed to reduce NO_x by operating at high air-to-fuel ratios. Engines operating at high air-to-fuel ratios (greater than 30:1) may require combustion modification to promote stable combustion with the high excess air. These modifications may include a turbo charger or a precombustion chamber (PCC). A turbo charger is used to force more air into the combustion chamber, and a PCC is used to ignite a fuel-rich mixture that propagates into the main cylinder and ignites the very lean combustion charge. Lean-burn engines typically have lower oxides of nitrogen (NO_x) emissions than rich-burn engines.

3.2.3 Emissions

The primary criteria pollutants from natural gas-fired reciprocating engines are oxides of nitrogen (NO_x), carbon monoxide (CO), and volatile organic compounds (VOC). The formation of nitrogen oxides is exponentially related to combustion temperature in the engine cylinder. The other pollutants, CO and VOC species, are primarily the result of incomplete combustion. Particulate matter (PM) emissions include trace amounts of metals, non-combustible inorganic material, and condensible,

semi-volatile organics which result from volatized lubricating oil, engine wear, or from products of incomplete combustion. Sulfur oxides are very low since sulfur compounds are removed from natural gas at processing plants. However, trace amounts of sulfur containing odorant are added to natural gas at city gates prior to distribution for the purpose of leak detection.

It should be emphasized that the actual emissions may vary considerably from the published emission factors due to variations in the engine operating conditions. This variation is due to engines operating at different conditions, including air-to-fuel ratio, ignition timing, torque, speed, ambient temperature, humidity, and other factors. It is not unusual to test emissions from two identical engines in the same plant, operated by the same personnel, using the same fuel, and have the test results show significantly different emissions. This variability in the test data is evidenced in the high relative standard deviation reported in the data set.

3.2.3.1 Nitrogen Oxides -

Nitrogen oxides are formed through three fundamentally different mechanisms. The principal mechanism of NO_x formation with gas-fired engines is thermal NO_x. The thermal NO_x mechanism occurs through the thermal dissociation and subsequent reaction of nitrogen (N_2) and oxygen (O_2) molecules in the combustion air. Most NO_x formed through the thermal NO_x mechanism occurs in high-temperature regions in the cylinder where combustion air has mixed sufficiently with the fuel to produce the peak temperature fuel/air interface. The second mechanism, called prompt NO_x, occurs through early reactions of nitrogen molecules in the combustion air and hydrocarbon radicals from the fuel. Prompt NO_x reactions occur within the flame and are usually negligible compared to the level of NO_x formed through the thermal NO_x mechanism. The third mechanism, fuel NO_x, stems from the evolution and reaction of fuel-bound nitrogen compounds with oxygen. Natural gas has negligible chemically bound fuel nitrogen (although some molecular nitrogen is present).

Essentially all NO_x formed in natural gas-fired reciprocating engines occurs through the thermal NO_x mechanism. The formation of NO_x through the prompt NO_x mechanism may be significant only under highly controlled situations in rich-burn engines when the thermal NO_x mechanism is suppressed. The rate of NO_x formation through the thermal NO_x mechanism is highly dependent upon the stoichiometric ratio, combustion temperature, and residence time at the combustion temperature. Maximum NO_x formation occurs through the thermal NO_x mechanism near the stoichiometric air-to-fuel mixture ratio since combustion temperatures are greatest at this air-to-fuel ratio.

3.2.3.2 Carbon Monoxide and Volatile Organic Compounds -

CO and VOC emissions are both products of incomplete combustion. CO results when there is insufficient residence time at high temperature to complete the final step in hydrocarbon oxidation. In reciprocating engines, CO emissions may indicate early quenching of combustion gases on cylinder walls or valve surfaces. The oxidation of CO to carbon dioxide (CO_2) is a slow reaction compared to most hydrocarbon oxidation reactions.

The pollutants commonly classified as VOC can encompass a wide spectrum of volatile organic compounds that are photoreactive in the atmosphere. VOC occur when some of the gas remains unburned or is only partially burned during the combustion process. With natural gas, some organics are carryover, unreacted, trace constituents of the gas, while others may be pyrolysis products of the heavier hydrocarbon constituents. Partially burned hydrocarbons result from poor air-to-fuel mixing prior to, or during, combustion, or incorrect air-to-fuel ratios in the cylinder during combustion due to maladjustment of the engine fuel system. Also, low cylinder temperature may yield partially burned hydrocarbons due to excessive cooling through the walls, or early cooling of the gases by expansion of the combustion volume caused by piston motion before combustion is completed.

3.2.3.3 Particulate Matter[4] -

PM emissions result from carryover of noncombustible trace constituents in the fuel and lubricating oil and from products of incomplete combustion. Emission of PM from natural gas-fired reciprocating engines are generally minimal and comprise fine filterable and condensible PM. Increased PM emissions may result from poor air-to-fuel mixing or maintenance problems.

3.2.3.4 Carbon Dioxide, Methane, and Nitrous Oxide[5] -

Carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) are referred to as greenhouse gases. Such gases are largely transparent to incoming solar radiation; however, they absorb infrared radiation re-emitted by the Earth. Where available, emission factors for these pollutants are presented in the emission factors tables of this section.

3.2.4 Control Technologies

Three generic control techniques have been developed for reciprocating engines: parametric controls (timing and operating at a leaner air-to-fuel ratio); combustion modifications such as advanced engine design for new sources or major modification to existing sources (clean-burn cylinder head designs and prestratified charge combustion for rich-burn engines); and postcombustion catalytic controls installed on the engine exhaust system. Post-combustion catalytic technologies include selective catalytic reduction (SCR) for lean-burn engines, nonselective catalytic reduction (NSCR) for rich-burn engines, and CO oxidation catalysts for lean-burn engines.

3.2.4.1 Control Techniques for 4-Cycle Rich-burn Engines[4,6] -

Nonselective Catalytic Reduction (NSCR) -

This technique uses the residual hydrocarbons and CO in the rich-burn engine exhaust as a reducing agent for NO_x. In an NSCR, hydrocarbons and CO are oxidized by O_2 and NO_x. The excess hydrocarbons, CO, and NO_x pass over a catalyst (usually a noble metal such as platinum, rhodium, or palladium) that oxidizes the excess hydrocarbons and CO to H_2O and CO_2, while reducing NO_x to N_2. NO_x reduction efficiencies are usually greater than 90 percent, while CO reduction efficiencies are approximately 90 percent.

The NSCR technique is effectively limited to engines with normal exhaust oxygen levels of 4 percent or less. This includes 4-stroke rich-burn naturally aspirated engines and some 4-stroke rich-burn turbocharged engines. Engines operating with NSCR require tight air-to-fuel control to maintain high reduction effectiveness without high hydrocarbon emissions. To achieve effective NO_x reduction performance, the engine may need to be run with a richer fuel adjustment than normal. This exhaust excess oxygen level would probably be closer to 1 percent. Lean-burn engines could not be retrofitted with NSCR control because of the reduced exhaust temperatures.

Prestratified Charge -

Prestratified charge combustion is a retrofit system that is limited to 4-stroke carbureted natural gas engines. In this system, controlled amounts of air are introduced into the intake manifold in a specified sequence and quantity to create a fuel-rich and fuel-lean zone. This stratification provides both a fuel-rich ignition zone and rapid flame cooling in the fuel-lean zone, resulting in reduced formation of NO_x. A prestratified charge kit generally contains new intake manifolds, air hoses, filters, control valves, and a control system.

3.2.4.2 Control Techniques for Lean-burn Reciprocating Engines[4,6] -

Selective Catalytic Reduction[4,6] -

Selective catalytic reduction is a postcombustion technology that has been shown to be effective in reducing NO_x in exhaust from lean-burn engines. An SCR system consists of an ammonia storage, feed, and injection system, and a catalyst and catalyst housing. Selective catalytic reduction systems selectively reduce NO_x emissions by injecting ammonia (either in the form of liquid anhydrous ammonia or aqueous ammonium hydroxide) into the exhaust gas stream upstream of the catalyst. Nitrogen oxides, NH_3, and O_2 react on the surface of the catalyst to form N_2 and H_2O. For the SCR system to operate properly, the exhaust gas must be within a particular temperature range (typically between 450 and 850°F). The temperature range is dictated by the catalyst (typically made from noble metals, base metal oxides such as vanadium and titanium, and zeolite-based material). Exhaust gas temperatures greater than the upper limit (850°F) will pass the NO_x and ammonia unreacted through the catalyst. Ammonia emissions, called NH_3 slip, are a key consideration when specifying a SCR system. SCR is most suitable for lean-burn engines operated at constant loads, and can achieve efficiencies as high as 90 percent. For engines which typically operate at variable loads, such as engines on gas transmission pipelines, an SCR system may not function effectively, causing either periods of ammonia slip or insufficient ammonia to gain the reductions needed.

Catalytic Oxidation -

Catalytic oxidation is a postcombustion technology that has been applied, in limited cases, to oxidize CO in engine exhaust, typically from lean-burn engines. As previously mentioned, lean-burn technologies may cause increased CO emissions. The application of catalytic oxidation has been shown to be effective in reducing CO emissions from lean-burn engines. In a catalytic oxidation system, CO passes over a catalyst, usually a noble metal, which oxidizes the CO to CO_2 at efficiencies of approximately 70 percent for 2SLB engines and 90 percent for 4SLB engines.

3.2.5 Updates Since the Fifth Edition

The Fifth Edition was released in January 1995. Revisions to this section since that date are summarized below. For further detail, consult the memoranda describing each supplement or the background report for this section. These and other documents can be found on the Clearinghouse for Inventories/Emission Factors (CHIEF) electronic bulletin board (919-541-5742), or on the new Emission Factor and Inventory Group (EFIG) home page (http://www.epa.gov/ttn/chief).

Supplement A, February 1996

- In the table for uncontrolled natural gas prime movers, the Source Classification Code (SCC) for 4-cycle lean-burn was changed from 2-01-002-53 to 2-02-002-54. The SCC for 4-cycle rich-burn was changed from 2-02-002-54 to 2-02-02-002-53.

- An SCC (2-02-002-53) was provided for 4-cycle rich-burn engines, and the "less than" symbol (<) was restored to the appropriate factors.

Supplement B, October 1996

- The introduction section was revised.

- Text was added concerning process description of turbines.

- Text concerning emissions and controls was revised.

- References in various tables were editorially corrected.

- The inconsistency between a CO_2 factor in the table and an equation in the footnote was corrected.

Supplement F, July 2000

- Turbines used for natural gas compression were removed from this section and combined with utility turbines in Section 3.1. Section 3.2 now only contains information on natural gas-fired reciprocating engines.

- All emission factors were updated based on emissions data points taken from 70 emission reports containing over 400 source tests. Many new emission factors have been incorporated in this section for speciated organic compounds, including hazardous air pollutants.

TABLE 3.2-1 UNCONTROLLED EMISSION FACTORS FOR 2-STROKE LEAN-BURN ENGINES[a]
(SCC 2-02-002-52)

Pollutant	Emission Factor (lb/MMBtu)[b] (fuel input)	Emission Factor Rating
Criteria Pollutants and Greenhouse Gases		
NO_x[c] 90 - 105% Load	3.17 E+00	A
NO_x[c] <90% Load	1.94 E+00	A
CO[c] 90 - 105% Load	3.86 E-01	A
CO[c] <90% Load	3.53 E-01	A
CO_2[d]	1.10 E+02	A
SO_2[e]	5.88 E-04	A
TOC[f]	1.64 E+00	A
Methane[g]	1.45 E+00	C
VOC[h]	1.20 E-01	C
PM10 (filterable)[i]	3.84 E-02	C
PM2.5 (filterable)[i]	3.84 E-02	C
PM Condensable[j]	9.91 E-03	E
Trace Organic Compounds		
1,1,2,2-Tetrachloroethane[k]	6.63 E-05	C
1,1,2-Trichloroethane[k]	5.27 E-05	C
1,1-Dichloroethane	3.91 E-05	C
1,2,3-Trimethylbenzene	3.54 E-05	D
1,2,4-Trimethylbenzene	1.11 E-04	C
1,2-Dichloroethane	4.22 E-05	D
1,2-Dichloropropane	4.46 E-05	C
1,3,5-Trimethylbenzene	1.80 E-05	D
1,3-Butadiene[k]	8.20 E-04	D
1,3-Dichloropropene[k]	4.38 E-05	C
2,2,4-Trimethylpentane[k]	8.46 E-04	B
2-Methylnaphthalene[k]	2.14 E-05	C
Acenaphthene[k]	1.33 E-06	C

Table 3.2-1. UNCONTROLLED EMISSION FACTORS FOR 2-STROKE LEAN-BURN ENGINES

(Continued)

Pollutant	Emission Factor (lb/MMBtu)[b] (fuel input)	Emission Factor Rating
Acenaphthylene[k]	3.17 E-06	C
Acetaldehyde[k,l]	7.76 E-03	A
Acrolein[k,l]	7.78 E-03	A
Anthracene[k]	7.18 E-07	C
Benz(a)anthracene[k]	3.36 E-07	C
Benzene[k]	1.94 E-03	A
Benzo(a)pyrene[k]	5.68 E-09	D
Benzo(b)fluoranthene[k]	8.51 E-09	D
Benzo(e)pyrene[k]	2.34 E-08	D
Benzo(g,h,i)perylene[k]	2.48 E-08	D
Benzo(k)fluoranthene[k]	4.26 E-09	D
Biphenyl[k]	3.95 E-06	C
Butane	4.75 E-03	C
Butyr/Isobutyraldehyde	4.37 E-04	C
Carbon Tetrachloride[k]	6.07 E-05	C
Chlorobenzene[k]	4.44 E-05	C
Chloroform[k]	4.71 E-05	C
Chrysene[k]	6.72 E-07	C
Cyclohexane	3.08 E-04	C
Cyclopentane	9.47 E-05	C
Ethane	7.09 E-02	A
Ethylbenzene[k]	1.08 E-04	B
Ethylene Dibromide[k]	7.34 E-05	C
Fluoranthene[k]	3.61 E-07	C
Fluorene[k]	1.69 E-06	C
Formaldehyde[k,l]	5.52 E-02	A

Table 3.2-1. UNCONTROLLED EMISSION FACTORS FOR 2-STROKE LEAN-BURN ENGINES (Concluded)

Pollutant	Emission Factor (lb/MMBtu)[b] (fuel input)	Emission Factor Rating
Indeno(1,2,3-c,d)pyrene[k]	9.93 E-09	D
Isobutane	3.75 E-03	C
Methanol[k]	2.48 E-03	A
Methylcyclohexane	3.38 E-04	C
Methylene Chloride[k]	1.47 E-04	C
n-Hexane[k]	4.45 E-04	C
n-Nonane	3.08 E-05	C
n-Octane	7.44 E-05	C
n-Pentane	1.53 E-03	C
Naphthalene[k]	9.63 E-05	C
PAH[k]	1.34 E-04	D
Perylene[k]	4.97 E-09	D
Phenanthrene[k]	3.53 E-06	C
Phenol[k]	4.21 E-05	C
Propane	2.87 E-02	C
Pyrene[k]	5.84 E-07	C
Styrene[k]	5.48 E-05	A
Toluene[k]	9.63 E-04	A
Vinyl Chloride[k]	2.47 E-05	C
Xylene[k]	2.68 E-04	A

[a] Reference 7. Factors represent uncontrolled levels. For NO_x, CO, and PM10, "uncontrolled" means no combustion or add-on controls; however, the factor may include turbocharged units. For all other pollutants, "uncontrolled" means no oxidation control; the data set may include units with control techniques used for NOx control, such as PCC and SCR for lean burn engines, and PSC for rich burn engines. Factors are based on large population of engines. Factors are for engines at all loads, except as indicated. SCC = Source Classification Code. TOC = Total Organic Compounds. PM10 = Particulate Matter ≤ 10 microns (μm) aerodynamic diameter. A "<" sign in front of a factor means that the corresponding emission factor is based on one-half of the method detection limit.

[b] Emission factors were calculated in units of (lb/MMBtu) based on procedures in EPA

Method 19. To convert from (lb/MMBtu) to (lb/10^6 scf), multiply by the heat content of the fuel. If the heat content is not available, use 1020 Btu/scf. To convert from (lb/MMBtu) to (lb/hp-hr) use the following equation:

$$\text{lb/hp-hr} = (\text{lb/MMBtu})\ (\text{heat input, MMBtu/hr})\ (1/\text{operating HP, 1/hp})$$

[c] Emission tests with unreported load conditions were not included in the data set.

[d] Based on 99.5% conversion of the fuel carbon to CO_2. CO_2 [lb/MMBtu] = (3.67)(%CON)(C)(D)(1/h), where %CON = percent conversion of fuel carbon to CO_2, C = carbon content of fuel by weight (0.75), D = density of fuel, 4.1 E+04 lb/10^6 scf, and h = heating value of natural gas (assume 1020 Btu/scf at 60°F).

[e] Based on 100% conversion of fuel sulfur to SO_2. Assumes sulfur content in natural gas of 2,000 gr/10^6 scf.

[f] Emission factor for TOC is based on measured emission levels of 43 tests.

[g] Emission factor for methane is determined by subtracting the VOC and ethane emission factors from the TOC emission factor. Measured emission factor for methane compares well with the calculated emission factor, 1.48 lb/MMBtu vs. 1.45 lb/MMBtu, respectively.

[h] VOC emission factor is based on the sum of the emission factors for all speciated organic compounds less ethane and methane.

[i] Considered $\leq 1\ \mu$m in aerodynamic diameter. Therefore, for filterable PM emissions, PM10(filterable) = PM2.5(filterable).

[j] No data were available for condensable PM emissions. The presented emission factor reflects emissions from 4SLB engines.

[k] Hazardous Air Pollutant as defined by Section 112(b) of the Clean Air Act.

[l] For lean burn engines, aldehyde emissions quantification using CARB 430 may reflect interference with the sampling compounds due to the nitrogen concentration in the stack. The presented emission factor is based on FTIR measurements. Emissions data based on CARB 430 are available in the background report.

Table 3.2-2. UNCONTROLLED EMISSION FACTORS FOR 4-STROKE LEAN-BURN ENGINES[a]
(SCC 2-02-002-54)

Pollutant	Emission Factor (lb/MMBtu)[b] (fuel input)	Emission Factor Rating
Criteria Pollutants and Greenhouse Gases		
NO_x[c] 90 - 105% Load	4.08 E+00	B
NO_x[c] <90% Load	8.47 E-01	B
CO[c] 90 - 105% Load	3.17 E-01	C
CO[c] <90% Load	5.57 E-01	B
CO_2[d]	1.10 E+02	A
SO_2[e]	5.88 E-04	A
TOC[f]	1.47 E+00	A
Methane[g]	1.25 E+00	C
VOC[h]	1.18 E-01	C
PM10 (filterable)[i]	7.71 E-05	D
PM2.5 (filterable)[i]	7.71 E-05	D
PM Condensable[j]	9.91 E-03	D
Trace Organic Compounds		
1,1,2,2-Tetrachloroethane[k]	<4.00 E-05	E
1,1,2-Trichloroethane[k]	<3.18 E-05	E
1,1-Dichloroethane	<2.36 E-05	E
1,2,3-Trimethylbenzene	2.30 E-05	D
1,2,4-Trimethylbenzene	1.43 E-05	C
1,2-Dichloroethane	<2.36 E-05	E
1,2-Dichloropropane	<2.69 E-05	E
1,3,5-Trimethylbenzene	3.38 E-05	D
1,3-Butadiene[k]	2.67E-04	D
1,3-Dichloropropene[k]	<2.64 E-05	E
2-Methylnaphthalene[k]	3.32 E-05	C
2,2,4-Trimethylpentane[k]	2.50 E-04	C
Acenaphthene[k]	1.25 E-06	C

Table 3.2-2. UNCONTROLLED EMISSION FACTORS FOR 4-STROKE LEAN-BURN ENGINES (Continued)

Pollutant	Emission Factor (lb/MMBtu)[b] (fuel input)	Emission Factor Rating
Acenaphthylene[k]	5.53 E-06	C
Acetaldehyde[k,l]	8.36 E-03	A
Acrolein[k,l]	5.14 E-03	A
Benzene[k]	4.40 E-04	A
Benzo(b)fluoranthene[k]	1.66 E-07	D
Benzo(e)pyrene[k]	4.15 E-07	D
Benzo(g,h,i)perylene[k]	4.14 E-07	D
Biphenyl[k]	2.12 E-04	D
Butane	5.41 E-04	D
Butyr/Isobutyraldehyde	1.01 E-04	C
Carbon Tetrachloride[k]	<3.67 E-05	E
Chlorobenzene[k]	<3.04 E-05	E
Chloroethane	1.87 E-06	D
Chloroform[k]	<2.85 E-05	E
Chrysene[k]	6.93 E-07	C
Cyclopentane	2.27 E-04	C
Ethane	1.05 E-01	C
Ethylbenzene[k]	3.97 E-05	B
Ethylene Dibromide[k]	<4.43 E-05	E
Fluoranthene[k]	1.11 E-06	C
Fluorene[k]	5.67 E-06	C
Formaldehyde[k,l]	5.28 E-02	A
Methanol[k]	2.50 E-03	B
Methylcyclohexane	1.23 E-03	C
Methylene Chloride[k]	2.00 E-05	C
n-Hexane[k]	1.11 E-03	C
n-Nonane	1.10 E-04	C

Table 3.2-2. UNCONTROLLED EMISSION FACTORS FOR 4-STROKE LEAN-BURN ENGINES
(Continued)

Pollutant	Emission Factor (lb/MMBtu)[b] (fuel input)	Emission Factor Rating
n-Octane	3.51 E-04	C
n-Pentane	2.60 E-03	C
Naphthalene[k]	7.44 E-05	C
PAH[k]	2.69 E-05	D
Phenanthrene[k]	1.04 E-05	D
Phenol[k]	2.40 E-05	D
Propane	4.19 E-02	C
Pyrene[k]	1.36 E-06	C
Styrene[k]	<2.36 E-05	E
Tetrachloroethane[k]	2.48 E-06	D
Toluene[k]	4.08 E-04	B
Vinyl Chloride[k]	1.49 E-05	C
Xylene[k]	1.84 E-04	B

[a] Reference 7. Factors represent uncontrolled levels. For NO_x, CO, and PM10, "uncontrolled" means no combustion or add-on controls; however, the factor may include turbocharged units. For all other pollutants, "uncontrolled" means no oxidation control; the data set may include units with control techniques used for NOx control, such as PCC and SCR for lean burn engines, and PSC for rich burn engines. Factors are based on large population of engines. Factors are for engines at all loads, except as indicated. SCC = Source Classification Code. TOC = Total Organic Compounds. PM-10 = Particulate Matter ≤ 10 microns (μm) aerodynamic diameter. A "<" sign in front of a factor means that the corresponding emission factor is based on one-half of the method detection limit.

[b] Emission factors were calculated in units of (lb/MMBtu) based on procedures in EPA Method 19. To convert from (lb/MMBtu) to (lb/10^6 scf), multiply by the heat content of the fuel. If the heat content is not available, use 1020 Btu/scf. To convert from (lb/MMBtu) to (lb/hp-hr) use the following equation:

$$\text{lb/hp-hr} = (\text{lb/MMBtu})\ (\text{heat input, MMBtu/hr})\ (1/\text{operating HP, 1/hp})$$

[c] Emission tests with unreported load conditions were not included in the data set.

[d] Based on 99.5% conversion of the fuel carbon to CO_2. CO_2 [lb/MMBtu] = (3.67)(%CON)(C)(D)(1/h), where %CON = percent conversion of fuel carbon to CO_2, C = carbon content of fuel by weight (0.75), D = density of fuel, 4.1 E+04 lb/10^6 scf, and

h = heating value of natural gas (assume 1020 Btu/scf at 60°F).

[e] Based on 100% conversion of fuel sulfur to SO_2. Assumes sulfur content in natural gas of 2,000 gr/10^6scf.

[f] Emission factor for TOC is based on measured emission levels from 22 source tests.

[g] Emission factor for methane is determined by subtracting the VOC and ethane emission factors from the TOC emission factor. Measured emission factor for methane compares well with the calculated emission factor, 1.31 lb/MMBtu vs. 1.25 lb/MMBtu, respectively.

[h] VOC emission factor is based on the sum of the emission factors for all speciated organic compounds less ethane and methane.

[i] Considered ≤ 1 μm in aerodynamic diameter. Therefore, for filterable PM emissions, PM10(filterable) = PM2.5(filterable).

[j] PM Condensable = PM Condensable Inorganic + PM-Condensable Organic

[k] Hazardous Air Pollutant as defined by Section 112(b) of the Clean Air Act.

[l] For lean burn engines, aldehyde emissions quantification using CARB 430 may reflect interference with the sampling compounds due to the nitrogen concentration in the stack. The presented emission factor is based on FTIR measurements. Emissions data based on CARB 430 are available in the background report.

Table 3.2-3. UNCONTROLLED EMISSION FACTORS FOR 4-STROKE RICH-BURN ENGINES[a]
(SCC 2-02-002-53)

Pollutant	Emission Factor (lb/MMBtu)[b] (fuel input)	Emission Factor Rating
Criteria Pollutants and Greenhouse Gases		
NO_x[c] 90 - 105% Load	2.21 E+00	A
NO_x[c] <90% Load	2.27 E+00	C
CO[c] 90 - 105% Load	3.72 E+00	A
CO[c] <90% Load	3.51 E+00	C
CO_2[d]	1.10 E+02	A
SO_2[e]	5.88 E-04	A
TOC[f]	3.58 E-01	C
Methane[g]	2.30 E-01	C
VOC[h]	2.96 E-02	C
PM10 (filterable)[i,j]	9.50 E-03	E
PM2.5 (filterable)[j]	9.50 E-03	E
PM Condensable[k]	9.91 E-03	E
Trace Organic Compounds		
1,1,2,2-Tetrachloroethane[l]	2.53 E-05	C
1,1,2-Trichloroethane[l]	<1.53 E-05	E
1,1-Dichloroethane	<1.13 E-05	E
1,2-Dichloroethane	<1.13 E-05	E
1,2-Dichloropropane	<1.30 E-05	E
1,3-Butadiene[l]	6.63 E-04	D
1,3-Dichloropropene[l]	<1.27 E-05	E
Acetaldehyde[l,m]	2.79 E-03	C
Acrolein[l,m]	2.63 E-03	C
Benzene[l]	1.58 E-03	B
Butyr/isobutyraldehyde	4.86 E-05	D
Carbon Tetrachloride[l]	<1.77 E-05	E

Table 3.2-3. UNCONTROLLED EMISSION FACTORS FOR 4-STROKE RICH-BURN ENGINES (Concluded)

Pollutant	Emission Factor (lb/MMBtu)[b] (fuel input)	Emission Factor Rating
Chlorobenzene[l]	<1.29 E-05	E
Chloroform[l]	<1.37 E-05	E
Ethane[n]	7.04 E-02	C
Ethylbenzene[l]	<2.48 E-05	E
Ethylene Dibromide[l]	<2.13 E-05	E
Formaldehyde[l,m]	2.05 E-02	A
Methanol[l]	3.06 E-03	D
Methylene Chloride[l]	4.12 E-05	C
Naphthalene[l]	<9.71 E-05	E
PAH[l]	1.41 E-04	D
Styrene[l]	<1.19 E-05	E
Toluene[l]	5.58 E-04	A
Vinyl Chloride[l]	<7.18 E-06	E
Xylene[l]	1.95 E-04	A

[a] Reference 7. Factors represent uncontrolled levels. For NO_x, CO, and PM-10, "uncontrolled" means no combustion or add-on controls; however, the factor may include turbocharged units. For all other pollutants, "uncontrolled" means no oxidation control; the data set may include units with control techniques used for NOx control, such as PCC and SCR for lean burn engines, and PSC for rich burn engines. Factors are based on large population of engines. Factors are for engines at all loads, except as indicated. SCC = Source Classification Code. TOC = Total Organic Compounds. PM10 = Particulate Matter ≤ 10 microns (μm) aerodynamic diameter. A "<" sign in front of a factor means that the corresponding emission factor is based on one-half of the method detection limit.

[b] Emission factors were calculated in units of (lb/MMBtu) based on procedures in EPA Method 19. To convert from (lb/MMBtu) to (lb/10^6 scf), multiply by the heat content of the fuel. If the heat content is not available, use 1020 Btu/scf. To convert from (lb/MMBtu) to (lb/hp-hr) use the following equation:

$$\text{lb/hp-hr} = (\text{lb/MMBtu})(\text{heat input, MMBtu/hr})(1/\text{operating HP, 1/hp})$$

[c] Emission tests with unreported load conditions were not included in the data set.

[d] Based on 99.5% conversion of the fuel carbon to CO_2. CO_2 [lb/MMBtu] = (3.67)(%CON)(C)(D)(1/h), where %CON = percent conversion of fuel carbon to CO_2,

C = carbon content of fuel by weight (0.75), D = density of fuel, 4.1 E+04 lb/10^6 scf, and h = heating value of natural gas (assume 1020 Btu/scf at 60°F).

[e] Based on 100% conversion of fuel sulfur to SO_2. Assumes sulfur content in natural gas of 2,000 gr/10^6scf.

[f] Emission factor for TOC is based on measured emission levels from 6 source tests.

[g] Emission factor for methane is determined by subtracting the VOC and ethane emission factors from the TOC emission factor.

[h] VOC emission factor is based on the sum of the emission factors for all speciated organic compounds. Methane and ethane emissions were not measured for this engine category.

[i] No data were available for uncontrolled engines. PM10 emissions are for engines equipped with a PCC.

[j] Considered ≤ 1 μm in aerodynamic diameter. Therefore, for filterable PM emissions, PM10(filterable) = PM2.5(filterable).

[k] No data were available for condensable emissions. The presented emission factor reflects emissions from 4SLB engines.

[l] Hazardous Air Pollutant as defined by Section 112(b) of the Clean Air Act.

[m] For rich-burn engines, no interference is suspected in quantifying aldehyde emissions. The presented emission factors are based on FTIR and CARB 430 emissions data measurements.

[n] Ethane emission factor is determined by subtracting the VOC emission factor from the NMHC emission factor.

References For Section 3.2

1. *Engines, Turbines, And Compressors Directory*, American Gas Association, Catalog #XF0488.

2. *Standards Support And Environmental Impact Statement, Volume I: Stationary Internal Combustion Engines*, EPA-450/2-78-125a, U. S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC, July 1979.

3. *Alternative Control Techniques Document - NO_x Emissions From Stationary Reciprocating Engines*, EPA-453/R-93-032, July 1993.

4. *Handbook - Control Technologies For Hazardous Air Pollutants*, EPA-625/6-91-014, June 1991.

5. *Limiting Net Greenhouse Gas Emissions In The United States, Volume II: Energy Responses,* Report for the Office of Environmental Analysis, Office of Policy, Planning and Analysis, Department of Energy (DOE), DOE/PE-0101 Volume II, September 1991.

6. C. Castaldini, *NO_x Reduction Technologies For Natural Gas Industry Prime Movers*, GRI-90/0215, Gas Research Institute, Chicago, IL, August 1990.

7. *Emission Factor Documentation for AP-42 Section 3.2, Natural Gas-Fired Reciprocating Engines*, EPA Contract No. 68-D2-0160, Alpha-Gamma Technologies, Inc., Raleigh, North Carolina, July 2000.

	UNITED STATES ENVIRONMENTAL PROTECTION AGENCY **2019 MODEL YEAR** **CERTIFICATE OF CONFORMITY** **WITH THE CLEAN AIR ACT**	**OFFICE OF TRANSPORTATION** **AND AIR QUALITY** **ANN ARBOR, MICHIGAN 48105**

Certificate Issued To: Cummins Inc. (U.S. Manufacturer or Importer) **Certificate Number: KCEXB60.0AAB-010**	**Effective Date:** **12/18/2018** **Expiration Date:** **12/31/2019**	**Byron J. Bunker, Division Director** **Compliance Division**	**Issue Date:** **12/18/2018** **Revision Date:** **N/A**

Manufacturer: Cummins Inc.
Engine Family: KCEXB60.0AAB
Mobile/Stationary Certification Type: Mobile and Stationary
Fuel : Natural Gas (CNG/LNG)
Emission Standards :
Part 60 Subpart JJJJ Table 1
CO (g/Hp-hr) : 2.0
NOx (g/Hp-hr) : 1.0
VOC (g/Hp-hr) : 0.7
Mobile Part 1048
CO (g/kW-hr) : 4.4
NMHC + NOx (g/kW-hr) : 2.7
Emergency Use Only : N

Pursuant to Section 213 of the Clean Air Act (42 U.S.C. section 7547) and 40 CFR Part 60, 40 CFR Part 1048, 1065, 1068, and 60 (stationary only and combined stationary and mobile) and subject to the terms and conditions prescribed in those provisions, this certificate of conformity is hereby issued with respect to the test engines which have been found to conform to applicable requirements and which represent the following nonroad engines, by engine family, more fully described in the documentation required by 40 CFR Part 60, 40 CFR Part 1048 and produced in the stated model year.

This certificate of conformity covers only those new nonroad spark-ignition engines which conform in all material respects to the design specifications that applied to those engines described in the documentation required by 40 CFR Part 60, 40 CFR Part 1048 and which are produced during the model year stated on this certificate of the said manufacturer, as defined in 40 CFR Part 60, 40 CFR Part 1048. This certificate of conformity does not cover nonroad engines imported prior to the effective date of the certificate.

It is a term of this certificate that the manufacturer shall consent to all inspections described in 40 CFR 1068.20 and authorized in a warrant or court order. Failure to comply with the requirements of such a warrant or court order may lead to revocation or suspension of this certificate for reasons specified in 40 CFR Part 60, 40 CFR Part 1048. It is also a term of this certificate that this certificate may be revoked or suspended or rendered void *ab initio* for other reasons specified in 40 CFR Part 60, 40 CFR Part 1048.

This certificate does not cover large nonroad engines sold, offered for sale, or introduced, or delivered for introduction, into commerce in the U.S. prior to the effective date of the certificate.

Generator Set Data Sheet
1000 kW Standby Power

Model:	**C1000N6**
Frequency:	**60 Hz**
Fuel Type:	**Pipeline Natural Gas**
Emissions NOx:	**EPA NSPS & Non-Road Mobile Factory Certified**
LT water inlet temp:	**50°C (122°F)**
HT water outlet temp:	**90°C (194°F)**

Measured sound performance data sheet:	**MSP-1089**
Prototype test summary data:	**PTS-640**
Remote radiator cooling outline:	**0500-5090**

Fuel Consumption (ISO3046/1)

	See Note	100% of Rated Load	90% of Rated Load	75% of Rated Load	50% of Rated Load
Fuel Consumption (LHV) ISO3046/1, kW (MMBTU/hr)	2,3,5	2885 (9.85)	2630 (8.98)	2248 (7.68)	Below Minimum
Electrical Efficiency ISO3046/1, percent	2,5,10	36.4%	35.9%	35.0%	Tested
Thermal Efficiency ISO3046/1, percent	2,5,17	52.4%	52.6%	53.0%	Power

Engine

Engine Manufacturer	Cummins
Engine Model	QSK60G
Configuration	V16
Displacement, L (cu.in)	60 (3672)
Aspiration	Turbocharged and Charge Air Aftercooled
Gross Engine Power Output, kWm (hp)	1082 (1451)
BMEP, bar (psi)	12.3 (178)
Bore, mm (in)	159 (6.25)
Stroke, mm (in)	190 (7.48)
Rated Speed, rpm	1800
Piston Speed, m/s (ft/min)	11.4 (2244)
Compression Ratio	11.4:1
Lube Oil Capacity, L (qt)	379 (400)
Full Load Lubricating oil consumption, g/kWe-hr (g/hp-hr)	0.15 (0.11)

Fuel

Gas supply pressure to FSOV inlet, bar (psi)[18]	0.2 - 0.46 (2.9 - 6.7)
Minimum Methane Index	55

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Starting System(s)

Electric Starter Voltage, volts	24
Minimum Battery Capacity @ 40°C (104°F), AH	450

Genset dimensions (see Note 1)

Genset Length, m (ft)	5.00 (16.40)
Genset Width, m (ft)	2.33 (7.64)
Genset Height, m (ft)	2.97 (9.74)
Genset Weight (wet), kg (lbs)	13924 (30697)

Energy data	See Notes	100% of Rated Load	90% of Rated Load	75% of Rated Load	50% of Rated Load
Continuous Generator Electrical Output kWe @ 1.0 pf	2,5,10	1050	945	787.5	Below Minimum Tested Power
Total Heat Rejected in LT Circuit, kW (MMBTU/h)	14	85 (0.29)	80 (0.27)	73 (0.25)	- -
Total Heat Rejected in HT Circuit, kW (MMBTU/h)	14	719 (2.45)	653 (2.23)	556 (1.90)	- -
Unburnt, kW (MMBTU/h)	14	93 (0.32)	86 (0.29)	75 (0.25)	- -
Heat Radiated to Ambient, kW (MMBTU/h)	14	126 (0.43)	115 (0.39)	97 (0.33)	- -
Available Exhaust heat to 120°C, kW (MMBTU/h)	14	795 (2.71)	731 (2.49)	635 (2.17)	- -

Intake air flow

Intake Air Flow Mass, kg/s (lb/hr)	14	1.83 (14513)	1.67 (13241)	1.43 (11345)	- -
Intake Air Flow Volume, m³/s @ 0°C (scfm)	14	1.41 (3150)	1.29 (2880)	1.11 (2480)	- -
Maximum Air Cleaner Restriction, mmHG (in H_2O)	19	18.3 (9.8)	18.3 (9.8)	18.3 (9.8)	- -

Exhaust air flow

Exhaust Gas Flow Mass, kg/s (lb/hr)	14	1.89 (15038)	1.73 (13721)	1.48 (11759)	- -
Exhaust Gas Flow Volume, m³/s (cfm)	14	4.15 (8790)	3.82 (8090)	3.32 (7030)	' -
Exhaust Temperature After Turbine, ºC (ºF)	4	500 (932)	507 (945)	518 (964)	- -
Max Exhaust System Back Pressure, mmHG (in H_2O)	12	37.3 (20.0)	37.3 (20.0)	37.3 (20.0)	- -
Min Exhaust System Back Pressure, mmHG (in H_2O)	12	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	- -

HT cooling circuit

HT Circuit Engine Coolant Volume, L (gal)		182 (48)	182 (48)	182 (48)	- -
HT Coolant Flow @ Max Ext Restriction, m³/h (gal/min)	13,15	83 (365)	83 (365)	83 (365)	- -
Maximum HT Engine Coolant Inlet Temp, ºC (ºF)	6	81 (179)	82 (180)	83 (182)	- -
HT Coolant Outlet Temp, ºC (ºF)	6	90 (194)	90 (194)	90 (194)	- -
Max Pressure Drop in External HT Circuit, bar (psig)	15	1.5 (21.8)	1.5 (21.8)	1.5 (21.8)	- -
HT Circuit Maximum Pressure, bar (psig)		4.5 (65)	4.5 (65)	4.5 (65)	- -
Minimum Static Head - Pump Inlet, bar (psig)		0.5 (7)	0.5 (7)	0.5 (7)	- -

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LT Cooling Circuit	See Notes	100% of Rated Load	90% of Rated Load	75% of Rated Load	50% of Rated Load
LT Circuit Engine Coolant Volume, L (gal)		34 (9)	34 (9)	34 (9)	- -
LT Coolant Flow @ Max Ext Restriction, m³/h (gal/min)	13,15	23 (101)	23 (101)	23 (101)	- -
Maximum LT Engine Coolant Inlet Temp, ºC (ºF)	7	50 (122)	50 (32)	50 (32)	- -
Nominal LT Coolant Outlet Temp, ºC (ºF)	7	54 (129)	54 (32)	54 (32)	- -
Max Pressure Drop in External LT Circuit, bar (psig)	15	1.0 (14.5)	1.0 (14.5)	1.0 (14.5)	- -
LT Circuit Maximum Pressure, bar (psig)		4.5 (65)	4.5 (65)	4.5 (65)	- -
Minimum Static Head - Pump Inlet, bar (psig)		0.5 (7)	0.5 (7)	0.5 (7)	- -

Emissions

NO_x Emissions dry, ppm		**This rating is EPA NSPS Certified. Please refer to EPA emissions datasheet for regulation limits.**
NO_x Emissions, mg/Nm³ @5% O_2 (g/hp-h)		
THC Emissions wet, ppm	11	
THC Emissions, mg/Nm³ @5% O_2 (g/hp-h)	11	
CO Emissions dry, ppm	14	
CO Emissions, mg/Nm³ @5% O_2 (g/hp-h)	14	
CO_2 Emissions dry, percent	14	
CO_2 Emissions, mg/Nm³ @5% O_2 (g/hp-h)	14	
O_2 Emissions dry, percent	14	
Particulates PM_{10}, g/hp-h	14	

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Genset De-rating

Altitude and Temperature Derate Multiplication Factor - On Grid, Soft Start

Barometer		Altitude		Table A								
In Hg	mbar	Feet	Meters	Derate Multiplier								
20.7	701	9843	3000	0.90	0.89	0.87	0.85	0.83	0.80	0.76	0.72	0.69
21.4	723	9022	2750	0.94	0.93	0.91	0.89	0.88	0.84	0.80	0.77	0.73
22.1	747	8202	2500	0.99	0.97	0.95	0.93	0.92	0.88	0.84	0.81	0.77
22.8	771	7382	2250	1.00	1.00	0.99	0.98	0.96	0.92	0.88	0.85	0.81
23.5	795	6562	2000	1.00	1.00	1.00	1.00	1.00	0.96	0.93	0.89	0.85
24.3	820	5741	1750	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.93	0.89
25.0	846	4921	1500	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.94
25.8	872	4101	1250	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98
26.6	899	3281	1000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
27.4	926	2461	750	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
28.3	954	1640	500	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
29.1	983	820	250	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
29.5	995	492	150	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
30.0	1012	0	0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
			°C	20	25	30	35	40	45	50	55	60
			°F	68	77	86	95	104	113	122	131	140
			Air Filter Inlet Temperature									

Altitude and Temperature Derate Multiplication Factor - Off Grid

Barometer		Altitude		Table A								
In Hg	mbar	Feet	Meters	Derate Multiplier								
20.7	701	9843	3000	0.88	0.86	0.85	0.83	0.81	0.77	0.73	0.68	-
21.4	723	9022	2750	0.92	0.91	0.89	0.87	0.85	0.81	0.77	0.72	0.68
22.1	747	8202	2500	0.96	0.95	0.93	0.91	0.89	0.85	0.81	0.77	0.72
22.8	771	7382	2250	1.00	0.99	0.97	0.95	0.94	0.89	0.85	0.81	0.77
23.5	795	6562	2000	1.00	1.00	1.00	0.99	0.98	0.93	0.89	0.85	0.81
24.3	820	5741	1750	1.00	1.00	1.00	1.00	1.00	0.98	0.93	0.89	0.85
25.0	846	4921	1500	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.93	0.89
25.8	872	4101	1250	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.93
26.6	899	3281	1000	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97
27.4	926	2461	750	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
28.3	954	1640	500	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
29.1	983	820	250	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
29.5	995	492	150	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
30.0	1012	0	0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
			°C	20	25	30	35	40	45	50	55	60
			°F	68	77	86	95	104	113	122	131	140
			Air Filter Inlet Temperature									

Temperature & altitude derate

1. Determine derate multiplier vs. temperature and altitude in Table A.
2. Assumes the LT return temperature is 10 °C above the air filter inlet with a maximum LT temperature of 50 °C.
3. If the LT temperature exceeds 50°C, consult factory for recommendations.
4. Altitude is based upon SAE standard ambient pressure vs. altitude. For low barometric conditions add 150 m (500 ft) to site altitude.

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Genset De-rating

Heat Rejection Factor (altitude and ambient) for HT and LT Circuits

Barometer		Altitude		Table B								
In Hg	mbar	Feet	Meters	Multiplier for HT & LT (1/4) Heat Rejection vs Alt & Temp.								
20.7	701	9843	3000	1.11	1.13	1.14	1.15	1.17	1.18	1.19	1.20	1.22
21.4	723	9022	2750	1.10	1.12	1.13	1.14	1.15	1.17	1.18	1.19	1.21
22.1	747	8202	2500	1.09	1.10	1.12	1.13	1.14	1.16	1.17	1.18	1.20
22.8	771	7382	2250	1.08	1.09	1.11	1.12	1.13	1.14	1.16	1.17	1.18
23.5	795	6562	2000	1.07	1.08	1.09	1.11	1.12	1.13	1.15	1.16	1.17
24.3	820	5741	1750	1.06	1.07	1.08	1.10	1.11	1.12	1.14	1.15	1.16
25.0	846	4921	1500	1.05	1.06	1.07	1.09	1.10	1.11	1.12	1.14	1.15
25.8	872	4101	1250	1.04	1.05	1.06	1.07	1.09	1.10	1.11	1.13	1.14
26.6	899	3281	1000	1.02	1.04	1.05	1.06	1.08	1.09	1.10	1.12	1.13
27.4	926	2461	750	1.01	1.03	1.04	1.05	1.07	1.08	1.09	1.10	1.12
28.3	954	1640	500	1.00	1.02	1.03	1.04	1.05	1.07	1.08	1.09	1.11
29.1	983	820	250	0.99	1.00	1.02	1.03	1.04	1.06	1.07	1.08	1.10
29.5	995	492	150	0.99	1.00	1.01	1.03	1.04	1.05	1.06	1.08	1.09
30.0	1012	0	0	0.98	0.99	1.01	1.02	1.03	1.05	1.06	1.07	1.08
			°C	20	25	30	35	40	45	50	55	60
			°F	68	77	86	95	104	113	122	131	140
			Air Filter Inlet Temperature									

LT & HT Circuit Heat Rejection Calculation

1. Determine derate multiplier vs. temperature and altitude in Table A.
2. Using the multiplier from #1 above as the percent load factor determine the heat rejection from the previous page.
3. From Table B find the LT circuit multiplier. *The HT circuit multiplier is 1/4 of the multiplier shown in the table e.g. if the table says 1.04, the actual factor for HT is 1.01.
4. Multiply the result of step 2 by the result of step 3 to obtain the heat rejection at your altitude and temperature.

Methane Index Derate Multiplication Factor*

Table C

Derate Mutiplier

LT Inlet Temp		Derate Factor			
°F	°C	**1.00**	**0.90**	**0.75**	**0.50**
122	50	55	52	48	-
131	55	59	56	52	-
140	60	63	60	56	-
149	65	67	64	60	-
158	70	71	68	64	-

Methane Index Derate

1. Determine derate multiplier vs. Methane Number in Table C based on MN given your gas analysis input into the Cummins Gas Analysis Tool.
2. Using the multiplier from #1 above as the percent load factor determine the max load in kW using the nominal max rated load.

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Alternator Data

Voltage Range	Connection Configuration	Temp Rise Degrees C	Duty[9] Cycle	Winding No.	Alternator Data Sheet
380-480	Wye, 3 Phase	80	S	N/A	See Note 16
600	Wye, 3 Phase	80	S	N/A	See Note 16
4160	Wye, 3 Phase	80	S	N/A	See Note 16
12470-13800	Wye, 3 Phase	80	S	N/A	See Note 16
4160	Wye, 3 Phase	105	S	N/A	See Note 16
380-416	Wye, 3 Phase	125	S	N/A	See Note 16
440-480	Wye, 3 Phase	125	S	N/A	See Note 16

Emergency Standby Power (ESP) Rating Defintion

Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528.

Note:

1) Weights and set dimensions represent a generator set with its standard features only. See outline drawing for other configurations.

2) At ISO3046 reference conditions, altitude 1013 mbar (30in Hg), air inlet temperature 25°C (77°F)

3) According to ISO 3046/I with fuel consumption tolerance of +5%, -0%

4) With air intake at 25°C (77°F). Tolerance ± 10°C.

5) Tested using pipeline natural gas with LHV of 35.64MJ/Nm3 (905BTU/scf).

6) Outlet temperature controlled by thermostat. Inlet temperature for reference only. Data taken with 50% Glycol and with outlet temperature at max allowance.

7) Inlet temperature controlled by thermostat, outlet temperature for reference only. Data taken with 50% Glycol.

8) Without engine driven coolant pumps

9) Standby (S), Prime (P), Continuous (C)

10) At electrical output of 1.0 Power Factor, 97% Alternator Efficiency

11) Tolerance ±15%. Values shown are measured using fuel with less than 1% NMHC by volume. Values can vary significantly depending on NMHC found in the fuel.

12) Exhaust system back pressure is at rated load and will decrease at lower loads. Minimum restriction/back pressure is 0 mm H_2O.

13) Flow including off engine thermostats.

14) Tolerance +/- 10%

15) Pressure drop external to genset.

16) Alternator model and data sheet information available on www.powersuite.cummins.com

17) Exhaust gas cooled to 120 °C.

18) Fuel pressure capability will vary depending on fuel quality and site conditions.

19) Maximum Air Cleaner Restriction based on intake air temperature below 35 °C. If intake air temperature rises above 35 °C, contact Application Engineering for guidance.

For more information contact your local Cummins distributor or visit power.cummins.com

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2020 EPA Exhaust Emission Compliance Statement
C1000 N6
60 Hz Spark Ignited Generator Set

Compliance Information:

The engine used in this generator set meets U.S. EPA emission limits under 40 CFR Part 60 and 1048 (Stationary and Mobile).

Engine Manufacturer:	Cummins Inc.
EPA Certificate Number:	LCEXB60.0AAB-009
Effective Date:	10/31/2019
Date Issued:	10/31/2019
EPA Engine Family (Cummins Emissions Family):	LCEXB60.0AAB

Engine Information:

Model:	QSK60G/GQSK60-G8	Bore:	6.26 in. (159 mm)
Engine Nameplate HP:	1953	Stroke:	7.48 in. (190 mm)
Type:	4 Cycle, Vee, 16 Cylinder, Lean Burn Natural Gas	Displacement:	3671.0 cu. in. (60 liters)
Aspiration:	Turbocharged and Aftercooled	Compression Ratio:	11.4:1
Emission Control Device:	Turbocharged and Aftercooled	Exhaust Stack Diameter:	8.0 in (203 mm)

U.S. Environmental Protection Agency SI Emission Limits

Lean Burn Gas: Non-Road 1048	**Grams per BHP-hr**		**Grams per kW_m-hr**	
	NOx+NMHC	**CO**	**NOx+NMHC**	**CO**
Test Results	0.8	2.0	1.1	2.7
EPA Emissions Limit	2.0	3.3	2.7	4.4

Lean Burn Gas: Stationary Part 60	**Grams per BHP-hr**			**Grams per kWm-hr**		
	NOx	**CO**	**VOC**	**NOx**	**CO**	**VOC**
Test Results	0.8	2.0	0.1	1.1	2.7	0.1
EPA Emissions Limit	1.0	2.0	0.7	1.3	2.7	0.9

Notes:

Tests conducted using alternate methods, instrumentation, fuel or reference conditions can yield different results.

Engine operation with excessive air intake or exhaust restriction beyond published maximum limits, or with improper maintenance, may result in elevated emission levels.

FLARE

Administrative Information

One original and one copy of All Application Forms Should Be Mailed To:
Division of Air Quality
100 West Water Street, Suite 6A
Dover, DE 19904

All Checks Should Be Made Payable To:
State of Delaware

Company and Site Information

1.	Company Name: **Bioenergy Devco**
2.	Company Mailing Address: **50 State Circle** City: **Annapolis** State: **Maryland** Zip Code: **21401**
3.	Site Name: **Bioenergy Innovation Center**
4.	Site Mailing Address: **28338 Enviro Way** *(if different from above)* City: **Seaford** State: **Delaware** Zip Code: **19973**
5.	Physical Location of Site: **28338 Enviro Way** *(if different from above)* City: **Seaford** State: **Delaware** Zip Code: **19973**
6.	Site Billing Address: **50 State Circle** *(if different from above)* City: **Annapolis** State: **Maryland** Zip Code: **21401**
7.	Air Quality Management Facility ID Number: **1000500281**
8.	Site NAICS Code): **221210, 325314** *(list all that apply*
9.	Site SIC Code: **4925, 2875** *(list all that apply)*
10.	Site Location Coordinates: Latitude: 38 ° 36’ 12” Longitude: -75 ° 36’ 16”
11.	Is the Facility New or Existing? ☐ NEW ☒ EXISTING
If the Facility is an Existing Facility, Complete the Rest of Question 11. If Not, Proceed to Question 12.	
11.1.	Does the Facility Have Active Air Permits? ☒ YES ☐ NO
12.	Is this Application For New Equipment or a Modification to Existing Equipment? ☒ New Equipment ☐ Modification of Existing Equipment ☐ Other (Specify):
If the application is for the modification of existing equipment, complete the rest of Question 12. If not, proceed to Question 13.	

Company and Site Information

12.1.	Does the Equipment Have an Active Air Permit? ☐ YES ☐ NO
If the equipment has an active air permit, complete the rest of Question 12. If not, proceed to Question 13.	
12.2.	Permit Number of Existing Equipment:
13.	Status of Equipment Being Applied For: ☒ Natural Minor Source ☐ Synthetic Minor Source ☐ Major Source ☐ Federally Enforceable Restrictions
14.	Facility Status: ☒ Natural Minor Facility ☐ Synthetic Minor Facility ☐ Major Facility
If the facility is a Major Source, complete the rest of Question 14. If not, proceed to Question 15.	
14.1.	Responsible Official Name:
14.2.	Responsible Official Title:

Contact Information

15.	Name of Owner or Facility Manager: **Jeff Deats**
16.	Title of Owner or Facility Manager: **Facility Manager**
17.	Permit Contact Name: **Christine McKiernan**
18.	Permit Contact Title: **Managing Director Engineering & Construction**
19.	Permit Contact Telephone Number: **(201) 779-1958**
20.	Permit Contact Fax Number: **NA**
21.	Permit Contact E-Mail Address: **cmckiernan@bioenergydevco.com**
22.	Billing Contact Name: **Dena Nolte**
23.	Billing Contact Title: **Controller**
24.	Billing Contact Telephone Number: **(443) 782-3384**
25.	Billing Contact Fax Number: **NA**
26.	Billing Contact E-Mail Address: **dnolte@bioenergydevco.com**

Proposed Construction and Operating Schedule

27.	When Will the Proposed Construction/Installation/Modification Occur: 04/01/2022
28.	Proposed Operating Schedule: **24** hours/day **7** days/week **52** weeks/year
28.1.	Is There Any Additional Information Regarding the Operating Schedule? ☒ YES ☐ NO
If YES, complete the rest of Question 28. If NO, proceed to Question 29.	

Proposed Construction and Operating Schedule

28.2. Describe the Additional Information: **Gas volume combusted in the flare will be limited to 840,960,000 SCF/year.**

Coastal Zone Information

29. Is the Facility Located in the Coastal Zone? ☐ YES ☒ NO

If the facility is located in the Coastal Zone complete the rest of Question 29. If not, proceed to Question 30.

29.1. Is a Coastal Zone Permit Required for Construction or Operation of the Source Being Applied for? ☐ YES ☐ NO

Attach a copy of the Coastal Zone Determination if it has not been previously submitted

If a Coastal Zone Permit is required complete the rest of Question 29. If not, proceed to Question 30.

29.2. Has a Coastal Zone Permit Been Issued? ☐ YES ☐ NO

Attach a copy of the Coastal Zone Permit if it has not been previously submitted

Local Zoning Information

30. Parcel Zoning: **Agricultural Residential (AR-1)**

Attach Proof of Local Zoning if it has not been previously submitted

Application Information

31. Is the Appropriate Application Fee Attached? ☒ YES ☐ NO

32. Is the Advertising Fee Attached? ☒ YES ☐ NO

For help determining your application and advertising fees see:
http://www.dnrec.state.de.us/DNREC2000/Library/Fees/DE%20Permit%20Fees.htm

Attach the appropriate fees. Note that your Application will not be considered complete if the appropriate fees are not included.

33. Is a Cover Letter Describing the Process Attached? ☒ YES ☐ NO

Attach a brief cover letter describing your Application.

If the Facility is a New Facility complete Question 34. If not, proceed to Question35.

34. Is a Copy of the Applicant Background Information Questionnaire on Record at the Department? ☐ YES ☐ NO

If NO, complete the rest of Question 34. If YES, process to Question 35.

34.1 Is a Copy of the Applicant Background Information Questionnaire Attached? ☐ YES ☐ NO

For a copy of the Applicant Background Information Questionnaire see
http://www.dnrec.delaware.gov/services/Documents/Chapter79Form.pdf

Attach a copy of the Applicant Background Information Questionnaire if applicable.

35. Check Which Application Forms are Attached:

Application Information

☒ AQM-1	☐ AQM-3.4	☐ AQM-3.9	☐ AQM-3.14	☐ AQM-4.4	☐ AQM-4.9	☐ AQM-6
☒ AQM-2	☐ AQM-3.5	☐ AQM-3.10	☐ AQM-3.15	☐ AQM-4.5	☐ AQM-4.10	
☒ AQM-3.1	☐ AQM-3.6	☐ AQM-3.11	☒ AQM-4.1	☐ AQM-4.6	☐ AQM-4.11	
☐ AQM-3.2	☐ AQM-3.7	☐ AQM-3.12	☒ AQM-4.2	☐ AQM-4.7	☐ AQM-4.12	
☐ AQM-3.3	☐ AQM-3.8	☐ AQM-3.13	☒ AQM-4.3	☐ AQM-4.8	☒ AQM-5	

36. Check Which Documents are Attached:

- ☐ Coastal Zone Determination
- ☐ Coastal Zone Permit
- ☒ Proof of Local Zoning
- ☐ Application Fee
- ☐ Advertising Fee
- ☐ Applicant Background Information Questionnaire
- ☐ Claim of Confidentiality
- ☒ Manufacturer Specification(s)
- ☐ Material Safety Data Sheets (MSDSs)
- ☒ Supporting Calculations
- ☒ Descriptive Cover Letter
- ☐ Other (Specify):

Confidentiality Information

37. Do You Consider Any of the Information Submitted With this Application Confidential? ☐ YES ☒ NO

For help on how to submit a confidentiality claim see
http://regulations.delaware.gov/register/december2011/final/15%20DE%20Reg%20864%2012-01-11.htm

If a Claim of Confidentiality is made it MUST meet the requirements of Section 6 of DNREC's Freedom of Information ("FOIA") Regulation at the time the Application is submitted.

Signature Block

I, the undersigned, hereby certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all of its attachments as to the truth, accuracy, and completeness of this information. I certify based on information and belief formed after reasonable inquiry, the statements and information in this document are true, accurate, and complete. By signing this form, I certify that I have not changed, altered, or deleted any portions of this application. I acknowledge that I cannot commence construction, alteration, modification or initiate operation until I receive written approval (i.e. permit, registration, or exemption letter) from the Department. I acknowledge that I may be required to perform testing of the equipment to receive construction or operation approval, and that if I do not receive approval to construct or operate that I may appeal the decision.

Peter Ettinger
Owner or Operator

1/12/22
Date

Signature of Owner or Operator

One Original and One Copy of All Application Forms Should Be Mailed To:
Division of Air Quality
100 W. Water Street, Suite 6A
Dover, Delaware 19904

All Checks Should Be Made Payable To:
State of Delaware

JAMIE WHITEHOUSE, AICP
PLANNING & ZONING DIRECTOR
(302) 855-7878 T
(302) 854-5079 F
jamie.whitehouse@sussexcountyde.gov

Sussex County
DELAWARE
sussexcountyde.gov

March 19, 2021

Mr. Dennis Schrader, Esq.
P.O. Box 690
Georgetown, DE 19947

By e-mail to: dschrader@morrisjames.com

RE: Notice of Decision Letter for Conditional Use (CU 2258) Bioenergy Development Group, LLC to amend CU 1314 (as amended by CU's 1691 and 1962) to permit the processing and handling of poultry litter to include nutrient recovery for natural gas and electrical generation to be located at 28338 Enviro Way in Seaford, DE.
Tax Parcels: 132-6.00-88.01 & 95.00 and 132-11.00-41.00 & 41.02

Dear Mr. Schrader,

At their meeting of April 20, 2021, the Sussex County Council approved the Conditional Use application to amend CU 1314 (as amended by CU's 1691 and 1962) to permit the processing and handling of poultry litter to include nutrient recovery for natural gas and electrical generation at 28338 Enviro Way in Seaford subject to twelve (12) conditions. The Conditional Use shall be substantially underway within three (3) years of the County Council approval otherwise the Conditional Use shall expire. A Site Plan showing the conditions of approval shall be reviewed and approved by the Planning Commission prior to commencement of the use on the parcel. The following are the conditions:

A. Except as otherwise amended by this grant of conditional use, the conditions imposed by Conditional Use No. 1314 as amended by Conditional Use Nos. 1691 and 1962 shall remain in effect.
B. The proposed facility shall be subject to DNREC and other state and federal regulatory approvals.
C. The proposed facility shall only accept, process and handle poultry litter and DAF.
D. There shall not be any stockpiling of DAF, poultry litter, or wastewater on site.
E. This conditional use shall be valid concurrent with DNREC's permits for this use. If the DNREC permits shall be terminated or expire, this conditional use shall also terminate and expire.
F. The proposed facility, anerobic digesters, pretanks, and other equipment and structure related to this use shall be located behind the site of the existing pelletizing facility and the area of disturbance related to this new use shall be no greater than 11.3 acres.
G. As proposed by the Applicant, there will be no change to the wooded coverage on the property.

H. All stormwater management facilities shall be subject to the review and approval of the Sussex Conservation District. The Final Site Plan shall include the approval of the Sussex Conservation District for the design and locations of the stormwater management areas.
I. Prior to the submission of the Final Site Plan, the Applicant must provide copies of all active permits from DNREC demonstrating that the Applicant has received all necessary approvals and permits from DNREC to operate the proposed facility.
J. As proffered by the Applicant, the landscape buffer shall be installed at the front of the site. A landscape buffer plan shall be included as part of the Final Site Plan for the project.
K. The failure to abide by these conditions shall result in the termination of the conditional use approval.
L. The Applicant shall submit a Final Site Plan, which shall be subject to the review and approval of the Sussex County Planning and Zoning Commission.

The Final Site Plan shall be prepared by a licensed Delaware Surveyor or Engineer and shall contain the conditions of approval on the plan. The Final Site Plan shall be approved prior to the commencement of the use on the property. The Site Plan shall be reviewed and approved by the Planning Commission. Agency approvals include but are not limited to: DelDOT, Sussex Conservation District and the Office of the State Fire Marshal.

Please submit a minimum of two (2) full size paper copies and an electronic copy (PDF) of the Preliminary Site Plan to the Planning and Zoning Office a minimum of twenty (20) days prior to a Planning Commission meeting.

An approved copy of the Ordinance granting approval of the Conditional Use will be sent to you from the Clerk of Council.

Please feel free to contact the Planning and Zoning Department with any questions during business hours 8:30 am to 4:30 pm, Monday through Friday, at (302)-855-7878.

Sincerely,

Christin Scott

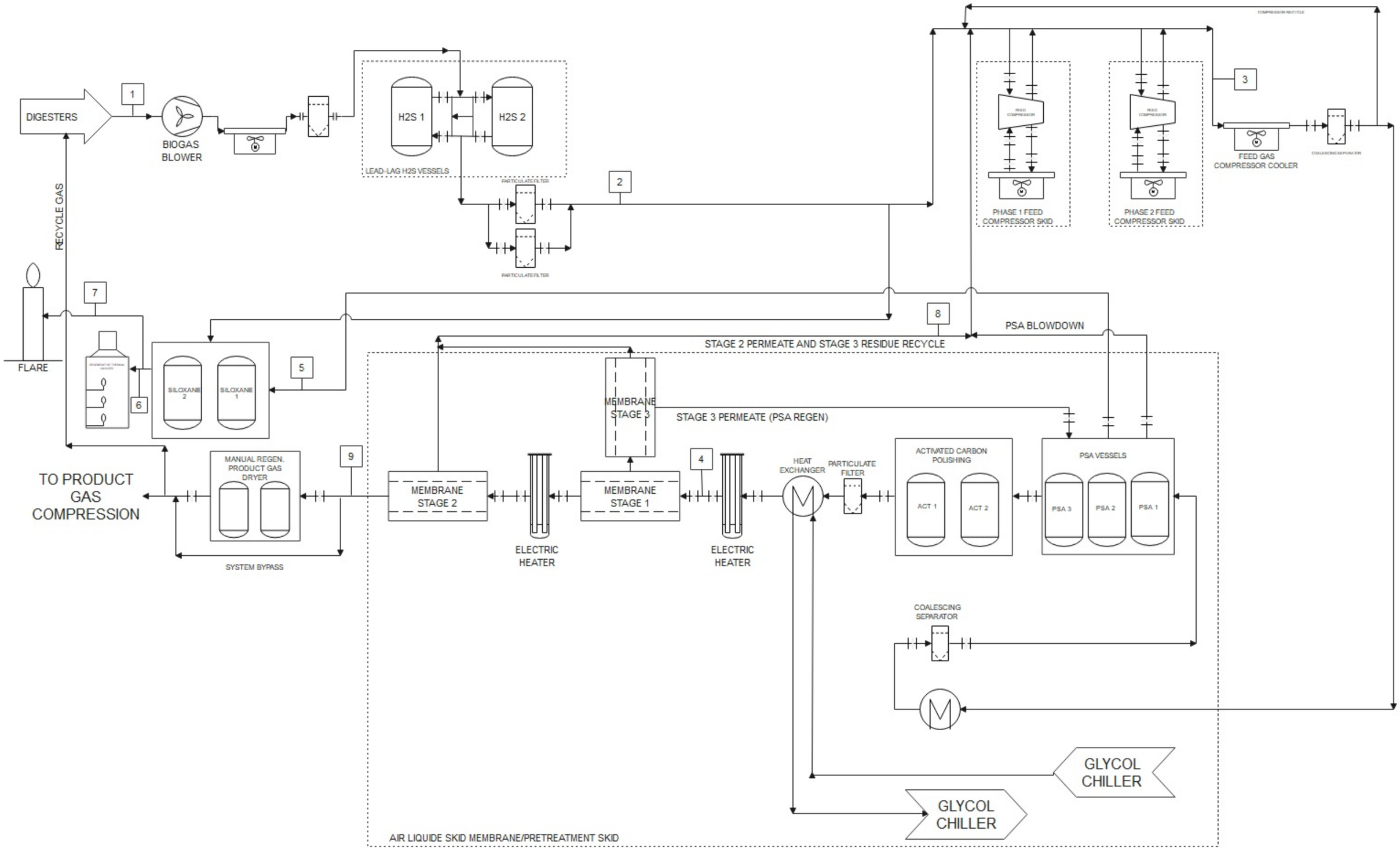
Mrs. Christin Scott
Planner I

CC: Mr. Lester Shaffer, Chief Constable
Ms. Susan Isaacs, Public Works
Mr. Andy Wright, Building Code
Mr. John Ashman, Engineering

Process Flow Diagram

Sketch the Process Flow Diagram for the equipment or process being applied for. Include each emission unit and control device (even existing emission units that will not be modified by this application). You may identify each emission unit with a simple shape. Label each emission unit and control device with a unique identifier. Show the relationship between each emission unit and/or control device by drawing arrows between them to indicate the flow of air pollutants. List which application forms are included for each emission unit or control device below the shape representing each emission unit or control device . See http://www.delaware.gov/reg2/default.htm for example Process Flow Diagrams for common processes. If you already have a Process Flow Diagram for the equipment or process being applied for, you may attach it to the application instead of using this form.

See attached Process Flow Diagram


DIGESTERS
1
BIOGAS BLOWER
H2S 1
H2S 2
LEAD-LAG H2S VESSELS
PARTICULATE FILTER
PARTICULATE FILTER
2
PHASE 1 FEED COMPRESSOR SKID
PHASE 2 FEED COMPRESSOR SKID
3
FEED GAS COMPRESSOR COOLER
RECYCLE GAS
FLARE
7
6
SILOXANE 2
SILOXANE 1
5
8
PSA BLOWDOWN
STAGE 2 PERMEATE AND STAGE 3 RESIDUE RECYCLE
MEMBRANE STAGE 3
STAGE 3 PERMEATE (PSA REGEN)
TO PRODUCT GAS COMPRESSION
MANUAL REGEN. PRODUCT GAS DRYER
9
MEMBRANE STAGE 2
ELECTRIC HEATER
MEMBRANE STAGE 1
4
ELECTRIC HEATER
HEAT EXCHANGER
PARTICULATE FILTER
ACTIVATED CARBON POLISHING
ACT 1
ACT 2
PSA VESSELS
PSA 3
PSA 2
PSA 1
SYSTEM BYPASS
COALESCING SEPARATOR
GLYCOL CHILLER
GLYCOL CHILLER
AIR LIQUIDE SKID MEMBRANE/PRETREATMENT SKID

Generic Process Equipment Application

If you are using this form electronically, press F1 at any time for help

General Information

1.	Facility Name: **Bioenergy Innovation Center**
2.	Equipment ID Number: **NA**
3.	Provide a brief description of Equipment or Process: **Operation of anaerobic digesters to produce renewable natural gas.**
4.	Manufacturer: **NA**
5.	Model: **NA**
6.	Serial Number: **NA**

Raw Material Information

7. Raw Materials Used in Process

If there are more than four Raw Materials used, attach additional copies of this page as needed.

	Raw Material Used	CAS Number	Usage Rate (include units)	MSDS Attached?
7.1.	**Poultry litter and DAF (liquid and solid cake; fats, oils & grease; and waste activated sludge)**		**250,000 tons/year**	☐ YES ☒ NO
7.2.				☐ YES ☐ NO
7.3.				☐ YES ☐ NO
7.4.				☐ YES ☐ NO

Attach a copy of all calculations made to support the data in the table above.
Attach a Material Safety Data Sheet (MSDS) for each Raw Material used.

Products Produced Information

8. Products Produced

If there are more than four Products Produced, attach additional copies of this page as needed.

	Product Produced	CAS Number	Production Rate (include units)	MSDS Attached?
8.1.	**Biogas**		**1,600 SCFM**	☐ YES ☒ NO
8.2.				☐ YES ☐ NO
8.3.				☐ YES ☐ NO

Products Produced Information

8.4.			☐ YES ☐ NO

Attach a copy of all calculations made to support the data in the table above.
Attach a Material Safety Data Sheet (MSDS) for each Product Produced.

Byproducts Generated Information

9. Byproducts Generated

If there are more than four Byproducts Generated, attach additional copies of this page as needed.

	Byproduct Generated	CAS Number	Generation Rate (include units)	MSDS Attached?
9.1.	**Dewatered digestate**		**45,000 tons/year**	☐ YES ☒ NO
9.2.				☐ YES ☐ NO
9.3.				☐ YES ☐ NO
9.4.				☐ YES ☐ NO

Attach a copy of all calculations made to support the data in the table above.
Attach a Material Safety Data Sheet (MSDS) for each Byproduct Generated.

General Information

10. Manufacturer's Rated Capacity or Maximum Throughput of Equipment or Process: **250,000 tons organic waste per year.**

11. Describe Important Manufacturer Specifications and/or Operating Parameters for Equipment or Process: **See cover letter.**

Attach the Manufacturer's Specification Sheet(s) for the equipment or process.

Control Device Information

12. Is an Air Pollution Control Device Used? ☒ YES ☐ NO

If an Air Pollution Control Device is used, complete the rest of Question 12. If not, proceed to Question 13.

12.1. Is Knockout Used? ☐ YES ☒ NO

If YES, complete Form AQM-4.11 and attach it to this application.

12.2. Is a Settling Chamber Used? ☐ YES ☒ NO

If YES, complete Form AQM-4.10 and attach it to this application.

12.3. Is an Inertial or Cyclone Collector Used? ☐ YES ☒ NO

If YES, complete Form AQM-4.5 and attach it to this application.

12.4. Is a Fabric Collector or Baghouse Used? ☐ YES ☒ NO

If YES, complete Form AQM-4.6 and attach it to this application.

Control Device Information

12.5. Is a Venturi Scrubber Used?	☐ YES ☒ NO
If YES, complete Form AQM-4.8 and attach it to this application.	
12.6. Is an Electrostatic Precipitator Used?	☐ YES ☒ NO
If YES, complete Form AQM-4.7 and attach it to this application.	
12.7. Is Adsorption Equipment Used?	☒ YES ☐ NO
If YES, complete Form AQM-4.2 and attach it to this application.	
12.8. Is a Scrubber Used?	☐ YES ☒ NO
If YES, complete Form AQM-4.4 and attach it to this application.	
12.9. Is a Thermal Oxidizer or Afterburner Used?	☒ YES ☐ NO
If YES, complete Form AQM-4.1 and attach it to this application.	
12.10. Is a Flare Used?	☒ YES ☐ NO
If YES, complete Form AQM-4.3 and attach it to this application.	
12.11. Is Any Other Control Device Used?	☐ YES ☒ NO
If YES, attach a copy of the control device Manufacturer's Specification Sheet(s).	
If any other control device is used, complete the rest of Question 12. If not, proceed to Question 13.	
12.12. Describe Control Device:	
12.13. Pollutants Controlled: ☐ VOCs ☐ HAPs ☐ PM ☐ PM_{10} ☐ $PM_{2.5}$ ☐ NO_X ☐ SO_X ☐ Metals ☐ Other (Specify):	
12.14. Control Device Manufacturer:	
12.15. Control Device Model:	
12.16. Control Device Serial Number:	
12.17. Control Device Design Capacity:	
12.18. Control Device Removal or Destruction Efficiency:	

Stack Information

13. How Does the Process Equipment Vent: *(check all that apply)* ☐ Directly to the Atmosphere ☒ Through a Control Device Covered by Forms AQM-4.1 through 4.12 ☐ Through Another Control Device Described on This Form
If any of the process equipment vents directly to the atmosphere or through another control device described on this form, proceed to Question 14. If the process equipment vents through a control device, provide the stack parameters on the control device form and proceed to Question 18.
14. Number of Air Contaminant Emission Points: **1**
If there are more than three Emission Points, attach additional copies of this page as needed.
For the first Emission Point
15. Emission Point Name: **See AQM-4.1**

Stack Information
15.1. Stack Height Above Grade: **feet**
15.2. Stack Exit Diameter: **feet** *(Provide Stack Dimensions If Rectangular Stack)*
15.3. Is a Stack Cap Present? ☐ YES ☐ NO
15.4. Stack Configuration: ☐ Vertical ☐ Horizontal ☐ Downward-Venting *(check all that apply)* ☐ Other (Specify):
15.5. Stack Exit Gas Temperature: **°F**
15.6. Stack Exit Gas Flow Rate: **ACFM**
15.7. Distance to Nearest Property Line: **feet**
15.8. Describe Nearest Obstruction:
15.9. Height of Nearest Obstruction: **feet**
15.10. Distance to Nearest Obstruction: **feet**
15.11. Are Stack Sampling Ports Provided? ☐ YES ☐ NO
For the second Emission Point. If there is no second Emission Point, proceed to Question 18.
16. Emission Point Name: **See AQM-4.3**
16.1. Stack Height Above Grade: **feet**
16.2. Stack Exit Diameter: **feet** *(Provide Stack Dimensions If Rectangular Stack)*
16.3. Is a Stack Cap Present? ☐ YES ☐ NO
16.4. Stack Configuration: ☐ Vertical ☐ Horizontal ☐ Downward-Venting *(check all that apply)* ☐ Other (Specify):
16.5. Stack Exit Gas Temperature: **°F**
16.6. Stack Exit Gas Flow Rate: **ACFM**
16.7. Distance to Nearest Property Line: **feet**
16.8. Describe Nearest Obstruction:
16.9. Height of Nearest Obstruction: **feet**
16.10. Distance to Nearest Obstruction: **feet**
16.11. Are Stack Sampling Ports Provided? ☐ YES ☐ NO
For the third Emission Point. If there is no third Emission Point, proceed to Question 18.
17. Emission Point Name:
17.1. Stack Height Above Grade: **feet**
17.2. Stack Exit Diameter: **feet** *(Provide Stack Dimensions If Rectangular Stack)*
17.3. Is a Stack Cap Present? ☐ YES ☐ NO
17.4. Stack Configuration: ☐ Vertical ☐ Horizontal ☐ Downward-Venting *(check all that apply)* ☐ Other (Specify):
17.5. Stack Exit Gas Temperature: **°F**
17.6. Stack Exit Gas Flow Rate: **ACFM**

Stack Information

17.7.	Distance to Nearest Property Line: **feet**
17.8.	Describe Nearest Obstruction:
17.9.	Height of Nearest Obstruction: **feet**
17.10.	Distance to Nearest Obstruction: **feet**
17.11.	Are Stack Sampling Ports Provided? ☐ YES ☐ NO

Monitoring Information

18.	Will Emissions Data be Recorded by a Continuous Emission Monitoring System? ☐ YES ☒ NO
If Yes, attach a copy of the Continuous Emission Monitoring System Manufacturer's Specification Sheets	
If YES, complete the rest of Question 18. If NO, proceed to Question 19.	
18.1.	Pollutants Monitored: ☐ VOCs ☐ HAPs ☐ PM ☐ PM_{10} ☐ $PM_{2.5}$ ☐ NO_X ☐ SO_X ☐ Metals ☐ Other (Specify):
18.2.	Describe the Continuous Emission Monitoring System:
18.3.	Manufacturer:
18.4.	Model:
18.5.	Serial Number:
18.6.	Will Multiple Emission Units Be Monitored at the Same Point? ☐ YES ☐ NO
If YES, complete the rest of Question 18. If NO, proceed to Question 19.	
18.7.	Emission Units Monitored:
18.8.	Will More Than One Emission Unit be Emitting From the Combined Point At Any Time? ☐ YES ☐ NO
If YES, complete the rest of Question 18. If NO, proceed to Question 19.	
18.9.	Emission Units Emitting Simultaneously:

Voluntary Emission Limitation Request Information

19.	Are You Requesting Any Voluntary Emission Limitations to Avoid Major Source Status, Minor New Source Review, MACT, NSPS, etc.? ☐ YES ☒ NO
If YES, complete the rest of Question 19. If NO, proceed to Question 20.	
19.1.	Describe Any Requested Emission Limitations:

Voluntary Operating Limitation Request Information

Voluntary Operating Limitation Request Information	
20. Are You Requesting Any Voluntary Operating Limitations to Avoid Major Source Status, Minor New Source Review, MACT, NSPS, etc.?	☒ YES ☐ NO
If YES, complete the rest of Question 20. If NO, proceed to Question 21.	
20.1. Describe Any Requested Operating Limitations:	

Additional Information	
21. Is There Any Additional Information Pertinent to this Application?	☐ YES ☒ NO
If YES, complete the rest of Question 21.	
21.1. Describe:	

Flare Application

If you are using this form electronically, press F1 at any time for help

General Information	
1.	Facility Name: **Section**
2.	Equipment ID Number: **Flare**
3.	Flare Type: ☒ Elevated ☐ Ground ☐ Other (Specify):
4.	Flare Design: ☐ Air-Assisted ☐ Steam-Assisted ☒ Non-Assisted ☐ Other (Specify):
If the Flare is Steam-Assisted, complete the rest of Question 4. If not, proceed to Question 5.	
4.1.	Steam Injection Rate: pounds/hour
4.2.	Steam Pressure: **atm**
5.	Manufacturer: **John Zink Company**
6.	Model: **ZEF 10x30**
7.	Serial Number: **Generated at time of sale**
Attach the Manufacturer's Specification Sheet.	

Operating Information	
8.	Flare Stack Height: **30 feet**
9.	Flare Stack Diameter: **0.83 feet**
10.	Flame Temperature: **500+ °F**
11.	Turn Down Ratio: **10:1**
12.	Flare Tip Diameter: **0.83 feet**
13.	Minimum BTU Rating for Flare: **455 BTU/scf**
14.	Maximum BTU Rating for Flare: **528 BTU/scf**
15.	Describe the Operation of the Flare's Ignition System: **Electronic spark ignitor mounted to an intermittently operating pilot. Once thermocouple detects presence of pilot flame, waste gas block valve is opened and pilot flame is cut once main flame is detected by separate thermocouple.**
16.	Heat Release Rate: **3,551,315** calories/second

Contaminant Information

17. Percent of Each Contaminant in the Waste Gas, Heating Value, and Destruction Efficiency

If more than five Contaminants are present, attach additional copies of this page as needed.

	Contaminant	CAS Number	Percent of Waste Gas	Heating Value	Destruction Efficiency
17.1.	**CH4**		**50 - 62 %**	**910** BTUs	**98** %
17.2.	**CO2**		**38 - 50 %**	**NA** BTUs	**0** %
17.3.	**N2**		**0 - 1 %**	**NA** BTUs	**0** %
17.4.	**O2**		**0 - 1 %**	**NA** BTUs	**0** %
17.5.			**%**	BTUs	%

Gas Stream Information

18. Maximum Inlet Volumetric Gas Flow Rate: **1,600 acfm** at **77 °F**

19. Maximum Outlet Volumetric Gas Flow Rate: **1,600 acfm** at **500+ °F**

20. Heat Content of Waste Gas: **528 BTU/scf**

21. Exit Gas Velocity: **49.3 feet/second**

Auxiliary Fuel Information

22. Describe the Operating Conditions that Necessitate Introducing Auxiliary Fuel to the Flare: **When the flare gets a start command, a natural gas supply is needed to spark the pilot. Once the presence of pilot flame is confirmed by the pilot thermocouple, the waste gas block valve is opened and waste gas is sent to the flare. Once the main flame thermocouple detects the presence of flame, the pilot gas supply is cut.**

23. Auxiliary Fuel Type:
- ☒ Natural Gas
- ☐ Diesel
- ☐ No. 2 Fuel Oil
- ☐ No. 4 Fuel Oil
- ☐ Propane
- ☐ Biodiesel
- ☐ Refinery Fuel Gas
- ☐ Other (Specify):

24. Heat Content of Auxiliary Fuel: **1050 BTU/MMCF**

25. % Sulfur of Auxiliary Fuel: **0** %

26. Maximum Hourly Fuel Usage: **0.00005 MMCF**

27. Maximum Yearly Fuel Usage: **0.12265 MMCF**

Pilot Flame Monitoring Information

28. Is the Presence of the Pilot Flame Monitored? ☒ YES ☐ NO

If Yes, complete the rest of Question 28. If NO, proceed to Question 29.

Pilot Flame Monitoring Information

28.1. Monitor Type: ☒ Thermocouple
☐ Other (Specify):

28.2. Does the Flare Shut Off if the Pilot Flame is Not Detected? ☒ YES ☐ NO

Monitoring and Alarm Information

29. Are There Any Alarms You Would Like the Department to Consider When Drafting the Permit? ☒ YES ☐ NO

If YES, complete the rest of Question 29. If NO, proceed to Question 30.

29.1. Describe the System Alarm(s):

If there are more than five alarms, attach additional copies of this page as needed.

	Operating Parameter Monitored	Describe Alarm Trigger	Monitoring Device or Alarm Type	Does the Alarm Initiate an Automated Response?
29.1.1.	**Flare temperature**	**Low temperature at 200F**	☒ Visual ☐ Auditory ☒ Automatic (Remote Monitoring) ☐ Other	☐ NO ☒ YES Describe: **Flare shutdown**
29.1.2.	**Flare temperature**	**High temperature at 300F and 1000F**	☒ Visual ☐ Auditory ☒ Automatic (Remote Monitoring) ☐ Other	☐ NO ☒ YES Describe: **At 300F waste gas valve opens, at 1000F pilot gas valve closes**
29.1.3.	**Arrester temperature**	**High temperature at 200F**	☒ Visual ☐ Auditory ☒ Automatic (Remote Monitoring) ☐ Other	☐ NO ☒ YES Describe: **Flare shutdown**
29.1.4.	**Block valve failure**	**Valve limit switch not triggered**	☒ Visual ☐ Auditory ☒ Automatic (Remote Monitoring) ☐ Other	☐ NO ☒ YES Describe: **Flare startup aborted**
29.1.5.			☐ Visual ☐ Auditory ☐ Automatic (Remote Monitoring) ☐ Other	☐ NO ☐ YES Describe:

Additional Information

30. Is There Any Additional Information Pertinent to this Application? ☒ YES ☐ NO

If YES, complete the rest of Question 30.

30.1. Describe: **Gas volume combusted in the flare will be limited to 840,960,000 SCF/year.**

Emissions Information Application

If you are using this form electronically, press F1 at any time for help

Process Information

1.	Number of Individual Pieces of Process Equipment in Process: **4**
2.	Number of Individual Control Devices in Process: **2**

Emissions Information for First Emission Point/Stack

3.	Emission Point Name: **Flare**
4.	Equipment ID Number for all Process Equipment and Control Devices Venting Through Emission Point/Stack: **Flare**
5.	Pollutant Emissions

If more than 15 pollutants are emitted at this Emission Point/Stack, attach additional copies of this page as needed.

	Pollutant Name (Specify VOCs and HAPs Individually in 5.10 through 5.18)	CAS Number (Not required for 5.1 through 5.10)	Maximum Uncontrolled Emission Rate at Design Capacity	Maximum Controlled Emission Rate at Design Capacity	Annual Potential to Emit (PTE)	Requested Permitted Annual Emissions
5.1.	Particulate Matter (PM)		**0 lbs/hour**	**0.00038 lbs/hour**	**0.0017** tons/year	**0.00047** tons/year
5.2.	PM_{10}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
5.3.	$PM_{2.5}$		**lbs/hour**	**lbs/hour**	tons/year	tons/year
5.4.	Sulfur Oxides (SO_X)		**0 lbs/hour**	**0.00003 lbs/hour**	**0.0001** tons/year	**0.00004** tons/year
5.5.	Nitrogen Oxides (NO_X)		**0 lbs/hour**	**3.7 lbs/hour**	**16** tons/year	**4.5** tons/year
5.6.	Carbon Monoxide (CO)		**0 lbs/hour**	**16.8 lbs/hour**	**74** tons/year	**20.6** tons/year
5.7.	Total Volatile Organic Compounds (VOCs)		**0 lbs/hour**	**0.00028 lbs/hour**	**0.0012** tons/year	**0.00034** tons/year

Emissions Information for First Emission Point/Stack

5.8.	Total Hazardous Air Pollutants (HAPs)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
5.9.	CO_2		**3,260 lbs/hour**	**9,489 lbs/hour**	**41,562** tons/year	**11,638** tons/year
5.10.	CO_{2e}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
5.11.	**Methane (CH4)**		**4,043 lbs/hour**	**81 lbs/hour**	**354** tons/year	**99** tons/year
5.12.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
5.13.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
5.14.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
5.15.			**lbs/hour**	**lbs/hour**	tons/year	tons/year

6. Provide Any Additional Information Necessary to Understanding the Emission Rates Provided Above:

Attach the Basis of Determination or Calculations for each Emission Rate provided above.

Emissions Information for Second Emission Point/Stack

7. Emission Point Name: **Thermal Oxidizer**

8. Equipment ID Number for all Process Equipment and Control Devices Venting Through Emission Point/Stack: **Thermal Oxidizer**

9. Pollutant Emissions

If more than 15 pollutants are emitted at this Emission Point/Stack, attach additional copies of this page as needed.

	Pollutant Name (Specify VOCs and HAPs Individually in 9.10 through 9.18)	CAS Number (Not required for 9.1 through 9.10)	Maximum Uncontrolled Emission Rate at Design Capacity	Maximum Controlled Emission Rate at Design Capacity	Annual Potential to Emit (PTE)	Requested Permitted Annual Emissions
9.1.	Particulate Matter (PM)		**0 lbs/hour**	**0.0051 lbs/hour**	**0.022** tons/year	**0.022** tons/year

Emissions Information for Second Emission Point/Stack

9.2.	PM_{10}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.3.	$PM_{2.5}$		**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.4.	Sulfur Oxides (SO_X)		**0 lbs/hour**	**0.0004 lbs/hour**	**0.002** tons/year	**0.002** tons/year
9.5.	Nitrogen Oxides (NO_X)		**0 lbs/hour**	**0.067 lbs/hour**	**0.29** tons/year	**0.29** tons/year
9.6.	Carbon Monoxide (CO)		**0 lbs/hour**	**0.056 lbs/hour**	**0.25** tons/year	**0.25** tons/year
9.7.	Total Volatile Organic Compounds (VOCs)		**0 lbs/hour**	**0.0037 lbs/hour**	**0.016** tons/year	**0.016** tons/year
9.8.	Total Hazardous Air Pollutants (HAPs)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.9.	CO_2		**2,615 lbs/hour**	**2,696 lbs/hour**	**11,808** tons/year	**11,808** tons/year
9.10.	CO_{2e}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.11.	**Methane (CH4)**		**38 lbs/hour**	**0.76 lbs/hour**	**3.3** tons/year	**3,3** tons/year
9.12.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.13.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.14.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.15.			**lbs/hour**	**lbs/hour**	tons/year	tons/year

10. Provide Any Additional Information Necessary to Understanding the Emission Rates Provided Above:

Attach the Basis of Determination or Calculations for each Emission Rate provided above.

Emissions Information for Third Emission Point/Stack

11. Emission Point Name:

Emissions Information for Third Emission Point/Stack

12. Equipment ID Number for all Process Equipment and Control Devices Venting Through Emission Point/Stack:

13. Pollutant Emissions

If more than 15 pollutants are emitted at this Emission Point/Stack, attach additional copies of this page as needed.

	Pollutant Name (Specify VOCs and HAPs Individually in 13.10 through 13.18)	CAS Number (Not required for 13.1 through 13.10)	Maximum Uncontrolled Emission Rate at Design Capacity	Maximum Controlled Emission Rate at Design Capacity	Annual Potential to Emit (PTE)	Requested Permitted Annual Emissions
13.1.	Particulate Matter (PM)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.2.	PM_{10}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.3.	$PM_{2.5}$		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.4.	Sulfur Oxides (SO_X)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.5.	Nitrogen Oxides (NO_X)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.6.	Carbon Monoxide (CO)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.7.	Total Volatile Organic Compounds (VOCs)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.8.	Total Hazardous Air Pollutants (HAPs)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.9.	CO_2		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.10.	CO_{2e}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.11.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.12.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.13.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.14.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.15.			**lbs/hour**	**lbs/hour**	tons/year	tons/year

Emissions Information for Third Emission Point/Stack

14. Provide Any Additional Information Necessary to Understanding the Emission Rates Provided Above:

Attach the Basis of Determination or Calculations for each Emission Rate provided above.

Emissions Information for Fourth Emission Point/Stack

15. Emission Point Name:

16. Equipment ID Number for all Process Equipment and Control Devices Venting Through Emission Point/Stack:

17. Pollutant Emissions

If more than 15 pollutants are emitted at this Emission Point/Stack, attach additional copies of this page as needed.

	Pollutant Name (Specify VOCs and HAPs Individually in 17.10 through 17.18)	CAS Number (Not required for 17.1 through 17.10)	Maximum Uncontrolled Emission Rate at Design Capacity	Maximum Controlled Emission Rate at Design Capacity	Annual Potential to Emit (PTE)	Requested Permitted Annual Emissions
17.1.	Particulate Matter (PM)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.2.	PM_{10}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.3.	$PM_{2.5}$		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.4.	Sulfur Oxides (SO_X)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.5.	Nitrogen Oxides (NO_X)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.6.	Carbon Monoxide (CO)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.7.	Volatile Organic Compounds (VOCs)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.8.	Total Hazardous Air Pollutants (HAPs)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.9.	CO_2		**lbs/hour**	**lbs/hour**	tons/year	tons/year

Emissions Information for Fourth Emission Point/Stack

17.10. CO_{2e}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.11.		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.12.		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.13.		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.14.		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.15.		**lbs/hour**	**lbs/hour**	tons/year	tons/year

18. Provide Any Additional Information Necessary to Understanding the Emission Rates Provided Above:

Attach the Basis of Determination or Calculations for each Emission Rate provided above.

If there are more than four Emission Points/Stacks, attach additional copies of this form as needed.

Overall Process Emissions

19. Pollutant Emissions

If more than 15 pollutants are emitted from this Process, attach additional copies of this page as needed.

Pollutant Name (Specify VOCs and HAPs Individually in 19.10 through 19.18)	CAS Number (Not required for 19.1 through 19.10)	Maximum Uncontrolled Emission Rate at Design Capacity	Maximum Controlled Emission Rate at Design Capacity	Annual Potential to Emit (PTE)	Requested Permitted Annual Emissions
19.1. Particulate Matter (PM)		**0 lbs/hour**	**0.0055 lbs/hour**	**0.024** tons/year	**0.022** tons/year
19.2. PM_{10}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
19.3. $PM_{2.5}$		**lbs/hour**	**lbs/hour**	tons/year	tons/year
19.4. Sulfur Oxides (SO_X)		**0 lbs/hour**	**0.00043 lbs/hour**	**0.0021** tons/year	**0.0020** tons/year
19.5. Nitrogen Oxides (NO_X)		**0 lbs/hour**	**3.8 lbs/hour**	**16.3** tons/year	**4.8** tons/year

Overall Process Emissions

19.6.	Carbon Monoxide (CO)		**0 lbs/hour**	**16.9 lbs/hour**	**74** tons/year	**21** tons/year
19.7.	Total Volatile Organic Compounds (VOCs)		**0 lbs/hour**	**0.0040 lbs/hour**	**0.017** tons/year	**0.016** tons/year
19.8.	Total Hazardous Air Pollutants (HAPs)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
19.9.	CO_2		**5,875 lbs/hour**	**12,185 lbs/hour**	**53,370** tons/year	**23,446** tons/year
19.10.	CO_{2e}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
19.12.	**Methane (CH4)**		**4,081 lbs/hour**	**82 lbs/hour**	**357** tons/year	**102** tons/year
19.13.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
19.14.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
19.15.			**lbs/hour**	**lbs/hour**	tons/year	tons/year

20. Provide Any Additional Information Necessary to Understanding the Emission Rates Provided Above:

Attach the Basis of Determination or Calculations for each Emission Rate provided above.

Minor New Source Review Information

21. Does the Process Have the Potential to Emit More Than Five Tons Per Year of Any Pollutant? ☒ YES ☐ NO

22. Is the Source New or Existing? ☒ NEW ☐ EXISTING
See Question 11 of AQM-1

If the Process has the Potential to Emit more than five tons per year of any pollutant, and is a New Source, a Control Technology Analysis pursuant to Regulation No. 1125 Section 4 must be conducted and attached to this application.

Major New Source Review Information

23. Does the Process Have the Potential to Emit More Than the Significance Level for Any Pollutant? *(Check All That Apply)*

- ☐ Greater Than 25 Tons Per Year of Particulate Matter (PM)
- ☐ Greater Than 15 Tons Per Year of PM_{10}
- ☐ Greater Than 10 Tons Per Year of $PM_{2.5}$
- ☐ Greater Than 40 Tons Per Year of Sulfur Dioxide(SO_2)
- ☐ Greater Than 25 Tons Per Year of Nitrogen Oxides (NO_X) in New Castle and Kent County
- ☐ Greater Than 100 Tons Per Year of Nitrogen Oxides (NO_X) in Sussex County
- ☐ Greater Than 100 Tons Per Year of Carbon Monoxide (CO)
- ☐ Greater Than 25 Tons Per Year of Total Volatile Organic Compounds (VOCs) in New Castle and Kent County
- ☐ Greater Than 50 Tons Per Year of Total Volatile Organic Compounds (VOCs) in Sussex County
- ☐ Greater Than 75,000 Tons Per Year of Equivalent Carbon Dioxide (CO_{2e})

If the Process has the Potential to Emit greater than any of the amounts listed above 7 DE Admin. Code 1125 Sections 2 and/or 3 apply. Contact the Department at (302) 323-4542 or (302) 739-9402 for additional information

Additional Information

24. Is There Any Additional Information Pertinent to this Application? ☒ YES ☐ NO

If YES, complete the rest of Question 24.

24.1. Describe: **Gas volume combusted in the flare will be limited to 840,960,000 SCF/year.**

FLARE EMISSION CALCULATIONS

GIVEN

Biogas Parameters		
Flow Rate	1,600	SCFM
Flow Rate	2,572	Nm3/hr
Flow Rate	61,727	Nm3/day
Flow Rate	156,497	lb/day
CH4	62	%
CO2	50	%
N2	1	%
O2	1	%
Heat content	564	BTU/SCF

Conversion factors	
2.5353	lb/Nm3
2E-06	lb/mg
1.6075	SCFM/Nm3/hr

Pilot emission factors			
PM	7.6	lb/MMSCF	AP-42 Table 1.4-2
SOx	0.6	lb/MMSCF	AP-42 Table 1.4-2
NOx	100	lb/MMSCF	AP-42 Table 1.4-1
CO	84	lb/MMSCF	AP-42 Table 1.4-1
VOC	5.5	lb/MMSCF	AP-42 Table 1.4-2

Engineering data		
Biogas density	1.15	kg/Nm3
CH4 destruction	98	%
Max flare usage	10	%
Max flare usage	876	hr/yr
Pilot gas usage	50	CFH

Process gas emission factors			
CO2	115	lb/MMBTU	Engineering standard
NOx	0.068	lb/MMBTU	Manufacturer
CO	0.31	lb/MMBTU	Manufacturer

CALCULATIONS

Uncontrolled

Process Gas Combustion			at 8760 hours		at 8760 hours	
CH4	4,043	lb/hr	97,028	lb/day	17,708	ton/yr
CO2	3,260	lb/hr	78,248	lb/day	14,280	ton/yr
N2	65	lb/hr	1,565	lb/day	286	ton/yr
O2	65	lb/hr	1,565	lb/day	286	ton/yr

Gas volume at 2,453 hours = **840,960,000** SCF/year

Controlled

Natural Gas Combustion			at 2,453 hours		at 8,760 hours	
PM	0.00038	lb/hr	0.00047	ton/yr	0.0017	ton/yr
SOx	0.00003	lb/hr	0.00004	ton/yr	0.0001	ton/yr
NOx	0.0050	lb/hr	0.0061	ton/yr	0.022	ton/yr
CO	0.0042	lb/hr	0.0052	ton/yr	0.018	ton/yr
VOC	0.00028	lb/hr	0.00034	ton/yr	0.0012	ton/yr

Process Gas Combustion			at 2,453 hours		at 8760 hours	
CH4	81	lb/hr	99	ton/yr	354	ton/yr
CO2 pass thru	3,260	lb/hr	3,999	ton/yr	14,280	ton/yr
CO2 from comb	6,229	lb/hr	7,640	ton/yr	27,282	ton/yr
CO2 total	9,489	lb/hr	11,638	ton/yr	41,562	ton/yr
NOx	3.7	lb/hr	4.5	ton/yr	16	ton/yr
CO	16.8	lb/hr	20.6	ton/yr	74	ton/yr

Total			at 2,453 hours		at 8,760 hours	
PM	0.00038	lb/hr	0.00047	ton/yr	0.0017	ton/yr
SOx	0.00003	lb/hr	0.00004	ton/yr	0.0001	ton/yr
NOx	3.7	lb/hr	4.5	ton/yr	16	ton/yr
CO	16.8	lb/hr	20.6	ton/yr	74	ton/yr
VOC	0.00028	lb/hr	0.00034	ton/yr	0.0012	ton/yr
CH4	81	lb/hr	99	ton/yr	354	ton/yr
CO2	9,489	lb/hr	11,638	ton/yr	41,562	ton/yr

1.4 Natural Gas Combustion

1.4.1 General[1-2]

Natural gas is one of the major combustion fuels used throughout the country. It is mainly used to generate industrial and utility electric power, produce industrial process steam and heat, and heat residential and commercial space. Natural gas consists of a high percentage of methane (generally above 85 percent) and varying amounts of ethane, propane, butane, and inerts (typically nitrogen, carbon dioxide, and helium). The average gross heating value of natural gas is approximately 1,020 British thermal units per standard cubic foot (Btu/scf), usually varying from 950 to 1,050 Btu/scf.

1.4.2 Firing Practices[3-5]

There are three major types of boilers used for natural gas combustion in commercial, industrial, and utility applications: watertube, firetube, and cast iron. Watertube boilers are designed to pass water through the inside of heat transfer tubes while the outside of the tubes is heated by direct contact with the hot combustion gases and through radiant heat transfer. The watertube design is the most common in utility and large industrial boilers. Watertube boilers are used for a variety of applications, ranging from providing large amounts of process steam, to providing hot water or steam for space heating, to generating high-temperature, high-pressure steam for producing electricity. Furthermore, watertube boilers can be distinguished either as field erected units or packaged units.

Field erected boilers are boilers that are constructed on site and comprise the larger sized watertube boilers. Generally, boilers with heat input levels greater than 100 MMBtu/hr, are field erected. Field erected units usually have multiple burners and, given the customized nature of their construction, also have greater operational flexibility and NO_x control options. Field erected units can also be further categorized as wall-fired or tangential-fired. Wall-fired units are characterized by multiple individual burners located on a single wall or on opposing walls of the furnace while tangential units have several rows of air and fuel nozzles located in each of the four corners of the boiler.

Package units are constructed off-site and shipped to the location where they are needed. While the heat input levels of packaged units may range up to 250 MMBtu/hr, the physical size of these units are constrained by shipping considerations and generally have heat input levels less than 100 MMBtu/hr. Packaged units are always wall-fired units with one or more individual burners. Given the size limitations imposed on packaged boilers, they have limited operational flexibility and cannot feasibly incorporate some NO_x control options.

Firetube boilers are designed such that the hot combustion gases flow through tubes, which heat the water circulating outside of the tubes. These boilers are used primarily for space heating systems, industrial process steam, and portable power boilers. Firetube boilers are almost exclusively packaged units. The two major types of firetube units are Scotch Marine boilers and the older firebox boilers. In cast iron boilers, as in firetube boilers, the hot gases are contained inside the tubes and the water being heated circulates outside the tubes. However, the units are constructed of cast iron rather than steel. Virtually all cast iron boilers are constructed as package boilers. These boilers are used to produce either low-pressure steam or hot water, and are most commonly used in small commercial applications.

Natural gas is also combusted in residential boilers and furnaces. Residential boilers and furnaces generally resemble firetube boilers with flue gas traveling through several channels or tubes with water or air circulated outside the channels or tubes.

1.4.3 Emissions[3-4]

The emissions from natural gas-fired boilers and furnaces include nitrogen oxides (NO_x), carbon monoxide (CO), and carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), volatile organic compounds (VOCs), trace amounts of sulfur dioxide (SO_2), and particulate matter (PM).

Nitrogen Oxides -

Nitrogen oxides formation occurs by three fundamentally different mechanisms. The principal mechanism of NO_x formation in natural gas combustion is thermal NO_x. The thermal NO_x mechanism occurs through the thermal dissociation and subsequent reaction of nitrogen (N_2) and oxygen (O_2) molecules in the combustion air. Most NO_x formed through the thermal NO_x mechanism occurs in the high temperature flame zone near the burners. The formation of thermal NO_x is affected by three furnace-zone factors: (1) oxygen concentration, (2) peak temperature, and (3) time of exposure at peak temperature. As these three factors increase, NO_x emission levels increase. The emission trends due to changes in these factors are fairly consistent for all types of natural gas-fired boilers and furnaces. Emission levels vary considerably with the type and size of combustor and with operating conditions (e.g., combustion air temperature, volumetric heat release rate, load, and excess oxygen level).

The second mechanism of NO_x formation, called prompt NO_x, occurs through early reactions of nitrogen molecules in the combustion air and hydrocarbon radicals from the fuel. Prompt NO_x reactions occur within the flame and are usually negligible when compared to the amount of NO_x formed through the thermal NO_x mechanism. However, prompt NO_x levels may become significant with ultra-low-NO_x burners.

The third mechanism of NO_x formation, called fuel NO_x, stems from the evolution and reaction of fuel-bound nitrogen compounds with oxygen. Due to the characteristically low fuel nitrogen content of natural gas, NO_x formation through the fuel NO_x mechanism is insignificant.

Carbon Monoxide -

The rate of CO emissions from boilers depends on the efficiency of natural gas combustion. Improperly tuned boilers and boilers operating at off-design levels decrease combustion efficiency resulting in increased CO emissions. In some cases, the addition of NO_x control systems such as low NO_x burners and flue gas recirculation (FGR) may also reduce combustion efficiency, resulting in higher CO emissions relative to uncontrolled boilers.

Volatile Organic Compounds -

The rate of VOC emissions from boilers and furnaces also depends on combustion efficiency. VOC emissions are minimized by combustion practices that promote high combustion temperatures, long residence times at those temperatures, and turbulent mixing of fuel and combustion air. Trace amounts of VOC species in the natural gas fuel (e.g., formaldehyde and benzene) may also contribute to VOC emissions if they are not completely combusted in the boiler.

Sulfur Oxides -

Emissions of SO_2 from natural gas-fired boilers are low because pipeline quality natural gas typically has sulfur levels of 2,000 grains per million cubic feet. However, sulfur-containing odorants are added to natural gas for detecting leaks, leading to small amounts of SO_2 emissions. Boilers combusting unprocessed natural gas may have higher SO_2 emissions due to higher levels of sulfur in the natural gas. For these units, a sulfur mass balance should be used to determine SO_2 emissions.

Particulate Matter -

Because natural gas is a gaseous fuel, filterable PM emissions are typically low. Particulate matter from natural gas combustion has been estimated to be less than 1 micrometer in size and has filterable and condensable fractions. Particulate matter in natural gas combustion are usually larger molecular weight hydrocarbons that are not fully combusted. Increased PM emissions may result from poor air/fuel mixing or maintenance problems.

Greenhouse Gases -[6-9]

CO_2, CH_4, and N_2O emissions are all produced during natural gas combustion. In properly tuned boilers, nearly all of the fuel carbon (99.9 percent) in natural gas is converted to CO_2 during the combustion process. This conversion is relatively independent of boiler or combustor type. Fuel carbon not converted to CO_2 results in CH_4, CO, and/or VOC emissions and is due to incomplete combustion. Even in boilers operating with poor combustion efficiency, the amount of CH_4, CO, and VOC produced is insignificant compared to CO_2 levels.

Formation of N_2O during the combustion process is affected by two furnace-zone factors. N_2O emissions are minimized when combustion temperatures are kept high (above 1475°F) and excess oxygen is kept to a minimum (less than 1 percent).

Methane emissions are highest during low-temperature combustion or incomplete combustion, such as the start-up or shut-down cycle for boilers. Typically, conditions that favor formation of N_2O also favor emissions of methane.

1.4.4 Controls[4,10]

NO_x Controls -

Currently, the two most prevalent combustion control techniques used to reduce NO_x emissions from natural gas-fired boilers are flue gas recirculation (FGR) and low NO_x burners. In an FGR system, a portion of the flue gas is recycled from the stack to the burner windbox. Upon entering the windbox, the recirculated gas is mixed with combustion air prior to being fed to the burner. The recycled flue gas consists of combustion products which act as inerts during combustion of the fuel/air mixture. The FGR system reduces NO_x emissions by two mechanisms. Primarily, the recirculated gas acts as a dilutent to reduce combustion temperatures, thus suppressing the thermal NO_x mechanism. To a lesser extent, FGR also reduces NO_x formation by lowering the oxygen concentration in the primary flame zone. The amount of recirculated flue gas is a key operating parameter influencing NO_x emission rates for these systems. An FGR system is normally used in combination with specially designed low NO_x burners capable of sustaining a stable flame with the increased inert gas flow resulting from the use of FGR. When low NO_x burners and FGR are used in combination, these techniques are capable of reducing NO_x emissions by 60 to 90 percent.

Low NO_x burners reduce NO_x by accomplishing the combustion process in stages. Staging partially delays the combustion process, resulting in a cooler flame which suppresses thermal NO_x formation. The two most common types of low NO_x burners being applied to natural gas-fired boilers are staged air burners and staged fuel burners. NO_x emission reductions of 40 to 85 percent (relative to uncontrolled emission levels) have been observed with low NO_x burners.

Other combustion control techniques used to reduce NO_x emissions include staged combustion and gas reburning. In staged combustion (e.g., burners-out-of-service and overfire air), the degree of staging is a key operating parameter influencing NO_x emission rates. Gas reburning is similar to the use of overfire in the use of combustion staging. However, gas reburning injects additional amounts of natural gas in the upper furnace, just before the overfire air ports, to provide increased reduction of NO_x to NO_2.

Two postcombustion technologies that may be applied to natural gas-fired boilers to reduce NO_x emissions are selective noncatalytic reduction (SNCR) and selective catalytic reduction (SCR). The SNCR system injects ammonia (NH_3) or urea into combustion flue gases (in a specific temperature zone) to reduce NO_x emission. The Alternative Control Techniques (ACT) document for NO_x emissions from utility boilers, maximum SNCR performance was estimated to range from 25 to 40 percent for natural gas-fired boilers.[12] Performance data available from several natural gas fired utility boilers with SNCR show a 24 percent reduction in NO_x for applications on wall-fired boilers and a 13 percent reduction in NO_x for applications on tangential-fired boilers.[11] In many situations, a boiler may have an SNCR system installed to trim NO_x emissions to meet permitted levels. In these cases, the SNCR system may not be operated to achieve maximum NO_x reduction. The SCR system involves injecting NH_3 into the flue gas in the presence of a catalyst to reduce NO_x emissions. No data were available on SCR performance on natural gas fired boilers at the time of this publication. However, the ACT Document for utility boilers estimates NO_x reduction efficiencies for SCR control ranging from 80 to 90 percent.[12]

Emission factors for natural gas combustion in boilers and furnaces are presented in Tables 1.4-1, 1.4-2, 1.4-3, and 1.4-4.[11] Tables in this section present emission factors on a volume basis (lb/10^6 scf). To convert to an energy basis (lb/MMBtu), divide by a heating value of 1,020 MMBtu/10^6 scf. For the purposes of developing emission factors, natural gas combustors have been organized into three general categories: large wall-fired boilers with greater than 100 MMBtu/hr of heat input, boilers and residential furnaces with less than 100 MMBtu/hr of heat input, and tangential-fired boilers. Boilers within these categories share the same general design and operating characteristics and hence have similar emission characteristics when combusting natural gas.

Emission factors are rated from A to E to provide the user with an indication of how "good" the factor is, with "A" being excellent and "E" being poor. The criteria that are used to determine a rating for an emission factor can be found in the Emission Factor Documentation for AP-42 Section 1.4 and in the introduction to the AP-42 document.

1.4.5 Updates Since the Fifth Edition

The Fifth Edition was released in January 1995. Revisions to this section are summarized below. For further detail, consult the Emission Factor Documentation for this section. These and other documents can be found on the Emission Factor and Inventory Group (EFIG) home page (http://www.epa.gov/ttn/chief).

Supplement D, March 1998

- Text was revised concerning Firing Practices, Emissions, and Controls.
- All emission factors were updated based on 482 data points taken from 151 source tests. Many new emission factors have been added for speciated organic compounds, including hazardous air pollutants.

July 1998 - minor changes

- Footnote D was added to table 1.4-3 to explain why the sum of individual HAP may exceed VOC or TOC, the web address was updated, and the references were reordered.

Table 1.4-1. EMISSION FACTORS FOR NITROGEN OXIDES (NO_x) AND CARBON MONOXIDE (CO) FROM NATURAL GAS COMBUSTION[a]

Combustor Type (MMBtu/hr Heat Input) [SCC]	NO_x[b]		CO	
	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating
Large Wall-Fired Boilers (>100) [1-01-006-01, 1-02-006-01, 1-03-006-01]				
Uncontrolled (Pre-NSPS)[c]	280	A	84	B
Uncontrolled (Post-NSPS)[c]	190	A	84	B
Controlled - Low NO_x burners	140	A	84	B
Controlled - Flue gas recirculation	100	D	84	B
Small Boilers (<100) [1-01-006-02, 1-02-006-02, 1-03-006-02, 1-03-006-03]				
Uncontrolled	100	B	84	B
Controlled - Low NO_x burners	50	D	84	B
Controlled - Low NO_x burners/Flue gas recirculation	32	C	84	B
Tangential-Fired Boilers (All Sizes) [1-01-006-04]				
Uncontrolled	170	A	24	C
Controlled - Flue gas recirculation	76	D	98	D
Residential Furnaces (<0.3) [No SCC]				
Uncontrolled	94	B	40	B

[a] Reference 11. Units are in pounds of pollutant per million standard cubic feet of natural gas fired. To convert from $lb/10^6$ scf to $kg/10^6$ m^3, multiply by 16. Emission factors are based on an average natural gas higher heating value of 1,020 Btu/scf. To convert from $lb/10^6$ scf to lb/MMBtu, divide by 1,020. The emission factors in this table may be converted to other natural gas heating values by multiplying the given emission factor by the ratio of the specified heating value to this average heating value. SCC = Source Classification Code. ND = no data. NA = not applicable.

[b] Expressed as NO_2. For large and small wall fired boilers with SNCR control, apply a 24 percent reduction to the appropriate NO_X emission factor. For tangential-fired boilers with SNCR control, apply a 13 percent reduction to the appropriate NO_X emission factor.

[c] NSPS=New Source Performance Standard as defined in 40 CFR 60 Subparts D and Db. Post-NSPS units are boilers with greater than 250 MMBtu/hr of heat input that commenced construction modification, or reconstruction after August 17, 1971, and units with heat input capacities between 100 and 250 MMBtu/hr that commenced construction modification, or reconstruction after June 19, 1984.

TABLE 1.4-2. EMISSION FACTORS FOR CRITERIA POLLUTANTS AND GREENHOUSE GASES FROM NATURAL GAS COMBUSTION[a]

Pollutant	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating
CO_2[b]	120,000	A
Lead	0.0005	D
N_2O (Uncontrolled)	2.2	E
N_2O (Controlled-low-NO_X burner)	0.64	E
PM (Total)[c]	7.6	D
PM (Condensable)[c]	5.7	D
PM (Filterable)[c]	1.9	B
SO_2[d]	0.6	A
TOC	11	B
Methane	2.3	B
VOC	5.5	C

[a] Reference 11. Units are in pounds of pollutant per million standard cubic feet of natural gas fired. Data are for all natural gas combustion sources. To convert from $lb/10^6$ scf to $kg/10^6$ m^3, multiply by 16. To convert from $lb/10^6$ scf to 1b/MMBtu, divide by 1,020. The emission factors in this table may be converted to other natural gas heating values by multiplying the given emission factor by the ratio of the specified heating value to this average heating value. TOC = Total Organic Compounds. VOC = Volatile Organic Compounds.

[b] Based on approximately 100% conversion of fuel carbon to CO_2. $CO_2[lb/10^6 \text{ scf}] = (3.67)(CON)(C)(D)$, where CON = fractional conversion of fuel carbon to CO_2, C = carbon content of fuel by weight (0.76), and D = density of fuel, 4.2×10^4 $lb/10^6$ scf.

[c] All PM (total, condensible, and filterable) is assumed to be less than 1.0 micrometer in diameter. Therefore, the PM emission factors presented here may be used to estimate PM_{10}, $PM_{2.5}$ or PM_1 emissions. Total PM is the sum of the filterable PM and condensible PM. Condensible PM is the particulate matter collected using EPA Method 202 (or equivalent). Filterable PM is the particulate matter collected on, or prior to, the filter of an EPA Method 5 (or equivalent) sampling train.

[d] Based on 100% conversion of fuel sulfur to SO_2.
Assumes sulfur content is natural gas of 2,000 grains/10^6 scf. The SO_2 emission factor in this table can be converted to other natural gas sulfur contents by multiplying the SO_2 emission factor by the ratio of the site-specific sulfur content (grains/10^6 scf) to 2,000 grains/10^6 scf.

TABLE 1.4-3. EMISSION FACTORS FOR SPECIATED ORGANIC COMPOUNDS FROM NATURAL GAS COMBUSTION[a]

CAS No.	Pollutant	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating
91-57-6	2-Methylnaphthalene[b, c]	2.4E-05	D
56-49-5	3-Methylcholanthrene[b, c]	<1.8E-06	E
	7,12-Dimethylbenz(a)anthracene[b,c]	<1.6E-05	E
83-32-9	Acenaphthene[b,c]	<1.8E-06	E
203-96-8	Acenaphthylene[b,c]	<1.8E-06	E
120-12-7	Anthracene[b,c]	<2.4E-06	E
56-55-3	Benz(a)anthracene[b,c]	<1.8E-06	E
71-43-2	Benzene[b]	2.1E-03	B
50-32-8	Benzo(a)pyrene[b,c]	<1.2E-06	E
205-99-2	Benzo(b)fluoranthene[b,c]	<1.8E-06	E
191-24-2	Benzo(g,h,i)perylene[b,c]	<1.2E-06	E
207-08-9	Benzo(k)fluoranthene[b,c]	<1.8E-06	E
106-97-8	Butane	2.1E+00	E
218-01-9	Chrysene[b,c]	<1.8E-06	E
53-70-3	Dibenzo(a,h)anthracene[b,c]	<1.2E-06	E
25321-22-6	Dichlorobenzene[b]	1.2E-03	E
74-84-0	Ethane	3.1E+00	E
206-44-0	Fluoranthene[b,c]	3.0E-06	E
86-73-7	Fluorene[b,c]	2.8E-06	E
50-00-0	Formaldehyde[b]	7.5E-02	B
110-54-3	Hexane[b]	1.8E+00	E
193-39-5	Indeno(1,2,3-cd)pyrene[b,c]	<1.8E-06	E
91-20-3	Naphthalene[b]	6.1E-04	E
109-66-0	Pentane	2.6E+00	E
85-01-8	Phenanathrene[b,c]	1.7E-05	D
74-98-6	Propane	1.6E+00	E

TABLE 1.4-3. EMISSION FACTORS FOR SPECIATED ORGANIC COMPOUNDS FROM NATURAL GAS COMBUSTION (Continued)

CAS No.	Pollutant	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating
129-00-0	Pyrene[b, c]	5.0E-06	E
108-88-3	Toluene[b]	3.4E-03	C

[a] Reference 11. Units are in pounds of pollutant per million standard cubic feet of natural gas fired. Data are for all natural gas combustion sources. To convert from $lb/10^6$ scf to $kg/10^6$ m^3, multiply by 16. To convert from $1b/10^6$ scf to lb/MMBtu, divide by 1,020. Emission Factors preceeded with a less-than symbol are based on method detection limits.

[b] Hazardous Air Pollutant (HAP) as defined by Section 112(b) of the Clean Air Act.

[c] HAP because it is Polycyclic Organic Matter (POM). POM is a HAP as defined by Section 112(b) of the Clean Air Act.

[d] The sum of individual organic compounds may exceed the VOC and TOC emission factors due to differences in test methods and the availability of test data for each pollutant.

TABLE 1.4-4. EMISSION FACTORS FOR METALS FROM NATURAL GAS COMBUSTION[a]

CAS No.	Pollutant	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating
7440-38-2	Arsenic[b]	2.0E-04	E
7440-39-3	Barium	4.4E-03	D
7440-41-7	Beryllium[b]	<1.2E-05	E
7440-43-9	Cadmium[b]	1.1E-03	D
7440-47-3	Chromium[b]	1.4E-03	D
7440-48-4	Cobalt[b]	8.4E-05	D
7440-50-8	Copper	8.5E-04	C
7439-96-5	Manganese[b]	3.8E-04	D
7439-97-6	Mercury[b]	2.6E-04	D
7439-98-7	Molybdenum	1.1E-03	D
7440-02-0	Nickel[b]	2.1E-03	C
7782-49-2	Selenium[b]	<2.4E-05	E
7440-62-2	Vanadium	2.3E-03	D
7440-66-6	Zinc	2.9E-02	E

[a] Reference 11. Units are in pounds of pollutant per million standard cubic feet of natural gas fired. Data are for all natural gas combustion sources. Emission factors preceeded by a less-than symbol are based on method detection limits. To convert from $lb/10^6$ scf to $kg/10^6$ m^3, multiply by l6. To convert from $lb/10^6$ scf to 1b/MMBtu, divide by 1,020.

[b] Hazardous Air Pollutant as defined by Section 112(b) of the Clean Air Act.

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Combustion of Fuels - Carbon Dioxide Emission

Environmental emission of carbon dioxide CO_2 when combustion fuels like coal, oil, natural gas, LPG and bio energy

To calculate the Carbon Dioxide - CO_2 - emission from a fuel, the carbon content of the fuel must be multiplied with the ratio of molecular weight of CO_2 (44) to the molecular weight of Carbon (12) -> 44 / 12 = 3.7

Carbon Dioxide emission from burning a fuel can be calculated as

$$q_{CO2} = c_f / h_f \; M_{CO2} / M_m \qquad [1]$$

where

q_{CO2} = specific CO_2 emission [kg_{CO2}/kWh]
c_f = specific carbon content in the fuel [kg_C/kg_{fuel}]
h_f = specific energy content in the fuel [kWh/kg_{fuel}]
M_C = Molecular weight Carbon [kg/kmol Carbon]
M_{CO2} = Molecular weight Carbon Dioxide [kg/kmol CO_2]

Emission of CO_2 from combustion of some common fuels are indicated in the table below.

Note! Heat loss - 55-75% - in power generation is not included in the numbers.

See also Heat of combustion , Fuels - Higher and Lower Calorific Values and Fossil and alternative fuels - energy content .

Fuel	Liquid density	Specific carbon content	Specific Energy content		Specific CO_2 emission (amount of fuel basis)			Specific CO_2 emission (amount of energy basis)		
	kg/l	kg_C/kg_{fuel}	kWh/kg_{fuel}	Btu/lb_{fuel}	Kg_{CO2}/kg_{fuel}	Kg_{CO2}/gal_{fuel}	lb_{CO2}/gal_{fuel}	kg_{CO2}/kWh	kg_{CO2}/GJ	lb_{CO2}/mill Btu

Fuel	Liquid density	Specific carbon content	Specific Energy content		Specific CO_2 emission (amount of fuel basis)			Specific CO_2 emission (amount of energy basis)		
	kg/l	kg_C/kg_{fuel}	kWh/kg_{fuel}	Btu/lb_{fuel}	Kg_{CO2}/kg_{fuel}	Kg_{CO2}/gal_{fuel}	lb_{CO2}/gal_{fuel}	kg_{CO2}/kWh	kg_{CO2}/GJ	$lb_{CO2}/mill\ Btu$
Methane (natural gas)		0.75	15.4	23900	2.75			0.18	50	115
Propane	0.510	0.82	13.8	21300	2.99	5.78	12.7	0.22	60	140
Butane	0.564	0.83	13.6	21100	3.03	6.47	14.3	0.22	62	144
LPG (wt of C3=C4)	0.537	0.82	13.7	21200	3.01	6.12	13.5	0.22	61	142
Gasoline	0.737	0.90	12.9	19900	3.30	9.20	20.3	0.26	71	165.3
Kerosene (Jet)	0.821	0.82	12.0	18500	3.00	9.33	20.6	0.25	70	162.5
Diesel	0.846	0.86	12.7	19605	3.15	10.1	22.3	0.25	69	160.8
Heavy fuel oil (No.6/Bunker C)	0.980	0.85	11.6	18000	3.11	11.6	25.5	0.27	75	173.3
Petroleum coke		0.89	9.4	14500	3.26	14.7	32.4	0.35	97	225.1
Coal:										227.3
Anthracite		0.92	9.0	14000	3.37			0.37	104	229.5
Bituminous		0.65	8.4	13000	2.38			0.28	79	231.7
Subbituminous		0.4	6.8	10500	1.47			0.22	60	233.9
Lignite		0.3	3.9	6000	1.10			0.28	79	236.1
Coke		0.77	7.2	11200	2.82			0.39	108	251.5
Peat (dry)[1)]		0.52	4.7	7300	1.91			0.40	112	260.7
Ethanol fuel (E100)[2)]	0.789	0.52	8.3	12800	1.91	5.71	12.6	0.23	64	149.6
Methanol fuel (M100)[2)]	0.791	0.37	5.5	8500	1.37	4.11	9.1	0.25	70	162.2
Biodiesel (B100)[2)]	0.880	0.78	11.3	17400	2.85	9.48	20.9	0.25	70	162.8
Wood [1) 2)]		0.50	4.5	7000	1.83			0.41	113	263.1
Bio energy [2)]								0 [2)]		

[1)] Commonly viewed as a Bio fuel.

[2)] Bio Energy is produced from biomass derived from any renewable organic plant, including

- dedicated energy crops and trees
- agricultural food and feed crops
- agricultural crop wastes and residues
- wood wastes
- aquatic plants

- animal wastes
- municipal wastes and other waste materials

Emissions of CO_2 can contribute to climate change. Combustion of bio energy don't add to the total emission of carbon dioxide as long as the burned bio mass don't exceed the renewed production (within a reasonable time), or it is not transformed in processes requiring CO_2-forming energy. The recycling of carbon from wood combustion is virtually instantaneous and continuous and it is also common to regard the net supply of CO_2 to the atmosphere from combustion of wood close to zero.

If the time of renewed production of the organic material is long (typically 50 year++), the the positive climate effect can be questioned. The renewed production rate of wood and peat varies with geography and climate.

A variety of **bio fuels** can be made from bio mass resources, including

- ethanol
- methanol
- biodiesel
- Fischer-Tropsch diesel
- gaseous fuels like hydrogen or methane

Production of all these bio fuels requires energy, and the total CO_2 gain depend on how much CO_2-releasing energy that is necessary to transform the bio mass to bio fuel. Biodiesel production via Fischer-Tropsch synthesis is typically a high energy demanding process, and the CO_2 gain compared to conventional diesel is low if the processing is run with energy with high CO_2 emissions.

Related Topics

- **Environment** - Climate, meteorology, sun, wind and environmental resources
- **Combustion** - Boiler house topics - fuels like oil, gas, coal, wood - chimneys, safety valves, tanks - combustion efficiency
- **Material Properties** - Material properties for gases, fluids and solids - densities, specific heats, viscosities and more

Related Documents

- **Alternative Fuels Properties** - Properties of alternative fuels like Biodiesel, E85, CNG and more
- **Atmospheric Carbon Dioxide Concentration** - Annual Carbon Dioxide concentration 1959 - 2015
- **Carbon dioxide - Density and Specific Weight** - Online calculator, figures and tables showing density and specific weight of carbon dioxide, CO_2, at temperatures ranging from -50 to 775 °C (-50 to 1400 °F) at atmospheric and higher pressure - Imperial and SI Units
- **Carbon dioxide - Prandtl Number** - Figures and table showing changes in Prandtl number for carbon dioxide with changes in temperature and pressure

- **Carbon Dioxide - Thermophysical Properties** - Chemical, physical and thermal properties of carbon dioxide. Phase diagram included.
- **Carbon Dioxide Properties** - Properties of saturated liquid Carbon Dioxide - CO_2 - density, specific heat, kinematic viscosity, thermal conductivity and Prandtl number
- **Carbon Dioxide Properties - Imperial Units** - Properties of saturated liquid Carbon Dioxide - CO_2 - density, specific heat, kinematic viscosity, thermal conductivity and Prandtl number
- **Classification of Coal** - Classification of coal based on volatile matter and cooking power of clean material
- **CO_2 Calculator - Emissions from Trains** - Calculator for CO_2 emissions from trains, comparing with alternative forms of transportation (as plane, bus, conventional and electrical cars)
- **CO_2 Calculator - Emissions from Airplanes** - Calculator for CO_2 emissions from planes, comparing with alternative forms of transportation (as train, bus, conventional and electrical cars)
- **CO_2 Calculator - Emissions from Cars** - Calculator for CO_2 emissions from different kind of cars (gasoline, diesel, LPG, electrical), comparing with alternative forms of transportation (as airplane, bus and train)
- **Combustion Efficiency and Excess Air** - Optimizing boilers efficiency is important to minimize fuel consumption and unwanted excess to the environment
- **Combustion of Fuels and Nitrogen Oxides (NO_x) Emission** - Emission of Nitrogen Oxides - NO_x - with combustion of fuels like oil, coal, propane and more
- **Energy Content in Biomasses used as Fuel** - Some biom fuels and their energy content
- **Fossil and Alternative Fuels Energy Content** - Listing of net (low) and gross (high) energy content in fossil and alternative fuels, together with a description of energy content measurement
- **Fuel Consumption Converter** - Convert between fuel consumption units like *US MPG, Imperial MPG, litre/nm, litre/100 km* and *km/litre*
- **Fuels - Combustion Air and Flue Gases** - Combustion air and flue gas for common fuels - coke, oil, wood, natural gas and more
- **Fuels - Higher and Lower Calorific Values** - Higher and lower calorific values (heating values) for some common fuels - coke, oil, wood, hydrogen and others
- **Gas Vent Termination - Clearance Tolerances** - Clearance tolerance per roof slope for gas vent terminations - vent caps
- **Gaseous Fuels and their Chemical Composition** - Chemical composition of some common gaseous fuels - like coal gas, natural gas, propane and more
- **Heat, Work and Energy** - Heat, work and energy tutorial - essentials as specific heat
- **Heating Fuels - Comparing Costs** - Cost comparison formulas for heating fuels like Natural Gas, Propane LP Gas, Fuel Oil and Electricity
- **Optimal Combustion Process - Fuels and Excess Air** - Stable and efficient combustion conditions require correct mixture of fuels and oxygen
- **Paraffins and Alkanes - Combustion Properties** - Heating values, air/fuel ratios, flame speed, flame temperatures, ignition temperatures, flash points and flammability limits
- **Standard Grade Coal - Heat Value** - Standard grades coal and heating values
- **Waste Fuel** - Heat values of fuel from waste products

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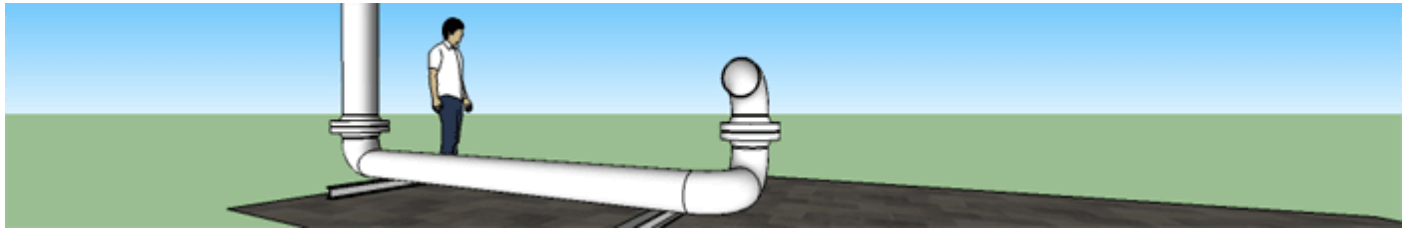

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ZEF™ Elevated Flare System

Budgetary Technical and Commercial Proposal

Prepared for:

Tressa Bathke
of
Bioenergy Devco

For:
Seaford, Delaware

Date:
August 20, 2021

John Zink reference number: 202108-186114REVA

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JOHN ZINK HAMWORTHY COMBUSTION®

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EXECUTIVE SUMMARY

Scope:..... John Zink ZEF™ Elevated Flare and Blower Skid

Price: $193,000
Submittal Schedule:..... 6-8 weeks after purchase order acceptance
Customer Approval Schedule:.....1 week after receipt of submittals
Fabrication Schedule: ..... 14-16 weeks after receiving approved submittal

INTRODUCTION

To satisfy your digester gas flare requirements per your recent request, John Zink Company is pleased to offer a budget quote for our **ZEF™ Elevated Flare System.**

For over 80 years, the John Zink brand has ensured quality, innovative technology, and worldwide service in the combustion industry. John Zink has supplied **over 800 flare systems** for the biogas industry, giving us unparalleled expertise. Each flare system is made in our own 330,000 square foot manufacturing facility; and **we possess the resources to care for your flare at every stage of life**: from installation and startup of new flares, to repair and retrofits of existing flares. Our national network of sales representatives and field technicians means you will always have someone available to assist you in any issues that may arise with your flare, and our portable rental units and spare parts inventory can ensure continued compliance and quick turnaround in case of flare shutdown.

John Zink offers a range of features and options as listed in this proposal. Our intent is to supply the safest, most reliable and economical system available that will also allow you to customize your system to meet your specific needs. After reviewing the proposal, please let us know if there are any additional options you would like to pursue.

We look forward to working with you on this project, and if you require any additional information please do not hesitate to contact me at (918) 234-2718 or our local sales representative, David Ryan, at (610) 517-2400.

DESIGN CRITERIA

Flare Gas Stream

Type: ..... digester gas
Composition: ..... 58% CH_4 (design); 50 to 62% CH_4 (range)
balance CO_2, air, inerts, less than 5% O_2
Lower Heating Value: ..... 528 BTU/SCF (design)
455 BTU/SCF to 564 BTU/SCF (range)
Temperature: ..... 100°F
Flow Rate: ..... 1,601 SCFM (design normalized at 58% CH_4)
310 SCFM (minimum without continuous pilot)
Heat Release: ..... 50.7 MMBTU/hr (design at 58% CH_4)

NOTE: *Hydrogen sulfide concentrations greater than 3,000 ppm may require special materials with potential commercial impact.*

Mechanical

Design Wind Speed (ASCE 7-95; EXP C): ..... 120 mph
Design Seismic (UBC-1994): ..... Zone 4
Ambient Temperature: ..... 0°F to 100 °F
Ambient Pressure: ..... 14.7 psia
Elevation: ..... Approx 20 feet above sea level
Electrical Area Classification: ..... Class 1 Div 2 Group D (flare and skid)

NOTE: *Heat tracing and insulating (by others) recommended to protect against freezing.*

Process

Smokeless Capacity: 100%
Required Flame Arrester Inlet Pressure: ..... 5 inches of H_2O (design)

NOTE: *Low methane concentrations may require auxiliary fuel to initiate combustion and maintain temperature.*

Utilities

Pilot Gas (intermittent): ..... 22 SCFH of propane at 7-10 psig (or)
50 SCFH of natural gas at 10-15 psig
Compressed Air (or Nitrogen): ..... 100 PSIG (regulated, clean and dry)
Electricity: ..... 480 V, 3 phase, 60 Hz for motor control;
transformer provided for 120 V, single phase
for control system components
Auxiliary Fuel: ..... none (pilot only)

EQUIPMENT DETAILS

FLARE

Quantity: ..... one (1)
Material:
Riser: ..... carbon steel
Flare Tip: ..... 304 stainless steel (top 5 feet)
Windshield: ..... 310 stainless steel
Nominal Diameter: ..... 10 in.
Nominal Stack Height: ..... 30 ft.
Inlet Diameter: ..... 10 in.
EEP Pilot Ignition: ..... 6000 V electronic spark ignitor; NEMA 7 ignition panel
Pilot Confirmation: ..... one (1) type K thermocouple
Main Flame Confirmation: ..... two (2) type K thermocouples
Structural Anchoring: ..... AISC continuous base plate
Lifting Lugs: ..... two (2)

SKID MOUNTED EQUIPMENT

Moisture Separator:

Quantity: ..... one (1)
Orientation: ..... vertical
Diameter: ..... 2 ft.
Height: ..... 8 ft.
Separator Material: ..... HDPE
Element Material: ..... 304 stainless steel
Design pressure: ..... ±5 psig
Inlet/Outlet Diameter: ..... 10 in.
Monitoring Equipment:
Sight Glass: ..... one (1)
Differential pressure gauge: ..... one (1)

Blowers:

Quantity: ..... one (1)
Manufacturer: ..... New York Blower (or equal)
Flow at design pressure: ..... 1,601 SCFM each
Inlet Suction: ..... -3 inches of H_2O
Outlet Pressure: ..... 10 inches of H_2O
Motor Power: ..... 7.5 HP
Motor Enclosure: ..... TEFC (NEMA)
Motor Control: ..... variable frequency drive (see below for additional details)
Inlet Attachments:

Manual butterfly valve:
- Quantity: ..... one (1) per blower inlet
- Diameter: ..... 10 in.
- Style: ..... wafer
- Body material: ..... ductile iron
- Disk: ..... 316 stainless steel
- Seat: ..... nitrile
- Manufacturer: ..... Bray (or equal)

Flexible expansion joint ..... one (1) per blower inlet
Bearing Thermocouple: ..... one (1) per blower inlet

Outlet Attachments:
Manual butterfly valve:
- Quantity: ..... one (1) per blower inlet
- Diameter: ..... 10 in.
- Style: ..... wafer
- Body material: ..... ductile iron
- Disk: ..... 316 stainless steel
- Seat: ..... nitrile
- Manufacturer: ..... Bray (or equal)

Flexible expansion joint: ..... one (1) per blower outlet
Bearing Thermocouple: ..... one (1) per blower outlet

Automatic Block Valve:

Quantity: ..... one (1)
Diameter: ..... 10 in.
Style: ..... wafer
Actuator: ..... pneumatic, fail closed
Body material: ..... carbon steel
Disk: ..... 316 stainless steel
Seat: ..... PTFE
Manufacturer: ..... Xomox (or equal)

Automatic Ignition and Control Station:

Panel Rack: ..... one (1); including the following:
Power Disconnect ..... one (1) [480V]
Power transformer: ..... 480V to 120V
Control Panel:
- Quantity ..... one (1)
- Enclosure ..... weatherproof
- Classified Area Operation: ..... Z-purge panel
- Certification ..... Underwriters Laboratory
- PLC ..... Allen Bradley Micrologix 1400
- Operator Touchscreen ..... 8” C-More (or equal) Color Operator Interface Panel
- Data Recorder ..... Yokogawa 6 channel recorder
- Emergency Stop Button ..... one (1)

Variable Frequency Drive:

Quantity ..... one (1) per blower
Enclosure ..... NEMA 3R
VFD Power ..... 7.5 HP
Drive Manufacturer ..... FUJI (or equal)

Skid Piping:

Material: ..... 304 stainless steel
Skid Inlet Pipe Diameter: ..... 10 in.
Skid Outlet Pipe Diameter: ..... 10 in.

NOTE: *Piping provided on blower skid only. Field piping is provided by others.*

SHIPPED LOOSE EQUIPMENT

Flame Arrester:

Quantity: ..... one (1)
Manufacturer: ..... Enardo (or equal)
Diameter: ..... 10 in.
Style: ..... eccentric
Housing material: ..... 304 stainless steel
Internals material: ..... 304 stainless steel
Internals monitoring:
Thermocouple ..... one (1) type K thermocouple for high temperature shutdown

Flow Meter:

Quantity: ..... one (1)
Type: ..... thermal mass
Probe material: ..... 304 stainless steel, Teflon coated
Manufacturer: ..... Thermal Instruments (or equal)

Ancillary Equipment:

Vacuum Transmitter: ..... one (1), for VFD control
Pilot Gas Spool: ..... one (1) including, ½" piping, solenoid valve, pressure regulator, manual valve, pressure gauge
Thermocouple Wire: ..... 400 ft.
Ignition Wire: ..... 25 ft.

Included Field Service:

Technicians: ..... one (1)
Trips: ..... three (3), totaling four (4) 10-hr days onsite

NOTE: *Days onsite are assumed to be normal business days.*
NOTE: *Additional days if required are per attached technical service contract rate sheet.*

JOHN ZINK FABRICATION STANDARDS

Packaging, Factory Test

The blower skid assembly and control panel will be packaged to include piping, electrical wiring, conduit, paint, and other miscellaneous materials requiring only minor field assembly. A shop functional test of the packaged control panel assembly is included.

Paint

Flare exterior protected with a commercial blast surface preparation (SSPC-SP-6) and one coat of inorganic zinc rich primer (one coat, 2.0-4.0 mil DFT).

Skid steel is galvanized or protected with one coat of inorganic zinc rich primer (one coat, 2.0-4.0 mils DFT).

Purchased components protected with factory product coating only. None required for stainless steel surfaces.

Operations & Maintenance Manual

John Zink will provide an operations & maintenance (O&M) manual available via the John Zink FTP site. The O&M manual will include essential operating instructions, appropriate vendor literature on instrumentation and drawings.

ESTIMATED EQUIPMENT DIMENSIONS AND WEIGHTS

ZEF1030 Elevated Flare:.....18” (baseplate diameter) x 34.5’ (height)
1,700 lb in weight

Blower skid:..... 15’ (length) x 10’ (height) x 8’ (width)
7,000 lb in weight

PERFORMANCE

Expected Emission Range (Design Flow)[1]

Overall Destruction Efficiency[2]	98%
NOx, lb / MM BTU[3]	0.068
CO, lb / MM BTU[4]	0.31
VOC, lb /MM BTU[5]	98% DRE

[1] Emissions and destruction efficiency stated are based on EPA 40 CFR 60.18 and AP-42 5th edition, Section 13.5.
[2] Typical sulphur containing compounds are expected to have greater than 98% oxidation efficiency.
[3] Excludes NOx from fixed nitrogen.
[4] Excludes CO contribution present in the gas.
[5] VOC emissions will be the lesser of 98% DRE or 0.66 lbs/MMBTU.

NOTE: *Destruction efficiency, NOx, and CO emissions shown are valid for combustion of specified gas only. Expected emissions are not guaranteed unless expressly stated elsewhere in this proposal.*

RECOMMENDED OPTIONAL EQUIPMENT

Item 1, Standard Communications

John Zink has currently not included provisions for controls communications. If communications are required John Zink can provide our standard communications list (see below).

Communication..... via dry contact
signals:..... remote start/stop (discrete signal)
gas flow in SCFM (analog signal)
flare temperature in degrees F (analog signal)

If additional signals are desired, please let us know what specific signals are needed so that we can evaluate commercial impact.

Item 2, InSite - John Zink Remote Monitoring System

InSite is a proprietary remote monitoring system that utilizes a cellular signal to transmit flare operations data to end users regardless of their proximity to the flare. Will provide alerts if an alarm is triggered, minimizing potential downtime. Includes one year of cellular service.
John Zink may provide [Customer] with software or firmware (collectively, "Software") pursuant to this proposal. Such Software is provided is "as-is" and under a non-exclusive, non-transferable license only. [Customer] will have no ownership rights in the Software.

Item 3, Control Panel Weather Hood

This fabricated steel hood is designed to limit control panel exposure to the elements. It provides approximately 4' of overhang to the front and 2' to the rear. The hood is painted to match the rest of the control panel rack and comes with an LED light assembly for enhanced visibility of the panel components at night.

Item 4, Estimated Shipping

CPT – Jobsite

PROCESS DESCRIPTION

Operation begins when power is applied to the system. First, gas flows to the pilot and a spark is generated to ignite the pilot flame. The automatic mode attempts to light the pilot three times. At the end of these three attempts "Pilot Flame Failure" will be illuminated and the operator will have to press the reset push-button to restart the unit. Upon proving the pilot flame with the thermocouple, the automatic block valve is opened and the gas blower is started, allowing gas flow to the flare. A thermocouple at the flare tip proves the main flame is lit.

After the automatic block valve is opened, the pilot gas is discontinued after a timed delay to limit utility gas usage. If the main flame is detected at the flare tip, the system continues operation otherwise it is shut down by flame failure. To prevent the potential of flashback beyond the flare system, a high temperature detected by the temperature switch located at the flare inlet also discontinues system operation

Due to the presence of an open flame, the flare system typically is located in an electrical area classified "non-hazardous".

PRICING

Budgetary Price for Quoted Scope: $193,000

(does not include shipping or taxes)

Recommended Optional Equipment Pricing

1.	Standard Communications	price available upon request
2.	One (1) Data Recorder	$4,500
3.	One (1) InSite – John Zink Remote Monitoring System	$6,000
4.	One (1) Control Panel Weather Hood	$2,500
5.	Estimated Shipping	price available upon request

John Zink Field Service for start-up, training, or testing assistance is available per the attached rate sheet.

PAYMENT AND TERMS SUMMARY

This is a budgetary proposal and is intended only as an estimate to facilitate your planning processes and does not constitute a commitment or offer to sell goods or services at the prices and terms referenced herein. Any firm offer or binding quotation will be the subject of a formal proposal at a future date and will be subject to restricted party screening and the full disclosure of the parties involved, including but not limited to the end-user and ultimate destination.

The shipping terms are EX WORKS point of manufacture. The price does not include any shipping and handling, customs, duties, or any taxes other than John Zink's contributions for unemployment insurance, old age retirement benefits, pensions, and annuities.

The price is based on the following terms of payment (all payments NET 30):

- 15% of order invoiced upon acceptance of the order
- 50% of order price invoiced upon issuance of general arrangement drawings
- 35% of order price **due** upon notification of availability for shipment*

*This payment is required in full prior to shipment or secure with a bank letter of credit. Payment is required in United States currency. A guaranteed form of payment acceptable to John Zink, such as, corporate or personal guarantees, payment by a confirmed, irrevocable letter of credit, or by three-party check may be required by John Zink.

DELIVERY SCHEDULE

Based on a release to purchase major materials at the time an order is accepted, John Zink offers the following delivery schedule:

Customer submittal:	6-8 weeks after acceptance of the order
Customer approval:	1 week for review and approval, after receipt of submittals
Completion of fabrication:	14-16 weeks after drawing approval

An improved schedule may be arranged based on specific project requirements.

Shipping will be via common carrier. Portions of the unit will be shipped loose to reduce shipping costs and damage to the unit.

OTHER CONDITIONS

Title of Goods

Title to the goods and services subject of this order shall pass to the Buyer only when John Zink Company receives payment in full therefor. The Buyer shall cooperate, if requested, in proper filings and other procedures necessary to assure that John Zink Company shall retain perfected security interest in the goods and services.

Changes to the Scope of Work

Price is based on the inquiry design information. In the event of a process change, John Zink reserves the right to alter the equipment design in order to maintain safe engineering practices. If additions or deletions to the scope of work are required after an order is received, John Zink will submit a price summary to the customer for approval. Equipment dimensions, sizes, and sub-venders offered in this quotation shall be subject to change after the design is finalized.

Design changes after receipt of the order will result in a reschedule of the equipment ship date. Late drawing approval will result in a reschedule of the equipment ship date which will be based on John Zink's production forecast upon receipt of drawing approval, and will not necessarily be a day-for-day tradeoff.

Field Service

Start-up and training services are not included unless specifically noted above. If field service is requested, it shall be performed according to the terms of the attached John Zink Technical Assistance Agreement.

Software

John Zink may provide [Customer] with software or firmware (collectively, "Software") pursuant to this proposal. Such Software is provided is "as-is" and under a non-exclusive, non-transferable license only. [Customer] will have no ownership rights in the Software.

General Scope of Work

John Zink will furnish the labor, materials, and equipment necessary to fabricate the system offered.

For the purpose of clarification, the supplies to be delivered will include general bolts, nuts, washers, gaskets, and similar fasteners associated with the assembly of the system supplied by John Zink.

OWNER REQUIREMENTS

- All civil works including creation of a suitable skid and stack foundation. John Zink will supply the data necessary to design such civil works by providing loading information for the system, including anchor bolt arrangement.
- Erection of system or installation of piping or electrical supply or instruments. John Zink, if requested, can supply turnkey installations.
- The supply or installation of fireproofing materials, personnel protection, lightning protection, heat tracing, external insulation, electrical/thermocouple wire, conduit, piping, finish paint, and other miscellaneous hardware unless specifically noted.
- Permits, licenses, and approval by and from authorities to install, test, and operate the system.
- Preparation of drawings, forms and/or data for approval by state or local agencies of the design of the system, unless otherwise noted.
- Compliance with state, local, or municipal codes, except as specifically identified. John Zink will design the system to applicable national codes and standards. However, John Zink has numerous similar systems operating in many of the states and is knowledgeable in coordinating with the respective regulatory authorities and, if requested, can comply with the agreed upon local requirement.
- Field alignment for rotating equipment, if applicable, by others.
- Non-destructive examination (NDE) or pressure testing.

CLARIFICATIONS

- A minimum undisturbed distance is required for proper installation and performance of the flow meter. A distance of approximately ten pipe diameters of straight pipe is required before the flow meter and approximately five pipe diameters of straight pipe after the flow meter.
- John Zink has bid only to section 44 13 56 “Waste Gas Flare System” and has taken exception to certain provisions therein (detailed in additional clarifications). Divergences are based on material selection and not on system functionality. The equipment will meet the operational intent of the RFP.
- 2.01.A – John Zink is providing piping and flame arrester internals made of 304 stainless steel, not 316.

ATTACHMENTS

- Standard Terms and Conditions of Sale
- Domestic Technical Assistance Agreement

GENERAL TERMS AND CONDITIONS OF SALE

(GOODS AND SERVICES)

1. **APPLICATION.** These General Terms and Conditions of Sale ("**Terms and Conditions**") will apply to all quotations and sales for goods, material, equipment and services by John Zink Company, LLC ("**Seller**") and are hereby incorporated into the purchase order, quotation, invoice or other document to which they are attached ("**Order**" and, together with the Terms and Conditions, the "**Contract**"). All purchases by customer, owner or its agent ("**Buyer**") are expressly limited and conditioned upon acceptance of the Terms and Conditions. Seller objects to and rejects any provision additional to or different from the Terms and Conditions that may appear in Buyer's purchase order, acknowledgement, confirmation, writing, or in any other prior or later communication from Buyer to Seller, unless such provision is expressly agreed to by Seller in a writing signed by Seller. For the purposes of these Terms and Conditions, the term "**Goods**" shall refer to the goods, material and equipment listed on the Order as well as all equipment or other materials provided in connection with any Services, and the term "**Services**" shall refer to the services listed on the Order. Terms not defined herein shall have the meanings set forth in the Order.
2. **PRICE AND OTHER CHARGES.** Unless otherwise stated in the Order, the Contract price does not include any packaging, transportation, duties, taxes or other charges (collectively, "**Additional Charges**"). Buyer shall be responsible for all applicable Additional Charges.
3. **PAYMENT TERMS.** (a) Unless otherwise stated in the Order, payment is due thirty (30) days after the invoice date. (b) All payments shall be made in USD unless otherwise specified in the Order. (c) Interest may be charged on all past due amounts owed by Buyer hereunder at an interest rate equal to the prevailing LIBOR rate of interest, expressed as an annual percent, plus three percent (3%) from the payment due date until paid in full, or the highest interest rate allowed by applicable law, whichever is less. Payments must be made via a financial institution that is not subject to the sanctions laws of the United States, the European Union, or other applicable jurisdictions.
4. **CREDIT TERMS.** If, in Seller's judgment, the creditworthiness or future performance of Buyer is or may become impaired or unsatisfactory, Seller may suspend performance hereunder and seek adequate assurances from Buyer. Buyer shall pay (or otherwise reimburse) Seller for any costs associated with such suspension (including charges for reactivation). Without limiting the foregoing, Seller may, for any reason, (a) require prepayment by wire transfer at least two (2) business days prior to a scheduled shipment of Goods or provision of Services, and/or (b) require Buyer to issue letter(s) of credit in a form, and from an issuing bank, acceptable to Seller at least three (3) business days prior to a scheduled shipment of Goods or provision of Services.
5. **DELIVERY.** (a) Unless otherwise stated in the Order, delivery of the Goods shall be EXW (Incoterms®2010 International Chamber of Commerce (ICC) publication) Seller's designated manufacturing facility. (b) If Buyer has not issued inspection and shipping instructions by the time the Goods are available to Buyer, Seller may, at its sole discretion, (i) store the Goods at Buyer's risk of loss and cost, or (ii) select any reasonable method of shipment, without liability by reason of its selection, costs of shipment and risk of loss to be the responsibility of Buyer. (c) Shipments or Goods in storage may be insured at Buyer's expense.
6. **TITLE/RISK OF LOSS.** Unless otherwise stated in the Order, title in the Goods shall pass to Buyer upon payment in full. The risk of loss or damage to the Goods shall pass to Buyer upon delivery in accordance with the Contract or as otherwise provided in the Delivery section.
7. **INSPECTION/REJECTION OF GOODS.** All Goods shall be received subject to Buyer's reasonable inspection and rejection. Buyer may only reject Goods that do not conform in all material respects to the specifications contained in the Contract. Rejected Goods will be held at Seller's risk for a reasonable time, to be returned or disposed of by Buyer at Seller's written instruction and at Seller's sole cost and expense. A failure by Buyer to reject nonconforming Goods in writing within thirty (30) days after receipt shall constitute an unqualified acceptance of such Goods by Buyer and a waiver by Buyer of all claims with respect thereto. Thereafter, nonconforming Goods shall be subject to the Warranty section.
8. **WARRANTY.** (a) Seller warrants that (i) the Goods shall be new and good quality and shall conform to the specifications specifically set forth in the Order and title to the Goods shall be free from any security interest, lien or encumbrance upon Seller's receipt of full payment for the Goods, and (ii) Seller shall perform the Services in a workmanlike manner in accordance with the specifications specifically set forth in the Order. (b) The foregoing warranties will last for the following period (the "Warranty Period"): (i) for Goods, eighteen (18) months after the date that the Goods are available for shipment or one (1) year after first start-up, whichever occurs first; and (ii) for Services, three (3) months after completion of the Services. If during the Warranty Period any Goods or Services prove not to meet the warranties set forth above, Seller will repair the Goods or supply identical or substantially similar replacement Goods EXW Seller's manufacturing facility, at Seller's sole discretion, or re-perform the Services (as applicable). Any replacement Goods or re-performed Services will be warranted for the unexpired portion of the Warranty Period applicable to the particular Goods or Services. (c) Seller will not be responsible for transportation costs or for the costs of removal, installation, re-installation or making of access of any Goods or other items, where such transportation, removal, installation, re-installation or making of access is required to repair or replace any defective Goods or to re-perform Services. Furthermore, Seller will not be responsible for and assumes no liability for materials or workmanship, labor costs or other related expenses for any work performed by Buyer or third parties (not authorized by Seller) in the repair or replacement of defective Goods or the re-performance of Services. (d) Seller's warranties will be voided if (i) the Goods or the subject of the Services have not been stored, installed, maintained or operated in accordance with accepted industrial practice or any specific instructions provided by Seller; (ii) the Goods or the subject of the Services have been subjected to any accident, misapplication, environmental contaminant, corrosion, damage, debris, improper passivation, abuse or misuse; (iii) Buyer has modified the Goods or the subject of the Services without Seller's prior written consent; (iv) Buyer has used or repaired the Goods or the subject of the Services after discovery of the defect without Seller's prior written consent; (v) Buyer or any third party refuses to permit Seller to examine the Goods or the subject of the Services and operating data to determine the nature of the defect claimed; or (vi) Buyer fails to meet its financial obligations under the Contract. (e) Goods not manufactured by Seller are subject only to warranties of Seller's vendors and Seller hereby assigns to Buyer all rights in such vendors' warranties, however, Seller shall furnish to Buyer reasonable assistance in enforcing such rights. (f) Inexpensive items requiring repair or replacement and routine maintenance-related or consumable items shall be outside the scope of these limited warranties. (g) Seller's performance guarantees, if any, shall be deemed to be met by a satisfactory demonstration of the guaranteed performance parameters during a performance test, which shall be the responsibility of Buyer and is to be based on test procedures as specified in the Order or, if not specified in the Order, to be based on test procedures mutually agreed upon by Seller and Buyer. In the absence of a performance test within sixty (60) days of delivery, unless otherwise specified in the Order, Seller's performance guarantees are deemed to have been met. (h) ALL WARRANTIES OR REPRESENTATIONS NOT SPECIFICALLY INCLUDED IN THESE TERMS AND CONDITIONS, INCLUDING THOSE WITH RESPECT TO MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE WHETHER EXPRESSED, IMPLIED, STATUTORY OR ARISING FROM A COURSE OF DEALING, USAGE OF THE TRADE OR OTHERWISE WITH RESPECT TO ANY GOODS OR SERVICES, ARE EXPRESSLY EXCLUDED. NO EXPRESS OR IMPLIED WARRANTY IS GIVEN AS TO THE CAPACITY, EFFICIENCY OR PERFORMANCE OF ANY GOODS, EXCEPT AS MAY BE PROVIDED IN A SEPARATE WRITTEN AGREEMENT SIGNED BY SELLER. (i) BUYER'S REMEDIES ARE SPECIFICALLY LIMITED TO THE REPAIR OR REPLACEMENT OF THE GOODS OR THE RE-PERFORMANCE OF THE SERVICES, AS APPLICABLE, DURING THE WARRANTY PERIOD, AND ARE EXCLUSIVE OF ALL OTHER REMEDIES. SHOULD THESE REMEDIES BE FOUND INADEQUATE OR TO HAVE FAILED OF THEIR ESSENTIAL PURPOSE FOR ANY REASON WHATSOEVER, BUYER AGREES THAT RETURN OF THE AMOUNT PAID BY BUYER TO SELLER FOR THE GOODS INVOLVED SHALL PREVENT THE REMEDIES FROM FAILING OF THEIR ESSENTIAL PURPOSE AND SHALL BE CONSIDERED BY BUYER AS A FAIR AND ADEQUATE REMEDY.
9. **BACKCHARGES**. No backcharges will be paid or allowed by Seller unless (i) Seller is notified in writing of Buyer's intent to incur costs and (ii) Seller provides prior written approval of such backcharges.
10. **OBLIGATIONS OF BUYER.** Buyer is solely responsible for identifying and defining all processes, mechanical considerations, and site requirements, which may affect the performance, reliability or operation of the Goods or Seller's performance of Services. Buyer represents that all information and data provided to Seller by or for Buyer is current, complete, and accurate. Buyer represents and warrants to Seller that Buyer has all necessary rights and permissions to provide all information provided by or on behalf of Buyer to Seller and shall indemnify Seller from any third party with respect to Seller's use of such information in connection with the Contract.

11. **INDEMNITY.** In the event that Seller performs onsite services at Buyer's facility, (i) Seller shall defend, indemnify and hold harmless Buyer against all damages, losses, costs, claims, liabilities, and expenses (including reasonable attorneys' fees), resulting from bodily injury, including death, or damage to tangible property to a Third Party, to the extent caused by the negligent acts or omissions of Seller, its officers, directors, employees or agents ("**Seller Group**"); and (ii) Buyer shall defend, indemnify and hold harmless Seller against all damages, losses, costs, claims, liabilities and expenses (including reasonable attorneys' fees), resulting from bodily injury, including death, or damage to tangible property to a Third Party, to the extent caused by the negligent acts or omissions of Buyer, its officers, directors, employees or agents ("**Buyer Group**"). All liability, losses, damages, costs or expenses resulting from bodily injury, including death, or damage to tangible property to a Third Party, caused by the joint or concurring acts of Buyer Group and Seller Group, shall be borne by Buyer and Seller to the extent each is determined negligent either by agreement of the parties or by a court of competent jurisdiction. The term "**Third Party"** shall mean any person or entity that is not a member of Seller Group, Buyer Group, the end user of the Goods or subject of the Services, or any of its respective affiliates, parent(s), subsidiaries or any of their respective officers, directors, employees, agents, or subcontractors.

12. **DEFAULT.** Upon the occurrence of any of the following events: (i) Seller has not received a payment due from Buyer hereunder by the date such payment is due under the Contract, and such failure remains uncured for a period of ten (10) business days after Buyer's receipt of written notice from Seller of such non-payment; (ii) Seller is unable to meet its warranty obligations and fails to commence to cure within ten (10) business days after Seller's receipt of written notice from Buyer of such uncured obligation; or (iii) Seller or Buyer fail to perform other material obligations in the Contract and such failure remains uncured for a period of thirty (30) business days after receipt of written notice

from the other party of such uncured obligation, or if cure is not possible within that period, the defaulting party fails to make continuous and diligent efforts to cure, then the non-defaulting party, in its sole discretion and without prior notice (other than as provided above) to the defaulting party, may do any one or more of the following: (a) suspend performance under the Contract; or (b) terminate the Contract, whereby any and all obligations of the defaulting party will, at the option of the non-defaulting party, become immediately due and payable or deliverable, as applicable. In the event of default by Buyer, Seller shall have the right to withhold delivery and/or sell the Goods to a third party and deduct from proceeds of such sale the purchase price and all reasonable costs resulting from the default. The prevailing party shall be entitled to recover all court costs, reasonable attorneys' fees and expenses incurred by the prevailing party in connection with the default, and interest on past due amounts as set forth in the payment terms of the Contract.

13. **INTELLECTUAL PROPERTY.** (a) Seller retains all intellectual property rights, whether registered or un-registered, including trademarks, patents, and copyright of all documents, drawing rights, design rights, developed programs, software, models and other data provided or developed in the course of the Contract ("Seller IP"), and hereby grants Buyer a non-exclusive, non-assignable royalty free license to use Seller IP delivered to Buyer or embodied in the Goods or related deliverables only for the purposes of Buyer's installation, operation and maintenance the Goods. (b) Seller will defend and indemnify Buyer from any claim, suit or proceeding brought against Buyer based on a claim that the Goods as manufactured and furnished by Seller and used in the manner for which it was intended and sold to Buyer constitutes an infringement of any United States, Canadian or European Union-member patent, if Seller is notified promptly in writing and given authority, information and assistance for the defense of such claim, suit or proceeding. All aspects of the defense and settlement of any such claim, suit or proceeding shall be within Seller's sole discretion. Buyer remains solely responsible for its own costs, including all fees and expenses of its own counsel, if any, or its personnel, which are incurred in conjunction with the defense of such claim, suit or proceeding. Should it be held that the Goods constitute an infringement and the use of the Goods is enjoined, Seller will, at its sole discretion and at its own expense, either procure for Buyer the right to continue using the Goods, replace the Goods with non-infringing goods, modify the Goods to become non-infringing or refund the purchase price for the infringing Goods. Seller's obligations to defend, and indemnify Buyer shall not apply to any liability for infringement (i) of any method patent where the Goods are used with other apparatus for carrying out a process resulting in a combination of steps which is deemed to infringe a method patent or patent directed to a combination of steps, (ii) where the Goods are modified by Buyer, (iii) where the Goods are used by Buyer in a manner different than the use communicated to and understood by Seller at the time the Goods were sold to Buyer and such use constitutes infringement, or (iv) with respect to claims of infringement where the Goods were designed and manufactured in accordance with the design or specifications furnished or required by Buyer. (c) Buyer will indemnify and hold harmless Seller from any suit or proceeding brought against Seller by any third party based on claims resulting from exceptions (i), (ii), (iii) or (iv) as stated above.

14. **DELIVERY DATE.** If the Order specifies a delivery date, Seller shall use commercially reasonable efforts to meet the requested date.

15. **CANCELLATION FEE.** Buyer may not cancel any part of the Contract except upon written notice and payment to Seller for (a) all Goods or Services completed prior to cancellation, (b) all costs incurred by Seller prior to cancellation, (c) all reasonable costs arising due to the cancellation, (d) unavoidable third party charges, and (e) a cancellation fee in the amount of twenty percent (20%) of the total price of the Contract. The parties agree that Seller's damages following a termination of any part of the Contract by Buyer are difficult to determine and that the cancellation fee provided by this provision is a genuine pre-estimate of loss and not a penalty and is reasonable in light of the circumstances. Seller shall be entitled to the payments set forth above if Seller cancels or terminates the Contract pursuant to the Default and Suspension sections. Title to all works in progress and all materials not delivered to Buyer prior to the date of cancellation will remain with Seller.

16. **SUSPENSION.** (a) Buyer may only suspend the Order upon written notice to Seller, subject to payment of Seller's costs. (b) If Buyer or any of its agents delays Seller's performance due to failure to promptly approve drawings or procedures or due to any other action or non-action on part of Buyer or its agents: (i) Buyer shall reimburse Seller for all costs incurred up to the date of suspension and as a result of such delay (including costs of reactivation), (ii) the delivery time shall be adjusted, and (iii) milestone payments (if applicable) will be adjusted to keep Seller whole for costs incurred up to the date of delay or suspension. (c) If, due to any action or non-action on the part of Buyer or its agents, Seller is delayed for more than forty-five (45) days, or such longer period of time as deemed reasonable by Seller in its sole discretion, Seller may elect to cancel the Order.

17. **FORCE MAJEURE.** Force Majeure means any circumstances beyond the reasonable control of either party, including acts of God, fire, explosion, breakdown of machinery or equipment, third party supplier plant shutdown, strikes or other labor disputes of Seller's suppliers or subcontractors, acts of terrorism or war, riots or other civil disturbances or voluntary or involuntary compliance with any law, order, regulation, recommendation or request of any governmental authority, inability to obtain materials necessary for manufacture of the Goods, total or partial failure of any of Seller's usual means of transportation of the Goods, or for failure to obtain necessary governmental approvals, permits or licenses. Neither party will have any liability, other than for the payment of monies owing, for their failure to perform any of their contractual obligations arising out of or in connection with events of Force Majeure.

18. **ASSIGNABILITY.** The rights and duties under the Contract are not assignable or transferable by Buyer or Seller, in whole or in part, by operation of law or otherwise, without the prior written consent of the non-assigning party, which consent may not be unreasonably withheld, delayed, or conditioned. Notwithstanding, upon written notice, Buyer or Seller may assign this Contract in whole or in part to any of its affiliates which are as equally creditworthy and provided such affiliate is compliant with all applicable laws. Any assignment or attempted assignment in contravention of the foregoing shall be null and void. Any assignee is subject to all of the obligations, liabilities, waivers and limitations of this Contract.

19. **GOVERNING LAW.** The Contract, and its execution, performance, interpretation, construction and enforcement, shall be governed by the law, both procedural and substantive, of the State of Texas, without regard to its conflicts of law rules; and all claims relating to or arising out of the Contract, including breach, and formation, whether sounding in contract, tort or otherwise, shall likewise be governed by the laws of the State of Texas, excluding choice-of-law principles. Any action or proceeding between Buyer and Seller relating to the Contract shall be commenced and maintained exclusively in the State or federal courts in Harris County, Houston, Texas; and, Buyer waives all venue and inconvenience of forum challenges and irrevocably submits itself unconditionally and irrevocably to the personal jurisdiction of such courts. BUYER AND SELLER EACH WAIVE, TO THE FULLEST EXTENT PERMITTED BY LAW, ANY RIGHT IT MAY HAVE TO A TRIAL BY JURY IN RESPECT TO ANY SUIT, ACTION, CLAIM OR PROCEEDING RELATING TO THE CONTRACT.

20. **NOTICE.** All official notices, made under this Agreement must be made via certified or registered mail with return receipt, postage prepaid addressed to the party to whom such notice is given at the address of such party stated in the Contract. All other communications or transmittals under the Contract shall be in writing and shall be deemed received on the day of delivery if personally hand delivered or sent by facsimile or electronic transmission (with written confirmation of the completed transmittal).

21. **ENTIRE AGREEMENT; AMENDMENT; WAIVERS.** This Contract supersedes all prior negotiations, discussions, and dealings concerning the subject matter hereof, and shall constitute the entire agreement between Seller and Buyer concerning the subject matter hereof. There are no understandings, inducements, commitments, conditions, representations or warranties of any kind, whether direct, indirect, collateral, express or implied, oral or written, from either party to the other, other than as contained in this Contract. No party shall claim any amendment, modification or release of any provisions hereof unless the same is in writing and signed by Buyer and Seller. No waiver by Buyer or Seller of any breach of any terms, conditions or obligations under the Contract shall be deemed a waiver of any continuing or subsequent breach of the same or any other terms, conditions or obligations hereunder.

22. **ELECTRONIC TRANSACTIONS.** The Contract may be digitally copied and stored on electronic storage media or devices (the "**Imaged Agreement**"). The Imaged Agreement (once digitally regenerated to paper form), and any facsimile, and all computer records of the foregoing, if introduced as evidence in any judicial, arbitration, mediation or administrative proceedings, will be admissible as between the parties to the same extent and under the same conditions as other business records originated and maintained in documentary form and neither party shall object on the basis that such business records were not originated or maintained in documentary form under any rule of evidence.

23. **COMPLIANCE.** Buyer and Seller shall: (i) comply fully with all applicable laws and regulations in their respective performances of the Contract; and, (ii) shall neither take nor refrain from taking any action that could result in liability for either party under applicable law, including the U.S. Foreign Corrupt Practices Act, the OECD Anti-Bribery Convention or any other applicable anti-bribery law or treaty, or those regulations maintained by the U.S. Treasury Department's Office of Foreign Assets Control (31 C. F. R. Chapter V) or the U.S. Commerce Department's Bureau of Industry and Security (15 C.F.R. Parts 730 et. Seq.). Buyer shall comply as follows: (i) Buyer acknowledges that any distribution, sale, transfer or re-export of the Goods is governed by and subject to the trade control laws of the United States; (ii) Buyer shall not distribute, sell, transfer or re-export the Goods, except in conformance with United States law; and, (iii) If Buyer knows or has reason to know that any of its customers intend to distribute, sell, transfer or re-export the Goods, either directly or through incorporation into other products, then Buyer shall inform its customer that the customer is responsible for obtaining any licenses or other approvals from the U.S. Government before such distribution, sale, transfer or re-export, by including the following language in Buyer's purchase order acknowledgement or other appropriate documentation to its customer: *NOTICE: The products, technical data, and/or software included in this Order were provided in compliance with the laws and regulations of the United States. Customer is responsible for obtaining all licenses, permits or other approvals that may be necessary under the laws of the United States before any distribution, sale, transfer or re-export of such items and for ensuring that the end-user and end use of these products are permitted under U.S. law. Re-export, diversion, transshipment, or use contrary to U.S. law is prohibited and is cause for cancellation of this [purchase order]."* Nothing in this Contract shall require Buyer or Seller to take or

refrain from taking any action impermissible or penalized under United States or other applicable laws. A Party's breach of this Section shall constitute cause for immediate termination of the Contract.

24. **INDEPENDENT CONTRACTORS.** Seller and Buyer are independent contractors only and are not partners, master/servant, principal/agent or involved herein as parties to any other similar legal relationship with respect to the transactions contemplated under the Contract or otherwise, and no fiduciary, trust, or advisor relationship, nor any other relationship imposing vicarious liability shall exist between the parties under the Contract or otherwise at law.

25. **NO THIRD PARTY BENEFICIARIES.** The Contract is solely for the benefit of, and shall inure to the benefit of, Buyer and Seller, and shall not otherwise be deemed to confer upon or give to any third party any right, claim, cause of action or other interest herein.

26. **SEVERABILITY.** The invalidity or unenforceability of any provision of the Contract shall not affect the validity or enforceability of its other provisions and the remaining provisions shall remain in full force and effect.

27. **CONFIDENTIALITY.** Except as provided in a separate written confidentiality agreement, all information that Buyer acquires from Seller hereunder, directly or indirectly, and all information that arises out of the sale of the Goods and/or Services hereunder, concerning such Goods, Services, and/or proprietary processes involved, including, but not limited to, information concerning Seller's current and future business plans, information relating to Seller's operations, know-how, and other Seller-furnished information shall be deemed Seller's "**Proprietary Information**". Buyer shall (a) hold Seller's Proprietary Information in strictest confidence, (b) not disclose it to others and (c) use it solely for purposes of the Contract.

28. **INSURANCE**. In the event the Seller performs onsite services at Buyer's facility, Seller shall maintain the following insurance coverage during the term of the Contract and, at Buyer's request, shall provide Buyer with a certificate evidencing such coverage: (a) Statutory Workers' Compensation and Employer's Liability Insurance, with limits of Five Hundred Thousand USD ($500,000.00) each accident, Five Hundred Thousand USD ($500,000.00) disease each employee, and Five Hundred Thousand USD ($500,000.00) disease policy limit; (b) Commercial General Liability Insurance, with a combined single limit for bodily injury and property damage of One Million USD ($1,000,000.00) per occurrence and in the aggregate; and (c) Automobile Liability Insurance, with a combined single limit for bodily injury and property damage of One Million USD ($1,000,000.00) per accident.

29. **SURVIVAL**. The provisions addressing indemnity, confidentiality, limitation of liability, and all other provisions which by their nature are intended to survive, shall survive expiration or termination of the Contract.

30. **MISCELLANEOUS.** The captions and section headings set forth in the Contract are used for convenience only and shall not be used in defining or construing any of the terms and conditions set forth in the Contract. The term "**days**", as used herein, shall mean actual days occurring, including, Saturdays, Sundays and holidays where banks are authorized to be closed in the city where Seller's chief executive office is located. The term "**business days**" shall mean days other than Saturdays, Sundays and holidays where banks are authorized to be closed in the city where Seller's chief executive office is located. The term "**including**" or any variation thereof means "**including, without limitation**" and shall not be construed to limit any general statement that it follows to the specific items immediately following it. Unless the context indicates otherwise, words importing the singular number shall include the plural and vice versa, and words importing person shall include firms, association, partnerships and corporations, including public bodies and governmental entities, as well as natural persons, and words of masculine gender shall be deemed to include correlative words of the feminine gender and vice versa as the circumstances may require. The United Nations Convention on Contracts for the International Sale of Goods shall not apply.

31. **LIMITATION OF LIABILITY**. (A) NO PARTY SHALL BE LIABLE FOR INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING LOSS OF PROFITS, REVENUES, OR OTHER ECONOMIC LOSSES WHETHER DEEMED DIRECT OR CONSEQUENTIAL, ARISING UNDER ANY CAUSE OR COMBINATION OF CAUSES, INCLUDING ANY THEORIES OF CONCURRENT OR JOINT LIABILITY. (B) THE LIABILITY OF SELLER AND ITS AFFILIATES IS LIMITED TO THE PRICE ALLOCABLE TO THE GOODS OR SERVICES DETERMINED TO BE DEFECTIVE, AND IN NO EVENT WILL THE CUMULATIVE LIABILITY OF SELLER AND ITS AFFILIATES BE IN EXCESS OF THE TOTAL PAYMENTS RECEIVED FROM BUYER UNDER THE ORDER REGARDLESS OF CAUSE OR ANY COMBINATION OF CAUSES WHATSOEVER. ALL INSURANCE, BOND AND BANK GUARANTEE OR LETTER OF CREDIT PROCEEDS WHICH MAY BE PAID BY THE INSURERS, SURETIES OR BANKS OF SELLER OR ITS AFFILIATES WILL BE CREDITED AGAINST THE LIMITATION STATED ABOVE AND SHALL REDUCE THE AMOUNT OF THE CUMULATIVE LIABILITY OF SELLER AND ITS AFFILIATES. (C) BUYER'S REMEDIES ARE LIMITED TO THOSE REMEDIES EXPRESSLY STATED IN THIS CONTRACT. (D) THESE LIMITATIONS SHALL APPLY NOTWITHSTANDING ANY FUNDAMENTAL BREACH OR FAILURE OF ESSENTIAL PURPOSE OF ANY LIMITED REMEDY.

[End of General Terms and Conditions of Sale]

SOFTWARE LICENSE AGREEMENT

THESE TERMS AND CONDITIONS (THE **"AGREEMENT"**) SUPPLEMENT THE PURCHASE ORDER TERMS AND CONDITIONS ENTERED INTO BY AND BETWEEN YOU ("**LICENSEE**") AND JOHN ZINK COMPANY, LLC. ("**JOHN ZINK**"). THIS AGREEMENT IS SPECIFIC TO THE INSITE SUBSCRIPTION SOFTWARE HOSTED BY JOHN ZINK AND EWON COMMUNICATION DEVICE FIRMWARE. PLEASE CAREFULLY READ THIS AGREEMENT. YOU AGREE TO BE BOUND BY THESE ADDITIONAL TERMS AND CONDITIONS OF THIS AGREEMENT BY CONTINUED USE OF THE SUBSCRIPTION SOFTWARE.

1. Definitions.

(a)**"Affiliate"** means any entity, directly or indirectly, controlling, controlled by, or under common control with, John Zink.

(b)"**Authorized Users**" means: (i) Licensee's employees; and (ii) contractors authorized by Licensee to access the Subscription Software who, prior to obtaining access to the Subscription Software, have executed a non-disclosure agreement with Licensee that protects John Zink's Confidential Information to the same extent as this Agreement.

(c)"**Confidential Information**" Confidential Information of John Zink includes, without limitation, the Documentation and the Subscription Software, including any software code and all algorithms, methods, techniques, and processes revealed or utilized therein. Confidential Information of Licensee includes Licensee Data. Confidential Information does not include Information that: (i) is or becomes known to the public without fault or breach of the Recipient; (ii) the Discloser regularly discloses to third parties without restriction on disclosure; (iii) the Recipient obtains from a third party without restriction on disclosure and without breach of a non-disclosure obligation known to Recipient; or (iv) is independently developed by the Recipient without use of Confidential Information.

(d)"**Customizations**" means any components deployed in the hosted environment for the Subscription Software other than the generally available Subscription Software or components that Licensee may deploy via the standard user interface or tools included in the generally available Subscription Software. Customizations may include, without limitation, code, databases or third party extensions that are not included in the generally available Subscription Software.

(e)"**Deployment Date**" means the date upon which all equipment, hardware, and software that is necessary to implement the Subscription Services is installed and operational.

(f)"**Deployment Fees**" means the fees for deployment of the equipment, hardware, and software that is necessary to implement the Subscription Services, as set forth on the applicable Purchase Order.

(g)"**Discloser**" means the party providing Confidential Information to the Recipient.

(h)"**Documentation**" means John Zink-provided documentation relating to the features, functions, and use of the Subscription Software.

(i)"**Documented Defect**" means a material deviation between the then-current, general release version of the Subscription Software and its Documentation.

(j)"**Effective Date**" means the date upon which the Licensee accepts this Agreement by executing the applicable Purchase Order.

(k)"**EquipmentID**" means a unique equipment identification credential used in combination with a unique password to access the Subscription Services.

(l)"Ewon Device" means the communication device provided by John Zink that contains or facilitates access to the Ewon Software and Subscription Services.

(m)"**Ewon Software**" means collectively or individually the computer software programs contained on the Ewon Device.

(n)"**Initial Subscription Term"** means the initial subscription period, which will begin on the date indicated in the Purchase Order and continue for the period specified in the Purchase Order.

(o)"**Intellectual Property Rights**" means any and all rights in patents, copyrights, trademarks and service marks.

(p)"**Licensee Data**" means information provided, entered or uploaded for use by or with the Subscription Software by the Licensee or its Authorized Users.

(q)"License Restriction" means any limitation on the use of the Subscription Software identified in a Purchase Order (e.g., number of Authorized Users, locations, connections).

(r)"Nonconformity" or "Nonconformities" means any failure or failures of the Subscription Software to conform to the requirements of this Agreement or Purchase Order, including any applicable documentation.

(s)"Purchase Order" means each Purchase Order between the Parties that incorporates this Agreement by reference, which shall contain, without limitation, a list of the Subscription Software and associated quantity and License Restriction.

(t)"Personal Information" means Information provided to John Zink by or at the direction of Licensee, or to which access was provided to John Zink in the course of John Zink's performance under this Agreement that: (i) identifies or can be used to identify an individual (including, without limitation, names, signatures, addresses, telephone numbers, e-mail addresses and other unique identifiers); or (ii) can be used to authenticate an individual (including, without limitation, employee identification numbers, government-issued identification numbers, passwords or PINs, financial account numbers, credit report Information, biometric or health data, answers to security questions and other personal identifiers). Personal Information shall include any non-public personal information regarding any individual that is subject to applicable national, state, regional, and/or local laws and regulations governing the privacy, security, confidentiality and protection of non-public Personal Information.

(u)"Recipient" means the party receiving Confidential Information of the Discloser.

(v)"Renewal Term" means any renewal or extension of Licensee's license to use the Subscription Software following the expiration of the Initial Subscription Term.

(w)"Residual Knowledge" shall mean ideas, concepts, know-how or techniques related to the Discloser's technology and Confidential Information that are retained in the unaided memories of the Recipient who had rightful access to Confidential Information.

(x)"Service Level Description" means the Service Level Description applicable to the Subscription Services (as set forth in Section 5(e)).

(y)"Subscription Fees" means the fees for the Subscription Services set forth on the applicable Purchase Order.

(z)"Subscription Services" means the Subscription Software-related application hosting services and Support (as defined in Sections 3(c) and 3(f)) that John Zink provides Licensee under this Agreement.

(aa)"Subscription Software" means collectively or individually the computer software programs identified in the applicable Purchase Order for which John Zink is providing the Subscription Services.

(bb)"Subscription Term" means the Initial Subscription Term or any Renewal Term, as applicable.

(cc)"Third Party Licensor" means a third party whose software products ("Third Party Products") have been made available to John Zink for distribution and licensing under the terms of its agreement with John Zink (a "Third Party Agreement").

(dd)"Updates" means generally available updates, enhancements or modifications to the then-current, general release version of the Subscription Software that are not separately priced or licensed as new products.

2. License. Subject to the terms and conditions of this Agreement and the applicable Purchase Order, John Zink hereby grants to Licensee: (i) a non-exclusive, non-transferable, limited license (without the right to sublease or sublicense) to access and use the Subscription Software and the Subscription Services, during the Subscription Term, in an operating environment hosted by John Zink, for Licensee's own internal use; and (ii) a non-exclusive, transferable (only to subsequent purchasers of the Ewon Device), limited license to use the Ewon Software. Any rights not expressly granted in this Agreement are expressly reserved.

(a) Documentation. Licensee may make a reasonable number of copies of the Documentation for the Ewon Software and Subscription Software for its internal use in accordance with the terms of this Agreement.

(b) License Restriction. Licensee's use of the Ewon Software and Subscription Software and Subscription Services is subject to any License Restriction specified in the applicable Purchase Order.

(c) Additional Restrictions on Use of the Ewon Software, Subscription Software and Subscription Services. In no event shall Licensee access the Subscription Software on any environment outside the hosted environment selected by John Zink as part of the Subscription Services. In no event shall Licensee or its Authorized Users possess or control the Ewon Software, Subscription Software or any related software code. Licensee is prohibited from causing or permitting the reverse engineering, disassembly or de-compilation of the Ewon Software or Subscription Software. Except as expressly provided by this Agreement, Licensee is prohibited from using the Subscription Software to provide service bureau services to third parties. Licensee will not allow the Subscription Software to be used by, or disclose all or any part of the Subscription Software to, any person except Authorized Users. Licensee acknowledges and agrees that U.S. export control laws and other applicable export and import laws govern its use of the Ewon Software and Subscription Software and Licensee will neither export or re-export, directly or indirectly, the Ewon Software and Subscription Software, nor any direct product thereof in violation of such laws, or use the Ewon Software and Subscription Software for any purpose prohibited by such laws.

(d) Intellectual Property Rights Notices. Licensee is prohibited from removing or altering any of the Intellectual Property Rights notice(s) embedded in the Ewon Software and Subscription Software or that John Zink otherwise provides with the Subscription Services. Licensee must reproduce the unaltered Intellectual Property Rights notice(s) in any full or partial copies that Licensee makes of the Documentation.

(e) Ownership. Use of the Ewon Software, Subscription Software and Subscription Services does not grant any ownership rights in or to the Ewon Software, Subscription Software, the Subscription Services, or the Documentation. Licensee Data shall be the sole property of Licensee. John Zink will collect data related to or including Licensee Data or use of the Ewon Software, Subscription Software and Subscription Services, (collectively "**Collected Data**"), and such Collected Data (which in no event will include Personal Information) shall be the sole property of Licensee. Licensee hereby grants John Zink, a fully paid-up, royalty-free, non-exclusive, world-wide, perpetual right and license to the Collected Data for: (1) use in satisfying its obligations under this Agreement and any Purchase Order, (2) for use in improving and developing the Ewon Software, Subscription Software, Subscription Services, and other software and hardware technologies; and (3) other uses so long as the Collected Data is anonymized and doesn't identify Licensee.

3. Subscription Services.

(a) Hosted Environment. John Zink will provide the application hosting environment, including the hardware, equipment, and systems software configuration on which John Zink supports use of the Subscription Software and Subscription Services, on servers located at a facility selected by John Zink.

(b) Support. John Zink shall (a) provide Licensee with access (via the internet, telephone or other means established by John Zink) to John Zink's support helpline, (b) install, when and if generally available, Updates; and (c) use reasonable efforts to correct or circumvent any material deviation between the then-current, general release version of the Subscription Software and its Documentation (the foregoing referred to collectively as "**Support**"). Support does not include engineering support or professional services, which may be the subject of a separate agreement. Support is included in the Subscription Fee.

(c) Equipment Accounts. Licensee is responsible for maintaining its own Authorized Equipment, EquipmentIDs and passwords which can be managed through the Subscription Software interface. Licensee is responsible for maintaining the confidentiality of Licensee's EquipmentIDs and passwords and shall cause its Authorized Users to maintain the confidentiality of the EquipmentIDs and passwords. Licensee is responsible for all uses of and activities undertaken with EquipmentIDs registered on Licensee's account. Licensee agrees to immediately notify John Zink of any unauthorized use of Licensee's EquipmentIDs of which Licensee becomes aware.

(d) Authentication of Equipment Accounts. John Zink may contract with a third-party (e.g. PingID, Auth0) to provide services related to the Equipment Accounts authentication onto the Hosted Environment and Subscription Software. Licensee hereby grants John Zink a limited license to use and transfer Personal Information, including but not limited to, EquipmentIDs and passwords, to such third-party solely for authentication services. Such license will terminate at the end of the Subscription Term.

(e) Connectivity. John Zink will be responsible for maintaining connectivity from its network to the Internet which is capable of servicing the relevant Internet traffic to and from the hosted environment. Licensee is responsible for providing connectivity to the Internet for itself and its Authorized Users. Licensee shall also be responsible for ensuring that latency and available bandwidth from the user's desktop to John Zink's hosted routers is adequate to meet Licensee's desired level of performance. If Licensee requires a VPN or private network connection to the Subscription Services, Licensee is responsible for all costs associated with any specialized network connectivity required by Licensee. Unless otherwise agreed in any applicable purchase order, Licensee shall be responsible for and pay for its use of cellular data. If the Parties agree in writing that John Zink is responsible for cellular data services, John Zink will charge back such cellular fees to Licensee.

(f) Restrictions. John Zink shall have no obligation to correct a problem caused by Licensee's negligence, Licensee's equipment malfunction or other causes beyond the control of John Zink.

(g) Customizations. Customizations are not permitted absent John Zink's prior written consent. If permitted, Customizations may only be created and deployed by John Zink, and shall be documented in a separate agreement between John Zink and Licensee. Support or other services for Customizations are not available under this Agreement or included as part of the Subscription Fees and may only be purchased pursuant to a separate agreement between John Zink and Licensee.

(h) Updates. John Zink will provide periodic Updates to the Subscription Software. John Zink will notify Licensee at least five (5) business days prior to installing the Updates; such notice will include the type of Update and anticipated downtime of the Subscription Software.

4. Payment and Taxes.

(a) Payment. Licensee shall pay John Zink the fees set forth on the Purchase Order according to the applicable terms and conditions.

5. Limited Warranties, Disclaimer of Warranties, and Remedies.

(a) Right to Grant License. John Zink warrants that that it owns all right, title and interest in and to the Ewon Software, Subscription Software or has obtained rights in such Subscription Software sufficient to grant the licenses granted to Licensee under this Agreement. Licensee's exclusive remedy, and John Zink's exclusive obligation, for a breach of this warranty is set forth in Section 7 (Indemnity).

(b) No Personal Information. Licensee warrants that the Licensee Data contains no Personal Information.

(c) Limited Subscription Software Warranty by John Zink and Remedy For Breach. John Zink warrants that the Subscription Software will operate without a Documented Defect during the Initial Subscription Term. John Zink's sole obligation with respect to a breach of the foregoing warranty shall be to repair or replace the Subscription Software giving rise to the breach of warranty. If John Zink is unable to repair or replace such Subscription Software within a reasonable period of time, then, subject to the limitations set forth in Section 14 of this Agreement, Licensee may pursue its remedies at law to recover direct damages resulting from the breach of this warranty. The remedies in this Section 5(c) are exclusive and in lieu of all other remedies, and represent John Zink's sole obligations, for a breach of the foregoing warranty. Licensee must provide notice to John Zink of any warranty claim within the warranty period. For clarity, Licensee's entitlement to Support (as defined in Section 3(b)) in connection with any Documented Defect shall continue throughout the Subscription Term.

(d) Malicious Code. John Zink represents that it has used commercially reasonable best efforts utilizing generally accepted industry tools and practices to provide Ewon Software and Subscription Software that does not contain any "time bombs," "worms," "viruses," "Trojan horses," "protect codes," "data destruct keys," or other programming devices that are intended to access, modify, delete, damage, deactivate or disable the Subscription Services ("**Malicious Code**"). As Licensee's sole remedy for breach of this representation, John Zink shall take action immediately to investigate, identify and remove such Malicious Code from the Subscription Software.

(e) Limited Services Warranty and Remedy For Breach. John Zink warrants to Licensee that, John Zink will render the Subscription Services with commercially reasonable care and skill. John Zink further warrants that the hosted environment will be available at all times throughout the Subscription Term, subject to the exceptions and allowances described in the Availability section of the applicable Service Level Description. The level of unavailability shall not exceed one half of one percent (0.5%) per month, excluding Scheduled Maintenance as described in the applicable Service Level Description (the "**Down Time Warranty**"). In the event of a breach of the foregoing warranty John Zink shall apply service level credits based on the actual availability measure for the applicable period as follows:

Availability	**Service Level Credit**
99.500% or greater	No Service Level Credit
99.499% - 99.000%	5% of the monthly prorated subscription fee
98.999% - 98.500%	15% of the monthly prorated subscription fee
98.499% - 95.000%	25% of the monthly prorated subscription fee
Below 95.000%	35% of the monthly prorated subscription fee

Service level credits for Subscription Fees paid on an annual basis shall be based on a monthly equivalent fee. For example, a 5% service level credit on an annual subscription fee shall be 5% of 1/12 of the annual fee. Service level credits shall be applied to Licensee's next invoice or, if Licensee has paid the final invoice under this Agreement, service level credits shall be paid to Licensee within thirty (30) calendar days following the determination that the credit is due. In the event availability for the production environment falls below 95% for any three consecutive months or any four months in a rolling 12 month period (a "Triggering Event"), Licensee may, within sixty (60) days of such Triggering Event, terminate this Agreement, in which case, in lieu of service level credits, Licensee shall receive a refund, on a pro rata basis, of any prepaid Fees applicable to the unused portion of the then-current Term following the effective date of termination of the Agreement. The service level credit is the exclusive remedy and is in lieu of all other remedies for breach of the Down Time Warranty.

(f) Disclaimer of Warranties. The limited warranties in this Section 5 are made to Licensee exclusively and are in lieu of all other warranties. **JOHN ZINK MAKES NO OTHER WARRANTIES WHATSOEVER, EXPRESS OR IMPLIED, WITH REGARD TO THE EWON SOFTWARE, SUBSCRIPTION SOFTWARE AND SUBSCRIPTION SERVICES PROVIDED UNDER THIS AGREEMENT AND/OR ANY PURCHASE ORDER, IN WHOLE OR IN PART. JOHN ZINK EXPLICITLY DISCLAIMS ALL WARRANTIES OF MERCHANTABILITY AND OF FITNESS FOR A PARTICULAR PURPOSE. JOHN ZINK EXPRESSLY DOES NOT WARRANT THAT THE EWON SOFTWARE, SUBSCRIPTION SOFTWARE OR SUBSCRIPTION SERVICES, IN WHOLE OR IN PART, WILL BE ERROR FREE, OPERATE WITHOUT INTERRUPTION OR MEET LICENSEE'S REQUIREMENTS.**

(g) Abrogation of Limited Warranty. John Zink will have no obligation under this Section 5 to the extent that any alleged breach of warranty is caused by any modification of the Ewon Software or Subscription Software not performed by or on behalf of John Zink. To the extent that an alleged breach of warranty concerns a Third Party Product that is subject to a more limited warranty under a Third Party Agreement than specified in Section 5 above, John Zink's obligations hereunder will be further limited accordingly.

(h) **FAILURE OF ESSENTIAL PURPOSE. THE PARTIES HAVE** AGREED **THAT THE LIMITATIONS SPECIFIED IN SECTIONS 5 AND 14 WILL SURVIVE AND APPLY EVEN IF ANY REMEDY SPECIFIED IN THIS AGREEMENT IS FOUND TO HAVE FAILED OF ITS ESSENTIAL PURPOSE, AND REGARDLESS OF WHETHER LICENSEE HAS ACCEPTED ANY EWON SOFTWARE, SUBSCRIPTION SOFTWARE OR SUBSCRIPTION SERVICE UNDER THIS AGREEMENT.**

(i) **HIGH RISK ACTIVITIES. THE EWON SOFTWARE, SUBSCRIPTION SOFTWARE MAY BE USED AS ON-LINE CONTROL EQUIPMENT, HAZARD PREDICTION, OR ENVIRONMENTAL MONITORING EQUIPMENT WITHOUT HUMAN OVERSIGHT IN HAZARDOUS ENVIRONMENTS REQUIRING FAIL-SAFE PERFORMANCE, SUCH AS IN THE OPERATION OF INDUSTRIAL EQUIPMENT, IN WHICH THE FAILURE OF THE EWON SOFTWARE OR SUBSCRIPTION SOFTWARE COULD LEAD DIRECTLY TO DEATH OR PERSONAL INJURY, OR SEVERE PHYSICAL, ENVIRONMENTAL, PROPERTY OR OTHER DAMAGE ("HIGH RISK ACTIVITIES"). JOHN ZINK DISCLAIMS AND LICENSEE AGREES TO WAIVE ANY EXPRESS OR IMPLIED WARRANTY OF FITNESS FOR HIGH RISK ACTIVITIES. LICENSEE AGREES THAT JOHN ZINK SHALL NOT BE LIABLE AND HEREBY INDEMNIFIES JOHN ZINK AGAINST ANY CLAIMS OR DAMAGES ARISING FROM OR RELATED TO THE USE OF THE EWON SOFTWARE OR SUBSCRIPTION SOFTWARE IN SUCH APPLICATIONS.**

6. Confidential Information.

(a) Confidentiality. The Confidential Information disclosed under this Agreement may be used, disclosed or reproduced only to the extent necessary to further and fulfill the purposes of this Agreement. Except as otherwise permitted under this Agreement, the Recipient will not knowingly disclose to any third party, or make any use of the Discloser's Confidential Information. The Recipient will use at least

the same standard of care to maintain the confidentiality of the Discloser's Confidential Information that it uses to maintain the confidentiality of its own Confidential Information, but in no event less than reasonable care. The non-disclosure and non-use obligations of this Agreement will survive in perpetuity with respect to each item of Confidential Information. Each of Licensee and John Zink shall be responsible for the breach of the confidentiality terms contained in this Section 6 by any of its directors, officers, employees, Authorized Users, agents, accountants and advisors. Notwithstanding the foregoing, this Section is not intended to prevent (a) a Recipient from using Residual Knowledge, subject to any Intellectual Property Rights of the Discloser, or (b) John Zink from using Collected Data. If the Recipient should receive any legal request or process in any form seeking disclosure of Discloser's Confidential Information, or if the Recipient should be advised by counsel of any obligation to disclose such Confidential Information, the Recipient shall (if allowed by law) provide the Discloser with prompt notice of such request or advice so that the Discloser may seek a protective order or pursue other appropriate assurance of the confidential treatment of the Confidential Information. Regardless of whether or not a protective order or other assurance is obtained, the Recipient shall furnish only that portion of the Discloser's Confidential Information which is legally required to be furnished and to use reasonable efforts to assure that the Information is maintained in confidence by the party to whom it is furnished.

(b) Security Policies and Safeguards. John Zink shall establish and maintain administrative, technical, and physical safeguards designed to protect against the destruction, loss, unauthorized access or alteration of Licensee Data in the possession or under the control of John Zink or to which John Zink has access, which are: (i) no less rigorous than those maintained by John Zink for its own information of a similar nature; (ii) no less rigorous than generally accepted industry standards; and (iii) required by applicable laws. The security procedures and safeguards implemented and maintained by John Zink pursuant to this Section 6(b) shall include, without limitation:

(i) User identification and access controls designed to limit access to Licensee's Data to authorized users;
(ii) the use of appropriate procedures and technical controls regulating data entering John Zink's network from any external source;
(iii) the use of encryption techniques when Licensee's Data is transmitted or transferred into or out of the hosted environment;
(iv) physical security measures, including without limitation securing Licensee's Data within a secure facility where only authorized personnel and agents will have physical access to Licensee Data;
(v) operational measures, including without limitation IT Service Management (ITSM) processes designed to ensure the correct and secure operations of information processing activities;
(v) periodic employee training regarding the security programs referenced in this Section; and
(vi) periodic testing of the systems and procedures outlined in this Section.

(c) Security Incident Response. In the event that John Zink becomes aware that the security of any Licensee Data has been compromised, or that such Licensee Data has been or is reasonably expected to be subject to a use or disclosure not authorized by this Agreement (an "**Information Security Incident**"), John Zink shall: (i) promptly (and in any event within 24 hours of becoming aware of such Information Security Incident), notify Licensee, in writing, of the occurrence of such Information Security Incident; (ii) investigate such Information Security Incident and conduct a reasonable analysis of the cause(s) of such Information Security Incident; (iii) provide periodic updates of any ongoing investigation to Licensee; (iv) develop and implement an appropriate plan to remediate the cause of such Information Security Incident to the extent such cause is within John Zink's control; and (v) cooperate with Licensee's reasonable investigation or Licensee's efforts to comply with any notification or other regulatory requirements applicable to such Information Security Incident.

7. Indemnity.

a. Section 6 Indemnity. Either Party ("Indemnitor") will defend, indemnify and hold the other Party ("Indemnitee") harmless from and against any loss, cost and expense to the extent arising from a breach of Section 6. Indemnitor's obligations under this indemnification are expressly conditioned on the following: (i) Indemnitee must promptly notify Indemnitor of any such claim; (ii) Indemnitee must, in writing, grant Indemnitor sole control of the defense of any such claim and of all negotiations for its settlement or compromise so long as such settlement or compromise does not result in payment of money by Indemnitee or an admission of guilt by Indemnitee (if Indemnitee chooses to represent its own interests in any such action, Indemnitee may do so at its own expense, but such representation must not prejudice Indemnitor's right to control the defense of the claim and negotiate its settlement or compromise); and (iii) Indemnitee must reasonably cooperate with Indemnitor to facilitate the settlement or defense of the claim. **THE FOREGOING SETS FORTH INDEMNITOR's EXCLUSIVE OBLIGATION WITH RESPECT TO BREACH OF CONTRACT UNDER SECTION 6.**

b. Intellectual Property Indemnity. See Purchase Order terms and conditions for relevant indemnity on third party intellectual property.

8. Term and Termination.

(a) Term. With respect to the Subscription Software, the Initial Subscription Term is set forth in Section 1. After the Initial Subscription Term, the Subscription Term shall renew for successive one-year Renewal Terms, unless either party provides written notice of non-renewal to the other party at least ninety (90) days prior to expiration of the Initial Subscription Term or then current Renewal Term, as the case may be. Except as set forth in Section 8(b), the Subscription Term cannot be terminated prior to its expiration date.

(b) Right of Termination. If either party breaches any material obligation in this Agreement or an Purchase Order (including, without limitation, any obligation to pay Subscription Fees), and fails to remedy such breach (if such breach can be remedied) within thirty (30) days of receipt of written notice of such breach, the other party may terminate this Agreement (including all Purchase Orders hereunder). Notwithstanding the foregoing, to the extent such material breach cannot be remedied through efforts of the breaching party, the other party has the right to terminate this Agreement (including all Purchase Orders hereunder) on less than thirty days' written notice.

(c) Effect of Termination. Upon termination of this Agreement by either party, Licensee's license to access and use the Subscription Software and Subscription Services shall immediately terminate as of the effective date of such termination. Termination of this Agreement will not release either party from making payments which may be owing to the other party under the terms of this Agreement through the effective date of such termination. Termination of this Agreement will be without prejudice to the terminating party's other rights and remedies pursuant to this Agreement, unless otherwise expressly stated herein.

(d) Return of Licensee Data. Upon termination or expiration of this Agreement, John Zink shall promptly make all Licensee Data available to Licensee as a native database export provided through John Zink's FTP server. In the event that Licensee requires the return of Licensee Data in an alternate format or requires any other termination assistance services, John Zink and Licensee shall mutually agree upon the scope of such termination assistance services and the fees and expenses payable for such termination assistance services.

(e) Survival of Obligations. All obligations relating to non-use and non-disclosure of Confidential Information, limitation of liability, and such other terms which by their nature survive termination, will survive termination or expiration of this Agreement.

9. Notices. All notices and other communications required or permitted under this Agreement must be in writing and will be deemed given when: delivered personally; sent by registered or certified mail, return receipt requested; transmitted by facsimile confirmed by first class mail; or sent by overnight courier. Notices must be sent to a party at its address shown on the signature page of the applicable Purchase Order, or to such other place as the party may subsequently designate for its receipt of notices in accordance with this Section. Licensee must promptly send copies of any notice of material breach and/or termination of the Agreement to John Zink, Attention: General Counsel or to such other place as John Zink may subsequently designate for its receipt of notices.

10. Force Majeure. Except with respect to the payment of fees hereunder, neither party will be liable to the other for any failure or delay in performance under this Agreement due to circumstances beyond its reasonable control, including, without limitation, Acts of God, war, terrorist acts, pandemics, quarantine, accident, labor disruption, acts, omissions and defaults of third parties and official, governmental and judicial action not the fault of the party failing or delaying in performance, or the threat of any of the foregoing.

11. Assignment. Licensee may not assign or transfer any of its rights or obligations under this Agreement without the prior written consent of John Zink, whether by operation of law or otherwise, including in connection with a change in control, merger, acquisition, consolidation, asset sale or other reorganization, and any attempt at such assignment or transfer will be void.

12. No Waiver. A party's failure to enforce its rights with respect to any single or continuing breach of this Agreement will not act as a waiver of the right of that party to later enforce any such rights or to enforce any other or any subsequent breach.

13. Choice of Law; Severability. See applicable purchase order terms and conditions, which apply to this agreement and are incorporated in their entirety.

14. LIMITATIONS OF LIABILITY. – SEE APPLICABLE PURCHASE ORDER TERMS AND CONDITIONS, WHICH APPLY TO THIS AGREEMENT AND ARE INCORPORATED IN THEIR ENTIRETY.

15. Audit Rights. John Zink (including any third party auditor retained by John Zink) may audit the records and systems of Licensee to ensure compliance with the terms of this Agreement and each applicable Purchase Order. John Zink will notify Licensee in writing at least ten (10) business days prior to any such audit. Any such audit will be conducted during regular business hours and will not interfere unreasonably with Licensee's business activities. John Zink may audit Licensee no more than once in any twelve (12) month period. If an audit reveals that Licensee is using the Subscription Software or Subscription Services beyond the scope of the license granted herein (for example, in excess of the License Restriction), then, in addition to any other remedies available to John Zink, Licensee will promptly pay John Zink the underpaid Subscription Fees associated therewith based on John Zink's then-current list rates, as well as any applicable late charges.

16. Compliance with Laws. Licensee will comply with all laws, rules and regulations applicable to the use of the Subscription Software and the Subscription Services including, without limitation, by not submitting any Licensee Data that is illegal, defamatory, or that infringes any third party proprietary rights.

17. Third Party Beneficiaries. The Parties acknowledge and agree that John Zink's affiliates are third party beneficiaries of this Agreement for app purposes including enforcement. Subject to the foregoing exception, this Agreement is entered into solely between John Zink and Licensee, may be enforced only by John Zink and Licensee, and will not be deemed to create any rights in third parties, including suppliers and subcontractors of a Party, or to create any obligations of a Party to any such third party

18. Entire Agreement. This Agreement contains the entire understanding of the parties with respect to its subject matter, and supersedes and extinguishes all prior oral and written communications between the parties about its subject matter. Any purchase order or similar document, which may be issued by Licensee in connection with this Agreement, does not modify, supplement or add terms to this Agreement. John Zink may modify this Agreement at any time, in its discretion, upon notice to Licensee and Licensee's continued use of the Ewon Software, Subscription Software constitutes Licensee's agreement to such modifications.

DOMESTIC TECHNICAL ASSISTANCE AGREEMENT (VAPOR CONTROL)

Scheduled Starting Date of Services: _____ Scheduled Completion Date of Services: _____

Is work tax exempt? ☐ ***Yes or*** ☐ ***No - If yes, return a tax exempt certificate with this agreement other wise tax will be charged.***

"**COMPANY**": _____	"**CONTRACTOR**":
Address: _____	John Zink Company, LLC *("John Zink")*
_____	11920 East Apache, Tulsa, Oklahoma 74116
Billing Address: _____	Point of Contact: _____
_____	Phone: _____
Work Site Address: _____	FAX: _____
_____	E-mail: _____
Point of Contact: _____	Service Required: _____
Phone: _____	_____
FAX: _____	_____
E-mail: _____	Equipment S.O. No.: _____

CALCULATION AND PAYMENT OF CHARGES

Calculations of rates for Labor, Travel Time, Travel Expenses, Living Expenses, Standby Time, Training, Field Materials, OEM Replacement Parts, Subcontracted Work, Rental Equipment, John Zink Owned Equipment, and Freight shipments shall be governed by Exhibit 1 "Domestic Reimbursable Hourly Rate Schedule" hereto attached. Payment of invoices shall be made net 30 days after submittal of the invoice. Documents supporting the invoices shall be furnished upon request. Payments due hereunder are not subject to any setoffs with any other contract.

WORKING HOURS

The normal working hours, consists of •"**Straight Time**" rates apply to the first eight (8) hours *(per shift)* of the workday on Monday, Tuesday, Wednesday, Thursday, or Friday. •"**Overtime**" rates apply for all hours in excess of Straight Time, except for Double Time situations. •"**Double Time**" rates apply on nationally recognized Holidays and on Saturday, Sunday after the first eight (8) hours *(per shift)* of the workday. •Travel time shall include both assignment travel and commuting travel.

SERVICES PROVIDED

The sole function of the Contractor's service personnel shall be to provide the technical advice and assistance expressly stated above. All services performed by the Contractor are expressly limited and conditioned upon the Company's acceptance of this Technical Assistance Agreement and the terms stated therein and any provision or differing terms proposed by Company shall be void and of no effect, unless accepted in writing by Contractor. No change to this Agreement shall be valid unless in writing, signed by the Company and Contractor. If this Agreement is incorporated into the purchase order or other agreement issued by the Company, which shall only be done with the approval of the Contractor, the terms of this Agreement shall take precedence over all conflicting terms stated in such other documents.

THE SERVICES PROVIDED BY THE CONTRACTOR HEREUNDER DO NOT SERVE TO MODIFY, WAIVE OR OTHERWISE LIMIT OR EXPAND THE TERMS OF THE CONTRACT WHICH APPLY TO THE SALE OF THE EQUIPMENT UPON WHICH SERVICES ARE TO BE PERFORMED BY THE CONTRACTOR.

In witness whereof, the parties to this Agreement have executed this Agreement effective as of the latest date stated below.

COMPANY	**CONTRACTOR**
(Signature) _____	*(Signature)* _____
Company (print): _____	Contractor: John Zink Company, LLC
Name (print): _____	Name (print): _____
Title (print): _____	Title (print): _____
Date: _____	Date: _____

1. RELATIONSHIP OF THE PARTIES. The parties hereto are independent contractors and neither the Contractor nor the Contractor's personnel are agents, servants or employees of the Company or its contractors or subcontractors. The Contractor shall notify the Company before proceeding with and upon completion of the services. At all times when Contractor's service personnel are present or performing services at the Company's work site, the Company shall provide an authorized representative to whom the Contractor's service personnel shall report and who shall be responsible for the safety of all persons and protection of all property in and adjacent to the work site. In providing the services hereunder, the Contractor assumes no right or duty to control or shut down the project or equipment or to control or direct the safety, operational, or maintenance procedures or methods utilized at the work site. Contractor assumes no responsibility for workmanship, productivity, technical qualification or training and qualification requirements of the personnel of the Company or others. Company shall provide emergency medical aid to Contractor's service personnel. Contractor shall reimburse Company for the cost of such aid.

2. WARRANTY. All services shall be performed by Contractor in a workmanlike manner, consistent with U.S. industry practices. If, within three months of performance of the services, any services prove deficient, Contractor will correct the deficiency. Contractor shall not be responsible for making of access required to re-perform the services. THERE ARE NO OTHER WARRANTIES, EXPRESS OR IMPLIED, EXCEPT AS EXPRESSLY STATED HEREIN. CONTRACTOR EXTENDS NO IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE. The Contractor shall not be responsible for goods and services furnished by the Company or others, or the costs thereof, without the Contractor's prior written agreement. Company's remedies under warranty are specifically limited to the correction of any deficient services performed by Contractor and are exclusive of all other remedies.

3. INSURANCE. Contractor shall maintain, and at Company's request shall provide Company with certificates evidencing, the following insurance coverage: (a) Statutory Workers' Compensation and Employer's Liability Insurance, with limits of $1,000,000.00 per occurrence; (b) Commercial General Liability Insurance, with a combined single limit for bodily injury and property damage of $1,000,000.00 per occurrence and in the aggregate; and (c) Automobile Liability Insurance, with a combined single limit for bodily injury and property damage of $1,000,000.00 per accident.. Company shall maintain the risk of physical loss or damage to its property and the work site, including, but not limited to, materials, equipment and supplies being shipped to, entering into, forming part of, or intended to be incorporated into the property at or near the work site.

4. INDEMNITY. CONTRACTOR SHALL DEFEND, INDEMNIFY AND HOLD HARMLESS COMPANY, ITS PARENT, AFFILIATES, SUBSIDIARIES, OFFICERS, DIRECTORS, EMPLOYEES AND AGENTS, AND THEIR SUCCESSORS AND ASSIGNS (COMPANY GROUP) AGAINST ALL THIRD PARTY DAMAGES, LOSSES, COSTS, CLAIMS, STRICT LIABILITY CLAIMS, LIENS, ENCUMBRANCES, LIABILITIES, AND EXPENSES (INCLUDING ATTORNEYS' FEES), BUT ONLY TO THE EXTENT OF THE NEGLIGENT ACTS OR OMISSIONS OF CONTRACTOR. COMPANY SHALL DEFEND, INDEMNIFY AND HOLD HARMLESS CONTRACTOR, ITS PARENT, AFFILIATES, SUBSIDIARIES, OFFICERS, DIRECTORS, EMPLOYEES AND AGENTS, AND THEIR SUCCESSORS AND ASSIGNS (CONTRACTOR GROUP), AGAINST ALL THIRD PARTY DAMAGES, LOSSES, COSTS, CLAIMS, STRICT LIABILITY CLAIMS, LIENS, ENCUMBRANCES, LIABILITIES, AND EXPENSES (INCLUDING ATTORNEYS' FEES), BUT ONLY TO THE EXTENT OF THE NEGLIGENT
ACTS OR OMISSIONS OF COMPANY. ALL LIABILITY, LOSSES, DAMAGES, COSTS OR EXPENSES RESULTING FROM PERSONAL INJURY, INCLUDING DEATH, LOSS OF OR PHYSICAL DAMAGE TO PROPERTY, CAUSED BY THE JOINT OR CONCURRING ACTS OF COMPANY AND CONTRACTOR, AND THEIR RESPECTIVE OFFICERS, DIRECTORS, EMPLOYEES OR AGENTS, SHALL BE BORNE BY COMPANY AND CONTRACTOR TO THE EXTENT EACH IS DETERMINED NEGLIGENT EITHER BY AGREEMENT OF THE PARTIES OR BY A COURT OF COMPETENT JURISDICTION. THE TERM "THIRD PARTY" SHALL MEAN ANY PERSON OR ENTITY THAT IS NOT A MEMBER OF COMPANY GROUP OR CONTRACTOR GROUP.

5. LIMITATIONS OF LIABILITY. NO PARTY SHALL BE LIABLE FOR INCIDENTAL, INDIRECT, OR CONSEQUENTIAL DAMAGES INCLUDING LOSS OF PROFITS, REVENUES OR OTHER ECONOMIC LOSSES WHETHER CLASSIFIED AS DIRECT OR CONSEQUENTIAL ARISING UNDER ANY CAUSE OR COMBINATION OF CAUSES, INCLUDING ANY THEORIES FOR CONCURRENT OR JOINT LIABILITY. IN NO EVENT SHALL CONTRACTOR'S AND/OR ITS PARENT/AFFILIATES CUMULATIVE LIABILITY EXCEED ONE MILLION DOLLARS REGARDLESS OF CAUSE OR COMBINATION OF CAUSES WHATSOEVER. ALL INSURANCE, BOND, BANK GUARANTEE OR LETTER OF CREDIT THAT MAY BE PAID BY THE INSURERS OR BANKS OF CONTRACTOR OR ITS PARENT/AFFILIATES SHALL BE CREDITED AGAINST THE LIMITATION OF LIABILITY AND REDUCE THE CUMULATIVE LIABILITY OF CONTRACTOR AND/OR ITS PARENT/AFFILIATES. COMPANY'S REMEDIES ARE LIMITED TO THOSE REMEDIES EXPRESSLY STATED IN THIS AGREEMENT; AND THOSE REMEDIES SHALL NOT FAIL THEIR ESSENTIAL PURPOSE BECAUSE COMPANY IS LIMITED TO THE EXCLUSIVE REMEDIES AS STATED. THESE LIMITATIONS SHALL APPLY NOTWITHSTANDING ANY FUNDAMENTAL BREACH OR FAILURE OF ESSENTIAL PURPOSE OF ANY LIMITED REMEDY.

6. MISCELLANEOUS: (a) The Company's audit rights shall consist of Contractor making available for Company's examination, at Contractor's home offices, the directly relevant and pertinent time sheets. (b) This Agreement supersedes all previous agreements and understandings of the parties on this subject matter and constitutes the entire Agreement between the parties. (c) If any provision of this Agreement is held to be illegal or invalid for any reason by a court of competent jurisdiction, the remaining provisions hereof shall be unimpaired and the illegal or invalid provision shall be construed and applied so as to most closely effectuate its intent. (d) The provisions for indemnity, limitation of liability and all other provisions which by their nature are intended to survive, shall survive expiration or termination of the Agreement. (e) Payment shall be via a financial institution that is not subject to the sanction laws of the United States, the European Union, or other applicable jurisdiction.

7. APPLICABLE LAW. These terms and conditions, this order and the legal relations of the parties shall be determined in accordance with the laws of the State of Texas, irrespective of Texas choice of law provisions. The parties disclaim any applicability of the U.N. Convention of the International Sale of Goods to the order. The parties hereby consent to the exclusive jurisdiction of either the District Court of Harris County, Texas, or the United States District Court for the Southern District of Texas, Houston Division (whichever is applicable), with respect to disputes relating to the order. THE PARTIES WAIVE, TO THE FULLEST EXTENT PERMITTED BY LAW, ANY RIGHT IT MAY HAVE TO A TRIAL BY JURY IN RESPECT OF ANY SUIT, ACTION, CLAIM OR PROCEEDING RELATING TO THE AGREEMENT.

VAPOR CONTROL - AFTERMARKET SERVICES DOMESTIC REIMBURSABLE HOURLY RATE SCHEDULE

For Work on Time & Material Contracts and Change Orders to Fixed Price Contracts

Standard Rates

Field Service Specialist	$150.00/hr.
Field Service Regional Advisor	$175.00/hr.
Engineers/Project Managers	$200.00/hr.
Controls Engineer/Process Engineer	$275.00/hr.

Below are Hourly Rates for Locations with a Preventative Maintenance (PM) Contract in place with John Zink. The discounted rates apply to all services at that facility.

Field Service Specialist	$120.00/hr.
Field Service Regional Advisor	$145.00/hr.
Engineers/Project Managers	$180.00/hr.
Controls Engineer/Process Engineer	$250.00/hr.

Clarifications

Standard Rates are considered Straight Time and these rates apply to the first eight (8) hours of a work shift on Monday, Tuesday, Wednesday, Thursday, or Friday. Minimum site call outs are four (4) hours.

Overtime rates apply to the first eight (8) hours of a shift on Saturday or Sunday and all hours in excess of Straight Time, except in situations where Double Time applies. Overtime rates = 1.5 x straight time rate

Double Time rates apply on nationally recognized Holidays and all hours in excess of the first eight (8) hours of a work shift on Saturday and Sunday. Double time rates = 2.0 x straight time rate

If a special request is made for a Field Service Specialist that does not normally cover their specific region then the rate for a Field Service Advisor will apply.

The minimum billing amount for call-outs is 4 hours.

The above hourly rates are in US dollars and include those taxes imposed on income, gross receipts and contributions and taxes for unemployment insurance, old age retirement benefits, pensions, annuities imposed by the United States or any state or political subdivision thereof, however measured. They do not include VAT, sales taxes, use taxes, and/or excise taxes. The above rates do not include travel and living expenses.

Other Field Charges

A. Travel Time: Man-hours for travel are calculated on a portal to portal basis and are in addition to hours worked.
B. Travel Expenses: John Zink vehicles will be billed at the current IRS Standard Mileage Rates plus $0.15 per mile. Airline tickets, rental cars, parking fees, toll roads, etc. will be invoiced at cost plus 15%.
C. Living Expenses: Meals and hotels will be invoiced at a cost plus 15%.
D. Standby Time: Any JZ employee put on stand-by will be paid 8 hours/day. The minimum 8-hour shift can be combined with time worked during the shift. Overtime rates are paid when the work extends past the 8-hour minimum.
E. Training: Training required to enter the facility will be billed at cost plus 15% for the training, plus the man-hours required for the training.
F. Field Materials: Field materials purchased, such as, pipe, fittings, flanges, gaskets, pipe supports, etc. will be billed at cost plus 20%.
G. OEM Replacement Parts: John Zink OEM parts and replacement equipment will be invoiced at normal pricing.
H. Subcontracted Work: will be billed at vendor's invoice plus 20%.
I. Rental Equipment: including, but not limited to cranes, forklifts, trailers, scaffold, welding machines, power tools, hand tools, breathing air, etc. will be billed at invoice plus 20%.
J. John Zink Owned Equipment: (i.e.; trucks, tools, etc.) shall be billed at $100.00 per day.
K. Freight shipments: ExWorks Tulsa, OK, or corresponding fabrication facility. Freight charges will be pre-paid and added to invoice.
L. Safety forms: Completion of Safety forms/Job safety analysis, lift plans, etc will be billed at actual time required for approval and processing
M. Drafting and Coordinators: Any additional work required for these services will be invoiced as needed.

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INTERNATIONAL TECHNICAL ASSISTANCE AGREEMENT (VAPOR CONTROL)

Scheduled Starting Date of Services: _____ Scheduled Completion Date of Services: _____

Is work tax exempt? ☐ ***Yes or*** ☐ ***No - If yes, return a tax-exempt certificate with this agreement otherwise tax will be charged.***

"**COMPANY**": _____
Address: _____
_____
Billing Address: _____
_____
Work Site Address: _____
_____
Point of Contact: _____
Phone: _____
FAX: _____
E-mail: _____

"**CONTRACTOR**":
John Zink Company, LLC *("John Zink")*
11920 East Apache, Tulsa, Oklahoma 74116
Point of Contact: _____
Phone: _____
FAX: _____
E-mail: _____
Service Required: _____
_____
_____
Equipment S.O. No.: _____

CALCULATION AND PAYMENT OF CHARGES

Calculations of rates for Labor, Travel Time, Travel Expenses, Living Expenses, Standby Time, Training, Field Materials, OEM Replacement Parts, Subcontracted Work, Rental Equipment, John Zink Owned Equipment, and Freight shipments shall be governed by Exhibit 1 "Domestic Reimbursable Hourly Rate Schedule" hereto attached. Payment of invoices shall be made net 30 days after submittal of the invoice. Documents supporting the invoices shall be furnished upon request. Payments due hereunder are not subject to any setoffs with any other contract.

WORKING HOURS

The minimum work day is 8 hours per day. The normal working hours, consists of •"**Straight Time**" rates apply to the first eight (8) hours *(per shift)* of the workday on Monday, Tuesday, Wednesday, Thursday, or Friday. •"**Overtime**" rates apply for all hours in excess of Straight Time, except for Double Time situations. •"**Double Time**" rates apply on nationally recognized Holidays and on Saturday, Sunday after the first eight (8) hours *(per shift)* of the workday. •Travel time shall include both assignment travel and commuting travel.

SERVICES PROVIDED

The sole function of the Contractor's service personnel shall be to provide the technical advice and assistance expressly stated above. All services performed by the Contractor are expressly limited and conditioned upon the Company's acceptance of this Technical Assistance Agreement and the terms stated therein and any provision or differing terms proposed by Company shall be void and of no effect, unless accepted in writing by Contractor. No change to this Agreement shall be valid unless in writing, signed by the Company and Contractor. If this Agreement is incorporated into the purchase order or other agreement issued by the Company, which shall only be done with the approval of the Contractor, the terms of this Agreement shall take precedence over all conflicting terms stated in such other documents.

THE SERVICES PROVIDED BY THE CONTRACTOR HEREUNDER DO NOT SERVE TO MODIFY, WAIVE OR OTHERWISE LIMIT OR EXPAND THE TERMS OF THE CONTRACT WHICH APPLY TO THE SALE OF THE EQUIPMENT UPON WHICH SERVICES ARE TO BE PERFORMED BY THE CONTRACTOR.

In witness whereof, the parties to this Agreement have executed this Agreement effective as of the latest date stated below.

COMPANY

(Signature) _____
Company (print): _____
Name (print): _____
Title (print): _____
Date: _____

CONTRACTOR

(Signature) _____
Contractor: John Zink Company, LLC
Name (print): _____
Title (print): _____
Date: _____

TERMS AND CONDITIONS - TECHNICAL ASSISTANCE AGREEMENT

1. RELATIONSHIP OF THE PARTIES. The parties hereto are independent contractors and neither the Contractor nor the Contractor's personnel are agents, servants or employees of the Company or its contractors or subcontractors. The Contractor shall notify the Company before proceeding with and upon completion of the services. At all times when Contractor's service personnel are present or performing services at the Company's work site, the Company shall provide an authorized representative to whom the Contractor's service personnel shall report and who shall be responsible for the safety of all persons and protection of all property in and adjacent to the work site. In providing the services hereunder, the Contractor assumes no right or duty to control or shut down the project or equipment or to control or direct the safety, operational, or maintenance procedures or methods utilized at the work site. Contractor assumes no responsibility for workmanship, productivity, technical qualification or training and qualification requirements of the personnel of the Company or others. Company shall provide emergency medical aid to Contractor's service personnel. Contractor shall reimburse Company for the cost of such aid.

2. WARRANTY. All services shall be performed by Contractor in a workmanlike manner, consistent with industry practices. If, within three months of performance of the services, any services prove deficient, Contractor will correct the deficiency. Contractor shall not be responsible for making of access required to reperform the services. THERE ARE NO OTHER WARRANTIES, EXPRESS OR IMPLIED, EXCEPT AS EXPRESSLY STATED HEREIN. CONTRACTOR EXTENDS NO IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE. The Contractor shall not be responsible for goods and services furnished by the Company or others, or the costs thereof, without the Contractor's prior written agreement. Company's remedies under warranty are specifically limited to the correction of any deficient services performed by Contractor and are exclusive of all other remedies.

3. INSURANCE. Contractor shall maintain, and at Company's request shall provide Company with certificates evidencing, the following insurance coverage: (a) Statutory Workers' Compensation and Employer's Liability Insurance, with limits of Five Hundred Thousand Euros (€500,000.00) per occurrence; (b) Commercial General Liability Insurance, with a combined single limit for bodily injury and property damage of One Million Euros (€1,000,000.00) per occurrence and in the aggregate; and (c) Automobile Liability Insurance, with a combined single limit for bodily injury and property damage of One Million Euros (€1,000,000.00) per accident. Company shall maintain the risk of physical loss or damage to its property and the work site, including, but not limited to, materials, equipment and supplies being shipped to, entering into, forming part of, or intended to be incorporated into the property at or near the work site.

4. INDEMNITY. CONTRACTOR SHALL DEFEND, INDEMNIFY AND HOLD HARMLESS COMPANY AGAINST ALL DAMAGES, LOSSES, COSTS, CLAIMS, LIABILITIES, AND EXPENSES (INCLUDING REASONABLE ATTORNEYS' FEES), RESULTING FROM BODILY INJURY, INCLUDING DEATH, OR DAMAGE TO TANGIBLE PROPERTY TO A THIRD PARTY, TO THE EXTENT CAUSED BY THE NEGLIGENT ACTS OR OMISSIONS OF CONTRACTOR, ITS OFFICERS, DIRECTORS, EMPLOYEES OR AGENTS ("CONTRACTOR GROUP"); AND COMPANY SHALL DEFEND, INDEMNIFY AND HOLD HARMLESS CONTRACTOR AGAINST ALL DAMAGES, LOSSES, COSTS, CLAIMS, LIABILITIES AND EXPENSES (INCLUDING REASONABLE ATTORNEYS' FEES), RESULTING FROM BODILY INJURY, INCLUDING DEATH, OR DAMAGE TO TANGIBLE PROPERTY TO A THIRD PARTY, TO THE EXTENT CAUSED BY THE NEGLIGENT ACTS OR OMISSIONS OF COMPANY, ITS OFFICERS, DIRECTORS, EMPLOYEES OR AGENTS ("COMPANY GROUP"). ALL LIABILITY, LOSSES, DAMAGES, COSTS OR EXPENSES RESULTING FROM BODILY INJURY, INCLUDING DEATH, OR DAMAGE TO TANGIBLE PROPERTY TO A THIRD PARTY, CAUSED BY THE JOINT OR CONCURRING ACTS OF COMPANY GROUP AND CONTRACTOR GROUP, SHALL BE BORNE BY COMPANY AND CONTRACTOR TO THE EXTENT EACH IS DETERMINED NEGLIGENT EITHER BY AGREEMENT OF THE PARTIES OR BY A COURT OF COMPETENT JURISDICTION. THE TERM "THIRD PARTY" SHALL MEAN ANY PERSON OR ENTITY THAT IS NOT A MEMBER OF CONTRACTOR GROUP, COMPANY GROUP, THE END USER OF THE GOODS SUBJECT TO THE SERVICES, INCLUDING ITS RESPECTIVE AFFILIATES, PARENT(S), SUBSIDIARIES OR ANY OF THEIR RESPECTIVE OFFICERS, DIRECTORS, EMPLOYEES, AGENTS, OR SUBCONTRACTORS.

5. LIMITATIONS OF LIABILITY. (A) NO PARTY SHALL BE LIABLE FOR INCIDENTAL, INDIRECT, OR CONSEQUENTIAL DAMAGES INCLUDING LOSS OF PROFITS, REVENUES OR OTHER ECONOMIC LOSSES WHETHER CLASSIFIED AS DIRECT OR CONSEQUENTIAL, ARISING UNDER ANY CAUSE OR COMBINATION OF CAUSES WHATSOEVER, INCLUDING ANY THEORIES FOR CONCURRENT OR JOINT LIABILITY. (B) OTHER THAN FOR DEATH OR PERSONAL INJURY RESULTING FROM CONTRACTOR'S NEGLIGENCE, IN NO EVENT SHALL CONTRACTOR'S AND/OR ITS PARENT/AFFILIATES CUMULATIVE LIABILITY EXCEED THE PURCHASE ORDER PRICE REGARDLESS OF CAUSE OR ANY COMBINATION OF CAUSES WHATSOEVER. ALL INSURANCE, BOND, BANK GUARANTEE OR LETTER OF CREDIT THAT MAY BE PAID BY THE INSURERS OR BANKS OF CONTRACTOR OR ITS PARENT/AFFILIATES SHALL BE CREDITED AGAINST THE LIMITATION OF LIABILITY AND REDUCE THE CUMULATIVE LIABILITY OF CONTRACTOR AND/OR ITS PARENT/AFFILIATES. (C) COMPANY'S REMEDIES ARE LIMITED TO THOSE REMEDIES EXPRESSLY STATED IN THIS AGREEMENT; AND THOSE REMEDIES SHALL NOT FAIL THEIR ESSENTIAL PURPOSE BECAUSE COMPANY IS LIMITED TO THE EXCLUSIVE REMEDIES AS STATED. (D) THESE LIMITATIONS SHALL APPLY NOTWITHSTANDING ANY FUNDAMENTAL BREACH OR FAILURE OF ESSENTIAL PURPOSE OF ANY LIMITED REMEDY.

6. MISCELLANEOUS: (a) The Company's audit rights shall consist of Contractor making available for Company's examination, at Contractor's home offices, the directly relevant and pertinent time sheets. (b) This Agreement supersedes all previous agreements and understandings of the parties on this subject matter and constitutes the entire Agreement between the parties. (c) If any provision of this Agreement is held to be illegal or invalid for any reason by a court of competent jurisdiction, the remaining provisions hereof shall be unimpaired and the illegal or invalid provision shall be construed and applied so as to most closely effectuate its intent. (d) The provisions for indemnity, limitation of liability and all other provisions which by their nature are intended to survive, shall survive expiration or termination of the Agreement. (e) Payment shall be via a financial institution that is not subject to the sanction laws of the United States, the European Union, or other applicable jurisdiction.

7. APPLICABLE LAW. These terms and conditions, this order and the legal relations of the parties shall be determined in accordance with the laws of England, irrespective of any choice of law provisions. All disputes shall be referred to and finally resolved by arbitration under the rules of the International Chamber of Commerce.

VAPOR CONTROL – PARTS AND SERVICE GROUP

INTERNATIONAL REIMBURSABLE HOURLY RATE SCHEDULE

For Work on Time & Material Contracts and Change Orders to Fixed Price Contracts

Standard Rates

Field Service Specialist……$225.00/hr.
Field Service Regional Advisor……$255.00/hr.
Engineers/Project Managers……$275.00/hr.
Controls Engineer/Process Engineer……$325.00/hr.

Clarifications

Standard Rates are considered Straight Time and these rates apply to the first eight (8) hours of a work shift on Monday, Tuesday, Wednesday, Thursday, or Friday. Minimum site call outs are four (4) hours.

Overtime rates apply to the first eight (8) hours of a shift on Saturday or Sunday and all hours in excess of Straight Time, except in situations where Double Time applies. Overtime rates = 1.5 x straight time rate

Double Time rates apply on nationally recognized Holidays and all hours in excess of the first eight (8) hours of a work shift on Saturday and Sunday. Double time rates = 2.0 x straight time rate

If a special request is made for a Field Service Specialist that does not normally cover their specific region then the rate for a Field Service Advisor will apply. The minimum billing amount for call-outs is 4 hours.

The above hourly rates are in US dollars and include those taxes imposed on income, gross receipts and contributions and taxes for unemployment insurance, old age retirement benefits, pensions, annuities imposed by the United States or any state or political subdivision thereof, however measured. They do not include VAT, sales taxes, use taxes, and/or excise taxes. The above rates do not include travel and living expenses.

Other Field Charges

A. **Travel Time:** Man-hours for travel are calculated on a portal to portal basis and are in addition to hours worked.
B. **Travel Expenses:** John Zink vehicles will be billed at the current IRS Standard Mileage Rates plus $0.15 per mile. Airline tickets, rental cars, parking fees, toll roads, etc. will be invoiced at cost plus 15%.
C. **Living Expenses:** Meals and hotels will be invoiced at a cost plus 15%.
D. **Standby Time:** Any JZ employee put on stand-by will be paid 8 hours/day. The minimum 8-hour shift can be combined with time worked during the shift. Overtime rates are paid when the work extends past the 8-hour minimum.
E. **Training:** Training required to enter the facility will be billed at cost plus 15% for the training, plus the man-hours required for the training.
F. **Field Materials:** Field materials purchased, such as, pipe, fittings, flanges, gaskets, pipe supports, etc. will be billed at cost plus 20%.
G. **OEM Replacement Parts:** John Zink OEM parts and replacement equipment will be invoiced at normal pricing.
H. **Subcontracted Work:** will be billed at vendor's invoice plus 20%.
I. **Rental Equipment:** including, but not limited to cranes, forklifts, trailers, scaffold, welding machines, power tools, hand tools, breathing air, etc. will be billed at invoice plus 20%.
J. **John Zink Owned Equipment:** (i.e.; trucks, tools, etc.) shall be billed at $100.00 per day.
K. **Freight shipments:** ExWorks Tulsa, OK, or corresponding fabrication facility. Freight charges will be pre-paid and added to invoice.
L. **Safety forms:** Completion of Safety forms/Job safety analysis, lift plans, etc will be billed at actual time required for approval and processing
M. **Drafting and Coordinators:** Any additional work required for these services will be invoiced as needed.

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Tressa Bathke

From: Pernu, Ben M <ben.pernu@kes.global>
Sent: Friday, November 5, 2021 7:42 AM
To: Tressa Bathke
Subject: RE: BIC - Flare VOC Clarification

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe. Please forward to it@bioenergydevco.com when in doubt.

Confirmed. That is just our boilerplate emissions expectations. If you have no organics other than methane, we aren't going to be creating VOCs in the flare.

Thanks,
Ben Pernu | Applications Engineer, Biogas Systems
918.234.2718

From: Tressa Bathke <tbathke@bioenergydevco.com>
Sent: Thursday, November 4, 2021 5:09 PM
To: Pernu, Ben M <ben.pernu@kes.global>
Subject: BIC - Flare VOC Clarification

Sent by an external sender

Hi Ben,

On page 8 of your proposal, you've listed the destruction efficiency of VOCs, which we don't have any in our biogas. Can you please confirm that if we have 0 VOCs in the inlet of the flare, there will be 0 in the outlet stream? Feel free to call me if you have any questions.

Thanks,

Tressa Bathke
Process Engineer
(443) 782-3424
BIOENERGY DEVCO
bioenergydevco.com

This email communication is confidential and is intended only for the individual(s) or entity named above and others who have been specifically authorized to receive it. If you are not the intended recipient, please do not read, copy, use or disclose the contents of this communication to others. Please notify the sender that you have received this email in error by replying to the email or by telephoning 443-782-3424. Please then delete the email and any copies of it. Thank you.

THERMAL OXIDIZER

Administrative Information

One original and one copy of All Application Forms Should Be Mailed To:
Division of Air Quality
100 West Water Street, Suite 6A
Dover, DE 19904

All Checks Should Be Made Payable To:
State of Delaware

Company and Site Information

1.	Company Name: **Bioenergy Devco**
2.	Company Mailing Address: **50 State Circle** City: **Annapolis** State: **Maryland** Zip Code: **21401**
3.	Site Name: **Bioenergy Innovation Center**
4.	Site Mailing Address: **28338 Enviro Way** *(if different from above)* City: **Seaford** State: **Delaware** Zip Code: **19973**
5.	Physical Location of Site: **28338 Enviro Way** *(if different from above)* City: **Seaford** State: **Delaware** Zip Code: **19973**
6.	Site Billing Address: **50 State Circle** *(if different from above)* City: **Annapolis** State: **Maryland** Zip Code: **21401**
7.	Air Quality Management Facility ID Number: **1000500281**
8.	Site NAICS Code): **221210, 325314** *(list all that apply*
9.	Site SIC Code: **4925, 2875** *(list all that apply)*
10.	Site Location Coordinates: Latitude: 38 ° 36’ 12” Longitude: -75 ° 36’ 16”
11.	Is the Facility New or Existing? ☐ NEW ☒ EXISTING
If the Facility is an Existing Facility, Complete the Rest of Question 11. If Not, Proceed to Question 12.	
11.1.	Does the Facility Have Active Air Permits? ☒ YES ☐ NO
12.	Is this Application For New Equipment or a Modification to Existing Equipment? ☒ New Equipment ☐ Modification of Existing Equipment ☐ Other (Specify):
If the application is for the modification of existing equipment, complete the rest of Question 12. If not, proceed to Question 13.	

Company and Site Information

12.1.	Does the Equipment Have an Active Air Permit? ☐ YES ☐ NO
If the equipment has an active air permit, complete the rest of Question 12. If not, proceed to Question 13.	
12.2.	Permit Number of Existing Equipment:
13.	Status of Equipment Being Applied For: ☒ Natural Minor Source ☐ Synthetic Minor Source ☐ Major Source ☐ Federally Enforceable Restrictions
14.	Facility Status: ☒ Natural Minor Facility ☐ Synthetic Minor Facility ☐ Major Facility
If the facility is a Major Source, complete the rest of Question 14. If not, proceed to Question 15.	
14.1.	Responsible Official Name:
14.2.	Responsible Official Title:

Contact Information

15.	Name of Owner or Facility Manager: **Jeff Deats**
16.	Title of Owner or Facility Manager: **Facility Manager**
17.	Permit Contact Name: **Christine McKiernan**
18.	Permit Contact Title: **Managing Director Engineering & Construction**
19.	Permit Contact Telephone Number: **(201) 779-1958**
20.	Permit Contact Fax Number: **NA**
21.	Permit Contact E-Mail Address: **cmckiernan@bioenergydevco.com**
22.	Billing Contact Name: **Dena Nolte**
23.	Billing Contact Title: **Controller**
24.	Billing Contact Telephone Number: **(443) 782-3384**
25.	Billing Contact Fax Number: **NA**
26.	Billing Contact E-Mail Address: **dnolte@bioenergydevco.com**

Proposed Construction and Operating Schedule

27.	When Will the Proposed Construction/Installation/Modification Occur: 04/01/2022
28.	Proposed Operating Schedule: **24** hours/day **7** days/week **52** weeks/year
28.1.	Is There Any Additional Information Regarding the Operating Schedule? ☐ YES ☒ NO
If YES, complete the rest of Question 28. If NO, proceed to Question 29.	

Proposed Construction and Operating Schedule

28.2. Describe the Additional Information:

Coastal Zone Information

29. Is the Facility Located in the Coastal Zone? ☐ YES ☒ NO

If the facility is located in the Coastal Zone complete the rest of Question 29. If not, proceed to Question 30.

29.1. Is a Coastal Zone Permit Required for Construction or Operation of the Source Being Applied for? ☐ YES ☐ NO

Attach a copy of the Coastal Zone Determination if it has not been previously submitted

If a Coastal Zone Permit is required complete the rest of Question 29. If not, proceed to Question 30.

29.2. Has a Coastal Zone Permit Been Issued? ☐ YES ☐ NO

Attach a copy of the Coastal Zone Permit if it has not been previously submitted

Local Zoning Information

30. Parcel Zoning: **Agricultural Residential (AR-1)**

Attach Proof of Local Zoning if it has not been previously submitted

Application Information

31. Is the Appropriate Application Fee Attached? ☒ YES ☐ NO

32. Is the Advertising Fee Attached? ☒ YES ☐ NO

For help determining your application and advertising fees see:
http://www.dnrec.state.de.us/DNREC2000/Library/Fees/DE%20Permit%20Fees.htm

Attach the appropriate fees. Note that your Application will not be considered complete if the appropriate fees are not included.

33. Is a Cover Letter Describing the Process Attached? ☒ YES ☐ NO

Attach a brief cover letter describing your Application.

If the Facility is a New Facility complete Question 34. If not, proceed to Question35.

34. Is a Copy of the Applicant Background Information Questionnaire on Record at the Department? ☐ YES ☐ NO

If NO, complete the rest of Question 34. If YES, process to Question 35.

34.1 Is a Copy of the Applicant Background Information Questionnaire Attached? ☐ YES ☐ NO

For a copy of the Applicant Background Information Questionnaire see
http://www.dnrec.delaware.gov/services/Documents/Chapter79Form.pdf

Attach a copy of the Applicant Background Information Questionnaire if applicable.

35. Check Which Application Forms are Attached:

Application Information

☒ AQM-1	☐ AQM-3.4	☐ AQM-3.9	☐ AQM-3.14	☐ AQM-4.4	☐ AQM-4.9	☐ AQM-6
☒ AQM-2	☐ AQM-3.5	☐ AQM-3.10	☐ AQM-3.15	☐ AQM-4.5	☐ AQM-4.10	
☒ AQM-3.1	☐ AQM-3.6	☐ AQM-3.11	☒ AQM-4.1	☐ AQM-4.6	☐ AQM-4.11	
☐ AQM-3.2	☐ AQM-3.7	☐ AQM-3.12	☒ AQM-4.2	☐ AQM-4.7	☐ AQM-4.12	
☐ AQM-3.3	☐ AQM-3.8	☐ AQM-3.13	☒ AQM-4.3	☐ AQM-4.8	☒ AQM-5	

36. Check Which Documents are Attached:

- ☐ Coastal Zone Determination
- ☐ Coastal Zone Permit
- ☒ Proof of Local Zoning
- ☐ Application Fee
- ☐ Advertising Fee
- ☐ Applicant Background Information Questionnaire
- ☐ Claim of Confidentiality
- ☒ Manufacturer Specification(s)
- ☐ Material Safety Data Sheets (MSDSs)
- ☒ Supporting Calculations
- ☒ Descriptive Cover Letter
- ☐ Other (Specify):

Confidentiality Information

37. Do You Consider Any of the Information Submitted With this Application Confidential? ☐ YES ☒ NO

For help on how to submit a confidentiality claim see http://regulations.delaware.gov/register/december2011/final/15%20DE%20Reg%20864%2012-01-11.htm

If a Claim of Confidentiality is made it MUST meet the requirements of Section 6 of DNREC's Freedom of Information ("FOIA") Regulation at the time the Application is submitted.

Signature Block

I, the undersigned, hereby certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all of its attachments as to the truth, accuracy, and completeness of this information. I certify based on information and belief formed after reasonable inquiry, the statements and information in this document are true, accurate, and complete. By signing this form, I certify that I have not changed, altered, or deleted any portions of this application. I acknowledge that I cannot commence construction, alteration, modification or initiate operation until I receive written approval (i.e. permit, registration, or exemption letter) from the Department. I acknowledge that I may be required to perform testing of the equipment to receive construction or operation approval, and that if I do not receive approval to construct or operate that I may appeal the decision.

Peter Ettinger
Owner or Operator

1/12/22
Date

Signature of Owner or Operator

One Original and One Copy of All Application Forms Should Be Mailed To:
Division of Air Quality
100 W. Water Street, Suite 6A
Dover, Delaware 19904

All Checks Should Be Made Payable To:
State of Delaware

JAMIE WHITEHOUSE, AICP
PLANNING & ZONING DIRECTOR
(302) 855-7878 T
(302) 854-5079 F
jamie.whitehouse@sussexcountyde.gov

Sussex County
DELAWARE
sussexcountyde.gov

March 19, 2021

Mr. Dennis Schrader, Esq.
P.O. Box 690
Georgetown, DE 19947

By e-mail to: dschrader@morrisjames.com

RE: Notice of Decision Letter for Conditional Use (CU 2258) Bioenergy Development Group, LLC to amend CU 1314 (as amended by CU's 1691 and 1962) to permit the processing and handling of poultry litter to include nutrient recovery for natural gas and electrical generation to be located at 28338 Enviro Way in Seaford, DE.
Tax Parcels: 132-6.00-88.01 & 95.00 and 132-11.00-41.00 & 41.02

Dear Mr. Schrader,

At their meeting of April 20, 2021, the Sussex County Council approved the Conditional Use application to amend CU 1314 (as amended by CU's 1691 and 1962) to permit the processing and handling of poultry litter to include nutrient recovery for natural gas and electrical generation at 28338 Enviro Way in Seaford subject to twelve (12) conditions. The Conditional Use shall be substantially underway within three (3) years of the County Council approval otherwise the Conditional Use shall expire. A Site Plan showing the conditions of approval shall be reviewed and approved by the Planning Commission prior to commencement of the use on the parcel. The following are the conditions:

A. Except as otherwise amended by this grant of conditional use, the conditions imposed by Conditional Use No. 1314 as amended by Conditional Use Nos. 1691 and 1962 shall remain in effect.
B. The proposed facility shall be subject to DNREC and other state and federal regulatory approvals.
C. The proposed facility shall only accept, process and handle poultry litter and DAF.
D. There shall not be any stockpiling of DAF, poultry litter, or wastewater on site.
E. This conditional use shall be valid concurrent with DNREC's permits for this use. If the DNREC permits shall be terminated or expire, this conditional use shall also terminate and expire.
F. The proposed facility, anerobic digesters, pretanks, and other equipment and structure related to this use shall be located behind the site of the existing pelletizing facility and the area of disturbance related to this new use shall be no greater than 11.3 acres.
G. As proposed by the Applicant, there will be no change to the wooded coverage on the property.

H. All stormwater management facilities shall be subject to the review and approval of the Sussex Conservation District. The Final Site Plan shall include the approval of the Sussex Conservation District for the design and locations of the stormwater management areas.
I. Prior to the submission of the Final Site Plan, the Applicant must provide copies of all active permits from DNREC demonstrating that the Applicant has received all necessary approvals and permits from DNREC to operate the proposed facility.
J. As proffered by the Applicant, the landscape buffer shall be installed at the front of the site. A landscape buffer plan shall be included as part of the Final Site Plan for the project.
K. The failure to abide by these conditions shall result in the termination of the conditional use approval.
L. The Applicant shall submit a Final Site Plan, which shall be subject to the review and approval of the Sussex County Planning and Zoning Commission.

The Final Site Plan shall be prepared by a licensed Delaware Surveyor or Engineer and shall contain the conditions of approval on the plan. The Final Site Plan shall be approved prior to the commencement of the use on the property. The Site Plan shall be reviewed and approved by the Planning Commission. Agency approvals include but are not limited to: DelDOT, Sussex Conservation District and the Office of the State Fire Marshal.

Please submit a minimum of two (2) full size paper copies and an electronic copy (PDF) of the Preliminary Site Plan to the Planning and Zoning Office a minimum of twenty (20) days prior to a Planning Commission meeting.

An approved copy of the Ordinance granting approval of the Conditional Use will be sent to you from the Clerk of Council.

Please feel free to contact the Planning and Zoning Department with any questions during business hours 8:30 am to 4:30 pm, Monday through Friday, at (302)-855-7878.

Sincerely,

Christin Scott

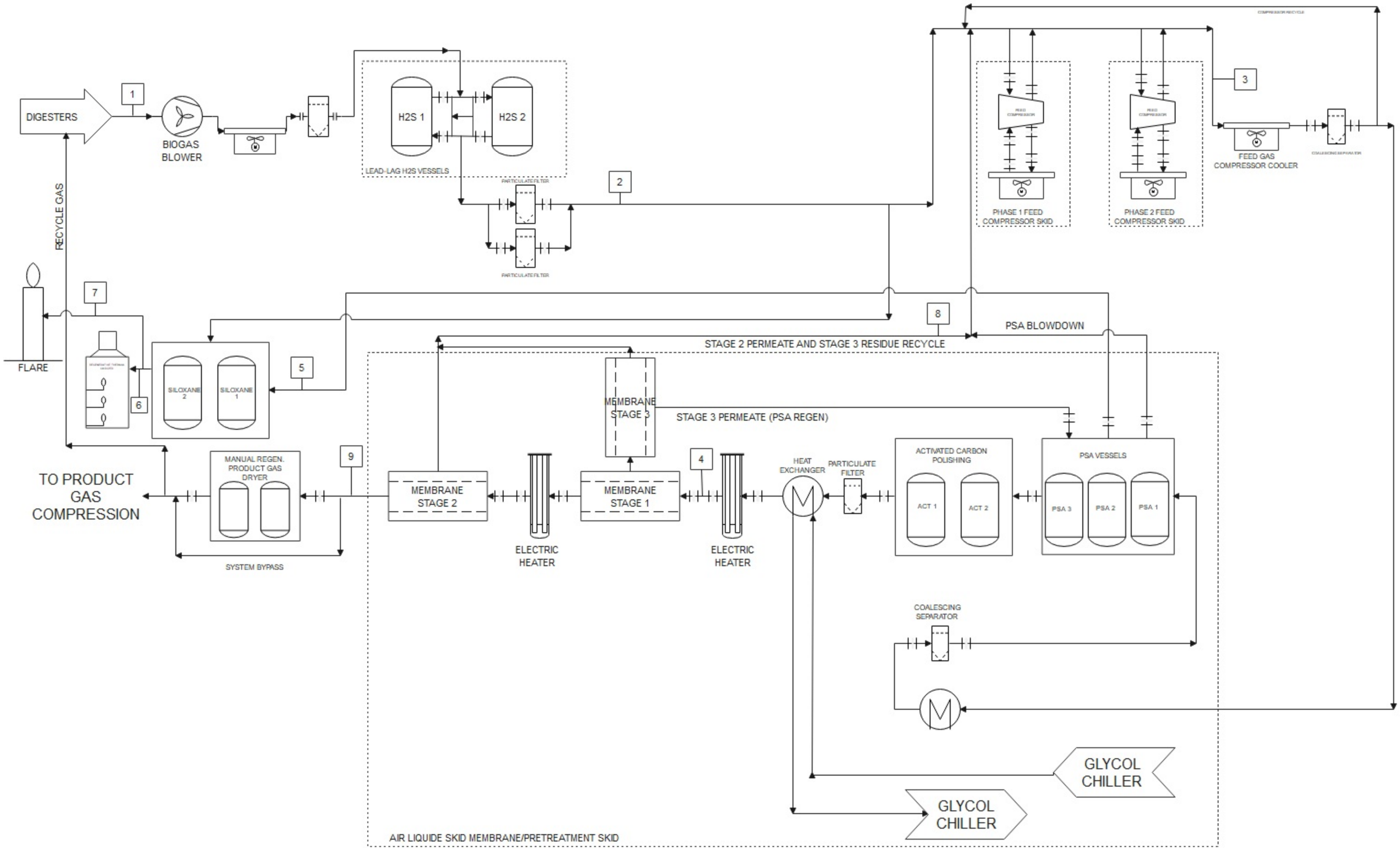
Mrs. Christin Scott
Planner I

CC: Mr. Lester Shaffer, Chief Constable
Ms. Susan Isaacs, Public Works
Mr. Andy Wright, Building Code
Mr. John Ashman, Engineering

Process Flow Diagram

Sketch the Process Flow Diagram for the equipment or process being applied for. Include each emission unit and control device (even existing emission units that will not be modified by this application). You may identify each emission unit with a simple shape. Label each emission unit and control device with a unique identifier. Show the relationship between each emission unit and/or control device by drawing arrows between them to indicate the flow of air pollutants. List which application forms are included for each emission unit or control device below the shape representing each emission unit or control device . See http://www.delaware.gov/reg2/default.htm for example Process Flow Diagrams for common processes. If you already have a Process Flow Diagram for the equipment or process being applied for, you may attach it to the application instead of using this form.

See attached Process Flow Diagram


DIGESTERS
1
BIOGAS BLOWER
H2S 1
H2S 2
LEAD-LAG H2S VESSELS
PARTICULATE FILTER
PARTICULATE FILTER
2
PHASE 1 FEED COMPRESSOR SKID
PHASE 2 FEED COMPRESSOR SKID
3
FEED GAS COMPRESSOR COOLER
RECYCLE GAS
FLARE
7
6
SILOXANE 2
SILOXANE 1
5
8
PSA BLOWDOWN
STAGE 2 PERMEATE AND STAGE 3 RESIDUE RECYCLE
MEMBRANE STAGE 3
STAGE 3 PERMEATE (PSA REGEN)
TO PRODUCT GAS COMPRESSION
MANUAL REGEN. PRODUCT GAS DRYER
9
MEMBRANE STAGE 2
ELECTRIC HEATER
MEMBRANE STAGE 1
4
ELECTRIC HEATER
HEAT EXCHANGER
PARTICULATE FILTER
ACTIVATED CARBON POLISHING
ACT 1
ACT 2
PSA VESSELS
PSA 3
PSA 2
PSA 1
SYSTEM BYPASS
COALESCING SEPARATOR
GLYCOL CHILLER
GLYCOL CHILLER
AIR LIQUIDE SKID MEMBRANE/PRETREATMENT SKID

Generic Process Equipment Application

If you are using this form electronically, press F1 at any time for help

General Information

1.	Facility Name: **Bioenergy Innovation Center**
2.	Equipment ID Number: **NA**
3.	Provide a brief description of Equipment or Process: **Operation of anaerobic digesters to produce renewable natural gas.**
4.	Manufacturer: **NA**
5.	Model: **NA**
6.	Serial Number: **NA**

Raw Material Information

7. Raw Materials Used in Process

If there are more than four Raw Materials used, attach additional copies of this page as needed.

	Raw Material Used	CAS Number	Usage Rate (include units)	MSDS Attached?
7.1.	**Poultry litter and DAF (liquid and solid cake; fats, oils & grease; and waste activated sludge)**		**250,000 tons/year**	☐ YES ☒ NO
7.2.				☐ YES ☐ NO
7.3.				☐ YES ☐ NO
7.4.				☐ YES ☐ NO

Attach a copy of all calculations made to support the data in the table above.
Attach a Material Safety Data Sheet (MSDS) for each Raw Material used.

Products Produced Information

8. Products Produced

If there are more than four Products Produced, attach additional copies of this page as needed.

	Product Produced	CAS Number	Production Rate (include units)	MSDS Attached?
8.1.	**Biogas**		**1,600 SCFM**	☐ YES ☒ NO
8.2.				☐ YES ☐ NO
8.3.				☐ YES ☐ NO

Products Produced Information

8.4.			☐ YES ☐ NO

Attach a copy of all calculations made to support the data in the table above.
Attach a Material Safety Data Sheet (MSDS) for each Product Produced.

Byproducts Generated Information

9. Byproducts Generated

If there are more than four Byproducts Generated, attach additional copies of this page as needed.

	Byproduct Generated	CAS Number	Generation Rate (include units)	MSDS Attached?
9.1.	**Dewatered digestate**		**45,000 tons/year**	☐ YES ☒ NO
9.2.				☐ YES ☐ NO
9.3.				☐ YES ☐ NO
9.4.				☐ YES ☐ NO

Attach a copy of all calculations made to support the data in the table above.
Attach a Material Safety Data Sheet (MSDS) for each Byproduct Generated.

General Information

10. Manufacturer's Rated Capacity or Maximum Throughput of Equipment or Process: **250,000 tons organic waste per year.**

11. Describe Important Manufacturer Specifications and/or Operating Parameters for Equipment or Process: **See cover letter.**

Attach the Manufacturer's Specification Sheet(s) for the equipment or process.

Control Device Information

12. Is an Air Pollution Control Device Used? ☒ YES ☐ NO

If an Air Pollution Control Device is used, complete the rest of Question 12. If not, proceed to Question 13.

12.1. Is Knockout Used? ☐ YES ☒ NO

If YES, complete Form AQM-4.11 and attach it to this application.

12.2. Is a Settling Chamber Used? ☐ YES ☒ NO

If YES, complete Form AQM-4.10 and attach it to this application.

12.3. Is an Inertial or Cyclone Collector Used? ☐ YES ☒ NO

If YES, complete Form AQM-4.5 and attach it to this application.

12.4. Is a Fabric Collector or Baghouse Used? ☐ YES ☒ NO

If YES, complete Form AQM-4.6 and attach it to this application.

Control Device Information

12.5. Is a Venturi Scrubber Used?	☐ YES ☒ NO
If YES, complete Form AQM-4.8 and attach it to this application.	
12.6. Is an Electrostatic Precipitator Used?	☐ YES ☒ NO
If YES, complete Form AQM-4.7 and attach it to this application.	
12.7. Is Adsorption Equipment Used?	☒ YES ☐ NO
If YES, complete Form AQM-4.2 and attach it to this application.	
12.8. Is a Scrubber Used?	☐ YES ☒ NO
If YES, complete Form AQM-4.4 and attach it to this application.	
12.9. Is a Thermal Oxidizer or Afterburner Used?	☒ YES ☐ NO
If YES, complete Form AQM-4.1 and attach it to this application.	
12.10. Is a Flare Used?	☒ YES ☐ NO
If YES, complete Form AQM-4.3 and attach it to this application.	
12.11. Is Any Other Control Device Used?	☐ YES ☒ NO
If YES, attach a copy of the control device Manufacturer's Specification Sheet(s).	
If any other control device is used, complete the rest of Question 12. If not, proceed to Question 13.	
12.12. Describe Control Device:	
12.13. Pollutants Controlled: ☐ VOCs ☐ HAPs ☐ PM ☐ PM_{10} ☐ $PM_{2.5}$ ☐ NO_X ☐ SO_X ☐ Metals ☐ Other (Specify):	
12.14. Control Device Manufacturer:	
12.15. Control Device Model:	
12.16. Control Device Serial Number:	
12.17. Control Device Design Capacity:	
12.18. Control Device Removal or Destruction Efficiency:	

Stack Information

13. How Does the Process Equipment Vent: *(check all that apply)* ☐ Directly to the Atmosphere ☒ Through a Control Device Covered by Forms AQM-4.1 through 4.12 ☐ Through Another Control Device Described on This Form
If any of the process equipment vents directly to the atmosphere or through another control device described on this form, proceed to Question 14. If the process equipment vents through a control device, provide the stack parameters on the control device form and proceed to Question 18.
14. Number of Air Contaminant Emission Points: **1**
If there are more than three Emission Points, attach additional copies of this page as needed.
For the first Emission Point
15. Emission Point Name: **See AQM-4.1**

Stack Information
15.1. Stack Height Above Grade: **feet**
15.2. Stack Exit Diameter: **feet** *(Provide Stack Dimensions If Rectangular Stack)*
15.3. Is a Stack Cap Present? ☐ YES ☐ NO
15.4. Stack Configuration: ☐ Vertical ☐ Horizontal ☐ Downward-Venting *(check all that apply)* ☐ Other (Specify):
15.5. Stack Exit Gas Temperature: **°F**
15.6. Stack Exit Gas Flow Rate: **ACFM**
15.7. Distance to Nearest Property Line: **feet**
15.8. Describe Nearest Obstruction:
15.9. Height of Nearest Obstruction: **feet**
15.10. Distance to Nearest Obstruction: **feet**
15.11. Are Stack Sampling Ports Provided? ☐ YES ☐ NO
For the second Emission Point. If there is no second Emission Point, proceed to Question 18.
16. Emission Point Name: **See AQM-4.3**
16.1. Stack Height Above Grade: **feet**
16.2. Stack Exit Diameter: **feet** *(Provide Stack Dimensions If Rectangular Stack)*
16.3. Is a Stack Cap Present? ☐ YES ☐ NO
16.4. Stack Configuration: ☐ Vertical ☐ Horizontal ☐ Downward-Venting *(check all that apply)* ☐ Other (Specify):
16.5. Stack Exit Gas Temperature: **°F**
16.6. Stack Exit Gas Flow Rate: **ACFM**
16.7. Distance to Nearest Property Line: **feet**
16.8. Describe Nearest Obstruction:
16.9. Height of Nearest Obstruction: **feet**
16.10. Distance to Nearest Obstruction: **feet**
16.11. Are Stack Sampling Ports Provided? ☐ YES ☐ NO
For the third Emission Point. If there is no third Emission Point, proceed to Question 18.
17. Emission Point Name:
17.1. Stack Height Above Grade: **feet**
17.2. Stack Exit Diameter: **feet** *(Provide Stack Dimensions If Rectangular Stack)*
17.3. Is a Stack Cap Present? ☐ YES ☐ NO
17.4. Stack Configuration: ☐ Vertical ☐ Horizontal ☐ Downward-Venting *(check all that apply)* ☐ Other (Specify):
17.5. Stack Exit Gas Temperature: **°F**
17.6. Stack Exit Gas Flow Rate: **ACFM**

Stack Information

17.7.	Distance to Nearest Property Line: **feet**
17.8.	Describe Nearest Obstruction:
17.9.	Height of Nearest Obstruction: **feet**
17.10.	Distance to Nearest Obstruction: **feet**
17.11.	Are Stack Sampling Ports Provided? ☐ YES ☐ NO

Monitoring Information

18.	Will Emissions Data be Recorded by a Continuous Emission Monitoring System? ☐ YES ☒ NO
If Yes, attach a copy of the Continuous Emission Monitoring System Manufacturer's Specification Sheets	
If YES, complete the rest of Question 18. If NO, proceed to Question 19.	
18.1.	Pollutants Monitored: ☐ VOCs ☐ HAPs ☐ PM ☐ PM_{10} ☐ $PM_{2.5}$ ☐ NO_X ☐ SO_X ☐ Metals ☐ Other (Specify):
18.2.	Describe the Continuous Emission Monitoring System:
18.3.	Manufacturer:
18.4.	Model:
18.5.	Serial Number:
18.6.	Will Multiple Emission Units Be Monitored at the Same Point? ☐ YES ☐ NO
If YES, complete the rest of Question 18. If NO, proceed to Question 19.	
18.7.	Emission Units Monitored:
18.8.	Will More Than One Emission Unit be Emitting From the Combined Point At Any Time? ☐ YES ☐ NO
If YES, complete the rest of Question 18. If NO, proceed to Question 19.	
18.9.	Emission Units Emitting Simultaneously:

Voluntary Emission Limitation Request Information

19.	Are You Requesting Any Voluntary Emission Limitations to Avoid Major Source Status, Minor New Source Review, MACT, NSPS, etc.? ☐ YES ☒ NO
If YES, complete the rest of Question 19. If NO, proceed to Question 20.	
19.1.	Describe Any Requested Emission Limitations:

Voluntary Operating Limitation Request Information

Voluntary Operating Limitation Request Information	
20. Are You Requesting Any Voluntary Operating Limitations to Avoid Major Source Status, Minor New Source Review, MACT, NSPS, etc.?	☒ YES ☐ NO
If YES, complete the rest of Question 20. If NO, proceed to Question 21.	
20.1. Describe Any Requested Operating Limitations:	

Additional Information	
21. Is There Any Additional Information Pertinent to this Application?	☐ YES ☒ NO
If YES, complete the rest of Question 21.	
21.1. Describe:	

Thermal Oxidizer and Afterburner Application

If you are using this form electronically, press F1 at any time for help

General Information

1. Facility Name: **Bioenergy Innovation Center**
2. Equipment ID Number: **RTO**
3. Type: ☐ Afterburner ☐ Thermal Oxidizer ☐ Catalytic Oxidizer ☒ Regenerative Thermal Oxidizer ☐ Other (Specify):
4. Manufacturer: **Griffith Consulting, LLC**
5. Model: **5**
6. Serial Number: **TBD**

Attach the Manufacturer's Specification Sheet

Contaminant Information

7. Percent of Each Contaminant in the Waste Gas, Heating Value, and Destruction Efficiency

If more than five Contaminants are present, attach additional copies of this page as needed.

	Contaminant Name	Contaminant CAS Number	Percent of Waste Gas	Heating Value	Destruction Efficiency
7.1.	**CO2**		**97.53 %**	BTUs	**0** %
7.2.	**CH4**		**1.41 %**	BTUs	**98** %
7.3.	**O2**		**0.58 %**	BTUs	**0** %
7.4.	**N2**		**0.08 %**	BTUs	**0** %
7.5.	**H2O**		**0.4 %**	BTUs	**0** %

Combustion Chamber Information

8. Combustion Chamber Length: **11 feet**
9. Combustion Chamber Cross-Sectional Area: **28.3 square feet**
10. Combustion Chamber Volume: **312 cubic feet**
11. Combustion Chamber Operating Temperature: **1,450 minimum °F**

Gas Stream Information

12. Maximum Inlet Volumetric Gas Flow Rate: **5,000 acfm** at **70 °F**
13. Maximum Outlet Volumetric Gas Flow Rate: **9,000 acfm** at **500 °F**
14. Residence Time: **1 seconds**

Gas Stream Information

15.	Describe Design Features to Ensure Proper Mixing: **An inlet air mixing tee, a GCL multi-directional injector to diffuse Permeate gas into inlet air going to main fan, which will contribute to the mixing, as will the RTO poppet valve and transitions.**
16.	Describe the Gas Preheating Equipment: **A bed of structured ceramic heat recovery media. The Permeate/air mixture will upflow through the bed to be preheated prior to entering the oxidation chamber.**

Burner Information

17.	Burner Manufacturer: **Maxon**
18.	Burner Model: **Kinemax**
19.	Burner Serial Number: **TBD**
20.	Fuel Used: ☒ Natural Gas ☐ No. 6 Fuel Oil ☐ No. 2 Fuel Oil (Diesel) ☐ Other (Specify):
21.	Number of Burners: **1**
22.	Design Heat Input to Each Burner: **0.7** million BTU/hr
23.	Total Combined Heat Input: **0.7** million BTU/hr
24.	Maximum Heat Input Capacity of Each Burner: **0.7** million BTU/hr

Regenerative Thermal Oxidizer Information

Complete Question 25 if the equipment is a Regenerative Thermal Oxidizer. If it is not, proceed to Question 26.

25.1	Describe the Process Heat Recovery System: **A bed of structured ceramic heat recovery media. The Permeate/air mixture will exit the oxidation chamber and downflow through the bed to heat the media prior to gases exhausting to atmosphere.**
25.2	Pressure Drop Across the RTO: **16 inches water**
25.3	Describe the Valve System in the RTO: **The switching valve is a patented double-bladed, machine-finished, 4-way poppet valve designed to be 99.9% airtight. The valve assembly operates as a rigid, one-piece mechanism. A soft-stop feature will allow the valve to move rapidly, but without the noise and wear associated with high-speed metal-to-metal contact.**

Catalytic Oxidizer Information

Complete Questions 26 through 36 if the equipment is a Catalytic Oxidizer. If it is not, proceed to Question 37.

26.	Catalyst Used: **NA**
27.	Design Life of Catalyst: **Hours**
28.	Design Temperature Rise Across Catalyst Bed: **°F**
29.	Maximum Operating Temperature of Catalyst: **°F**
30.	Catalyst Bed Height: **feet**
31.	Catalyst Bed Diameter or Width: **feet**

Catalytic Oxidizer Information

32.	Catalyst Bed Depth: **feet**
33.	Total Catalyst Bed Volume: **cubic feet**
34.	Design Pressure Drop Across Catalytic Bed: **inches water**
35.	Describe the Instrumentation Used to Measure the Temperature Across the Catalyst Bed:
36.	Will the Spent Catalyst be Regenerated or Disposed? ☐ Regenerated ☐ Disposed
36.1	Describe the Method Used to Regenerate or Dispose of the Spent Catalyst:
Attach the Manufacturer's Specification Sheets for the Catalyst	

Stack Information

37.	Emission Point Name: **RTO**
37.1.	Stack Height Above Grade: **25 feet**
37.2.	Stack Exit Diameter: **2 feet** *(Provide Stack Dimensions If Rectangular Stack)*
37.3.	Is a Stack Cap Present? ☐ YES ☒ NO
37.4.	Stack Configuration: ☒ Vertical ☐ Horizontal ☐ Downward-Venting *(check all that apply)* ☐ Other (Specify):
37.5.	Stack Exit Gas Temperature: **500 °F**
37.6.	Stack Exit Gas Flow Rate: **9,000 ACFM**
37.7.	Distance to Nearest Property Line: **325 feet**
37.8.	Describe Nearest Obstruction: **Anaerobic digestion tank (fermenter)**
37.9.	Height of Nearest Obstruction: **39.5 feet**
37.10.	Distance to Nearest Obstruction: **137 feet**
37.11.	Are Stack Sampling Ports Provided? ☒ YES ☐ NO

Monitoring and Alarm Information

38.	Are There Any Alarms You Would Like the Department to Consider When Drafting the Permit? ☒ YES ☐ NO
If YES, complete the rest of Question 38. If NO, proceed to Question 39.	
38.1.	Describe the System Alarm(s):
If there are more than five alarms, attach additional copies of this page as needed.	

	Operating Parameter Monitored	Describe Alarm Trigger	Monitoring Device or Alarm Type	Does the Alarm Initiate an Automated Response?

Monitoring and Alarm Information				
38.1.1.	**See Attachment AQM-4.1**		☐ Visual ☐ Auditory ☐ Automatic (Remote Monitoring) ☐ Other	☐ NO ☐ YES Describe:
38.1.2.			☐ Visual ☐ Auditory ☐ Automatic (Remote Monitoring) ☐ Other	☐ NO ☐ YES Describe:
38.1.3.			☐ Visual ☐ Auditory ☐ Automatic (Remote Monitoring) ☐ Other	☐ NO ☐ YES Describe:
38.1.4.			☐ Visual ☐ Auditory ☐ Automatic (Remote Monitoring) ☐ Other	☐ NO ☐ YES Describe:
38.1.5.			☐ Visual ☐ Auditory ☐ Automatic (Remote Monitoring) ☐ Other	☐ NO ☐ YES Describe:

Additional Information
39. Is There Any Additional Information Pertinent to this Application? ☒ YES ☐ NO
If YES, complete the rest of Question 39.

Additional Information

39.1. Describe: **The contaminants included in section 7 are calculated estimates provided by the process equipment manufacturer and are not based on measured results. The contaminants consist of the tail gas from the membranes. The stated values are estimated and are subject to change given the variability in operations at the facility.**

The RTO firebox temperature will be monitored and recorded.

Griffith Consulting, LLC.

Preliminary/Typical RTO Alarms

Limits and Alarms

These conditions are indicated on the operator terminal (HMI) by a flashing message and by the alarm horn. Silence and reset functions are provided by specific keys on the HMI. The message on the screen will return to its normal state after reset.

Each limit or alarm event is indicated on the Alarm Banner which will appear at the top of the current HMI screen. The alarm banner remains visible until acknowledged. All limit and alarm events are listed chronologically on the Alarm History screen.

Alarm conditions are divided into two categories. They are Burner Safety Limits and Warning Alarms. When a Burner Safety Limit alarm occurs, the burner and oxidizer will shut down. A System Alarm condition will provide a warning but does not stop operation. Limit and alarm interlocks are detailed below.

Burner Limits

The following limits are provided for start-up and proper operation of the burners. They are shown on the Burner Limits screen.

- LOW GAS PRESSURE - automated response
- HIGH GAS PRESSURE - automated response
- COMBUSTION CHAMBER HIGH TEMPERATURE [1] - automated response
- LOW COMBUSTION AIR DIFFERENTIAL PRESSURE - automated response
- LOW INLET PRESSURE
- COMBUSTION AIR BLOWER FAILURE - automated response
- RTO BLOWER FAILURE - automated response
- FLAMEOUT - automated response
- THERMOCOUPLE FAILURE
- RECOVERY CHAMBER OUTLET HIGH TEMPERATURE

If any limit opens, burner operation will stop and process air flow to the oxidizer will be interrupted.

[1] The High Temperature Limit requires manual reset at the panel mounted limit controller before the limit on the HMI can be reset Warning Alarms

2125 Bustard Road, Lansdale, PA 19446 ● 610-222-4530 ● fax: 610-222-4531● cgriffith@gclequipment.com

The following alarm conditions are shown on the Oxidizer Alarm screen.

- ISOLATION VALVE FAILURE (automated response) indicates the damper did not move to its full closed or full open position when required by the control logic. The failure to fully close condition prevents the purge cycle from starting. This alarm does not permit the Oxidizer Ready.
- GAS SAFETY SHUTOFF VALVE FAILURE (automated response) warns that the valves are not full closed or full open as required. The failure to fully close condition prevents the purge cycle from starting.
- POPPET VALVE FAILURE indicates the valve did not move to its fully extended or fully retracted position as required. This condition will activate the INLET PATH FAILURE LIMIT (automated response)
- OXIDIZER LOW TEMPERATURE
- OXIDIZER HIGH TEMPERATURE (automated response)
- RECOVERY CHAMBER A OUTLET HIGH TEMPERATURE
- RECOVERY CHAMBER B OUTLET HIGH TEMPERATURE
- EXHAUST HIGH TEMPERATURE
- LOSS OF COMMUNICATION indicates the RTO PLC is not receiving data from the process control PLC. (automated response)

The following alarm conditions are shown on the Transmitter Alarm screen.

- INLET THERMOCOUPLE FAIL
- RECOVERY CHAMBER A THERMOCOUPLE FAIL - automated response
- RECOVERY CHAMBER B THERMOCOUPLE FAIL - automated response
- EXHAUST THERMOCOUPLE FAIL

Confidential Information

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Emissions Information Application

If you are using this form electronically, press F1 at any time for help

Process Information

1.	Number of Individual Pieces of Process Equipment in Process: **4**
2.	Number of Individual Control Devices in Process: **2**

Emissions Information for First Emission Point/Stack

3.	Emission Point Name: **Flare**
4.	Equipment ID Number for all Process Equipment and Control Devices Venting Through Emission Point/Stack: **Flare**
5.	Pollutant Emissions

If more than 15 pollutants are emitted at this Emission Point/Stack, attach additional copies of this page as needed.

	Pollutant Name (Specify VOCs and HAPs Individually in 5.10 through 5.18)	CAS Number (Not required for 5.1 through 5.10)	Maximum Uncontrolled Emission Rate at Design Capacity	Maximum Controlled Emission Rate at Design Capacity	Annual Potential to Emit (PTE)	Requested Permitted Annual Emissions
5.1.	Particulate Matter (PM)		**0 lbs/hour**	**0.00038 lbs/hour**	**0.0017** tons/year	**0.00047** tons/year
5.2.	PM_{10}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
5.3.	$PM_{2.5}$		**lbs/hour**	**lbs/hour**	tons/year	tons/year
5.4.	Sulfur Oxides (SO_X)		**0 lbs/hour**	**0.00003 lbs/hour**	**0.0001** tons/year	**0.00004** tons/year
5.5.	Nitrogen Oxides (NO_X)		**0 lbs/hour**	**3.7 lbs/hour**	**16** tons/year	**4.5** tons/year
5.6.	Carbon Monoxide (CO)		**0 lbs/hour**	**16.8 lbs/hour**	**74** tons/year	**20.6** tons/year
5.7.	Total Volatile Organic Compounds (VOCs)		**0 lbs/hour**	**0.00028 lbs/hour**	**0.0012** tons/year	**0.00034** tons/year

Emissions Information for First Emission Point/Stack

5.8.	Total Hazardous Air Pollutants (HAPs)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
5.9.	CO_2		**3,260 lbs/hour**	**9,489 lbs/hour**	**41,562** tons/year	**11,638** tons/year
5.10.	CO_{2e}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
5.11.	**Methane (CH4)**		**4,043 lbs/hour**	**81 lbs/hour**	**354** tons/year	**99** tons/year
5.12.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
5.13.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
5.14.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
5.15.			**lbs/hour**	**lbs/hour**	tons/year	tons/year

6. Provide Any Additional Information Necessary to Understanding the Emission Rates Provided Above:

Attach the Basis of Determination or Calculations for each Emission Rate provided above.

Emissions Information for Second Emission Point/Stack

7. Emission Point Name: **Thermal Oxidizer**

8. Equipment ID Number for all Process Equipment and Control Devices Venting Through Emission Point/Stack: **Thermal Oxidizer**

9. Pollutant Emissions

If more than 15 pollutants are emitted at this Emission Point/Stack, attach additional copies of this page as needed.

	Pollutant Name (Specify VOCs and HAPs Individually in 9.10 through 9.18)	CAS Number (Not required for 9.1 through 9.10)	Maximum Uncontrolled Emission Rate at Design Capacity	Maximum Controlled Emission Rate at Design Capacity	Annual Potential to Emit (PTE)	Requested Permitted Annual Emissions
9.1.	Particulate Matter (PM)		**0 lbs/hour**	**0.0051 lbs/hour**	**0.022** tons/year	**0.022** tons/year

Emissions Information for Second Emission Point/Stack

9.2.	PM_{10}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.3.	$PM_{2.5}$		**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.4.	Sulfur Oxides (SO_X)		**0 lbs/hour**	**0.0004 lbs/hour**	**0.002** tons/year	**0.002** tons/year
9.5.	Nitrogen Oxides (NO_X)		**0 lbs/hour**	**0.067 lbs/hour**	**0.29** tons/year	**0.29** tons/year
9.6.	Carbon Monoxide (CO)		**0 lbs/hour**	**0.056 lbs/hour**	**0.25** tons/year	**0.25** tons/year
9.7.	Total Volatile Organic Compounds (VOCs)		**0 lbs/hour**	**0.0037 lbs/hour**	**0.016** tons/year	**0.016** tons/year
9.8.	Total Hazardous Air Pollutants (HAPs)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.9.	CO_2		**2,615 lbs/hour**	**2,696 lbs/hour**	**11,808** tons/year	**11,808** tons/year
9.10.	CO_{2e}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.11.	**Methane (CH4)**		**38 lbs/hour**	**0.76 lbs/hour**	**3.3** tons/year	**3,3** tons/year
9.12.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.13.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.14.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
9.15.			**lbs/hour**	**lbs/hour**	tons/year	tons/year

10. Provide Any Additional Information Necessary to Understanding the Emission Rates Provided Above:

Attach the Basis of Determination or Calculations for each Emission Rate provided above.

Emissions Information for Third Emission Point/Stack

11. Emission Point Name:

Emissions Information for Third Emission Point/Stack

12. Equipment ID Number for all Process Equipment and Control Devices Venting Through Emission Point/Stack:

13. Pollutant Emissions

If more than 15 pollutants are emitted at this Emission Point/Stack, attach additional copies of this page as needed.

	Pollutant Name (Specify VOCs and HAPs Individually in 13.10 through 13.18)	CAS Number (Not required for 13.1 through 13.10)	Maximum Uncontrolled Emission Rate at Design Capacity	Maximum Controlled Emission Rate at Design Capacity	Annual Potential to Emit (PTE)	Requested Permitted Annual Emissions
13.1.	Particulate Matter (PM)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.2.	PM_{10}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.3.	$PM_{2.5}$		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.4.	Sulfur Oxides (SO_X)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.5.	Nitrogen Oxides (NO_X)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.6.	Carbon Monoxide (CO)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.7.	Total Volatile Organic Compounds (VOCs)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.8.	Total Hazardous Air Pollutants (HAPs)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.9.	CO_2		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.10.	CO_{2e}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.11.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.12.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.13.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.14.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
13.15.			**lbs/hour**	**lbs/hour**	tons/year	tons/year

Emissions Information for Third Emission Point/Stack

14. Provide Any Additional Information Necessary to Understanding the Emission Rates Provided Above:

Attach the Basis of Determination or Calculations for each Emission Rate provided above.

Emissions Information for Fourth Emission Point/Stack

15. Emission Point Name:

16. Equipment ID Number for all Process Equipment and Control Devices Venting Through Emission Point/Stack:

17. Pollutant Emissions

If more than 15 pollutants are emitted at this Emission Point/Stack, attach additional copies of this page as needed.

	Pollutant Name (Specify VOCs and HAPs Individually in 17.10 through 17.18)	CAS Number (Not required for 17.1 through 17.10)	Maximum Uncontrolled Emission Rate at Design Capacity	Maximum Controlled Emission Rate at Design Capacity	Annual Potential to Emit (PTE)	Requested Permitted Annual Emissions
17.1.	Particulate Matter (PM)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.2.	PM_{10}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.3.	$PM_{2.5}$		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.4.	Sulfur Oxides (SO_X)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.5.	Nitrogen Oxides (NO_X)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.6.	Carbon Monoxide (CO)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.7.	Volatile Organic Compounds (VOCs)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.8.	Total Hazardous Air Pollutants (HAPs)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.9.	CO_2		**lbs/hour**	**lbs/hour**	tons/year	tons/year

Emissions Information for Fourth Emission Point/Stack

17.10. CO_{2e}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.11.		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.12.		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.13.		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.14.		**lbs/hour**	**lbs/hour**	tons/year	tons/year
17.15.		**lbs/hour**	**lbs/hour**	tons/year	tons/year

18. Provide Any Additional Information Necessary to Understanding the Emission Rates Provided Above:

Attach the Basis of Determination or Calculations for each Emission Rate provided above.

If there are more than four Emission Points/Stacks, attach additional copies of this form as needed.

Overall Process Emissions

19. Pollutant Emissions

If more than 15 pollutants are emitted from this Process, attach additional copies of this page as needed.

Pollutant Name (Specify VOCs and HAPs Individually in 19.10 through 19.18)	CAS Number (Not required for 19.1 through 19.10)	Maximum Uncontrolled Emission Rate at Design Capacity	Maximum Controlled Emission Rate at Design Capacity	Annual Potential to Emit (PTE)	Requested Permitted Annual Emissions
19.1. Particulate Matter (PM)		**0 lbs/hour**	**0.0055 lbs/hour**	**0.024** tons/year	**0.022** tons/year
19.2. PM_{10}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
19.3. $PM_{2.5}$		**lbs/hour**	**lbs/hour**	tons/year	tons/year
19.4. Sulfur Oxides (SO_X)		**0 lbs/hour**	**0.00043 lbs/hour**	**0.0021** tons/year	**0.0020** tons/year
19.5. Nitrogen Oxides (NO_X)		**0 lbs/hour**	**3.8 lbs/hour**	**16.3** tons/year	**4.8** tons/year

Overall Process Emissions

19.6.	Carbon Monoxide (CO)		**0 lbs/hour**	**16.9 lbs/hour**	**74** tons/year	**21** tons/year
19.7.	Total Volatile Organic Compounds (VOCs)		**0 lbs/hour**	**0.0040 lbs/hour**	**0.017** tons/year	**0.016** tons/year
19.8.	Total Hazardous Air Pollutants (HAPs)		**lbs/hour**	**lbs/hour**	tons/year	tons/year
19.9.	CO_2		**5,875 lbs/hour**	**12,185 lbs/hour**	**53,370** tons/year	**23,446** tons/year
19.10.	CO_{2e}		**lbs/hour**	**lbs/hour**	tons/year	tons/year
19.12.	**Methane (CH4)**		**4,081 lbs/hour**	**82 lbs/hour**	**357** tons/year	**102** tons/year
19.13.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
19.14.			**lbs/hour**	**lbs/hour**	tons/year	tons/year
19.15.			**lbs/hour**	**lbs/hour**	tons/year	tons/year

20. Provide Any Additional Information Necessary to Understanding the Emission Rates Provided Above:

Attach the Basis of Determination or Calculations for each Emission Rate provided above.

Minor New Source Review Information

21. Does the Process Have the Potential to Emit More Than Five Tons Per Year of Any Pollutant? ☒ YES ☐ NO

22. Is the Source New or Existing? ☒ NEW ☐ EXISTING
See Question 11 of AQM-1

If the Process has the Potential to Emit more than five tons per year of any pollutant, and is a New Source, a Control Technology Analysis pursuant to Regulation No. 1125 Section 4 must be conducted and attached to this application.

Major New Source Review Information

23. Does the Process Have the Potential to Emit More Than the Significance Level for Any Pollutant? *(Check All That Apply)*

- ☐ Greater Than 25 Tons Per Year of Particulate Matter (PM)
- ☐ Greater Than 15 Tons Per Year of PM_{10}
- ☐ Greater Than 10 Tons Per Year of $PM_{2.5}$
- ☐ Greater Than 40 Tons Per Year of Sulfur Dioxide(SO_2)
- ☐ Greater Than 25 Tons Per Year of Nitrogen Oxides (NO_X) in New Castle and Kent County
- ☐ Greater Than 100 Tons Per Year of Nitrogen Oxides (NO_X) in Sussex County
- ☐ Greater Than 100 Tons Per Year of Carbon Monoxide (CO)
- ☐ Greater Than 25 Tons Per Year of Total Volatile Organic Compounds (VOCs) in New Castle and Kent County
- ☐ Greater Than 50 Tons Per Year of Total Volatile Organic Compounds (VOCs) in Sussex County
- ☐ Greater Than 75,000 Tons Per Year of Equivalent Carbon Dioxide (CO_{2e})

If the Process has the Potential to Emit greater than any of the amounts listed above 7 DE Admin. Code 1125 Sections 2 and/or 3 apply. Contact the Department at (302) 323-4542 or (302) 739-9402 for additional information

Additional Information

24. Is There Any Additional Information Pertinent to this Application? ☒ YES ☐ NO

If YES, complete the rest of Question 24.

24.1. Describe: **Gas volume combusted in the flare will be limited to 840,960,000 SCF/year.**

THERMAL OXIDIZER EMISSION CALCULATIONS

GIVEN

Biogas Parameters

Flow Rate	658	SCFM
Flow Rate	1,058	Nm3/hr
Flow Rate	25,385	Nm3/day
Flow Rate	64,359	lb/day
CH4	1.41	%
CO2	97.53	%
N2	0.58	%
O2	0.08	%
Heat content	528	BTU/SCF

Conversion factors

2.535313	lb/Nm3
2.2E-06	lb/mg
1.60747	SCFM/Nm3/hr

Emission factors

PM	7.6	lb/MMSCF	AP-42 Table 1.4-2
SOx	0.6	lb/MMSCF	AP-42 Table 1.4-2
NOx	100	lb/MMSCF	AP-42 Table 1.4-1
CO	84	lb/MMSCF	AP-42 Table 1.4-1
VOC	5.5	lb/MMSCF	AP-42 Table 1.4-2
CO2	115	lb/MMBTU	Engineering standard

Manufacturer data

Equpment	Griffith RTO Model 5	
Power Rating	0.7	MMBTU/hr

Engineering data

Fuel BTU	1,050	BTU/CF
Biogas density	1.15	kg/Nm3
CH4 destruction	98	%

CALCULATIONS

Fuel consumption	0.0007	MMSCF/hr
Annual consumption	6	MMSCF/yr

Uncontrolled

Process Gas					at 8,760 hours	
CH4	38	lb/hr	907	lb/day	166	ton/yr
CO2	2,615	lb/hr	62,770	lb/day	11455	ton/yr
N2	16	lb/hr	373	lb/day	68	ton/yr
O2	2	lb/hr	51	lb/day	9	ton/yr

Controlled

Natural Gas Combustion			at 8,760 hours	
PM	0.0051	lb/hr	0.022	ton/yr
SOx	0.0004	lb/hr	0.002	ton/yr
NOx	0.067	lb/hr	0.29	ton/yr
CO	0.056	lb/hr	0.25	ton/yr
VOC	0.0037	lb/hr	0.016	ton/yr

Process Gas Combustion			at 8,760 hours	
CH4	0.76	lb/hr	3.3	ton/yr
CO2 pass thru	2,615	lb/hr	11,455	ton/yr
CO2 from comb	81	lb/hr	353	ton/yr

Total			at 8,760 hours	
PM	0.0051	lb/hr	0.022	ton/yr
SOx	0.0004	lb/hr	0.002	ton/yr
NOx	0.067	lb/hr	0.29	ton/yr
CO	0.056	lb/hr	0.25	ton/yr
VOC	0.0037	lb/hr	0.016	ton/yr
CH4	0.76	lb/hr	3.3	ton/yr
CO2	2,696	lb/hr	11,808	ton/yr

1.4 Natural Gas Combustion

1.4.1 General[1-2]

Natural gas is one of the major combustion fuels used throughout the country. It is mainly used to generate industrial and utility electric power, produce industrial process steam and heat, and heat residential and commercial space. Natural gas consists of a high percentage of methane (generally above 85 percent) and varying amounts of ethane, propane, butane, and inerts (typically nitrogen, carbon dioxide, and helium). The average gross heating value of natural gas is approximately 1,020 British thermal units per standard cubic foot (Btu/scf), usually varying from 950 to 1,050 Btu/scf.

1.4.2 Firing Practices[3-5]

There are three major types of boilers used for natural gas combustion in commercial, industrial, and utility applications: watertube, firetube, and cast iron. Watertube boilers are designed to pass water through the inside of heat transfer tubes while the outside of the tubes is heated by direct contact with the hot combustion gases and through radiant heat transfer. The watertube design is the most common in utility and large industrial boilers. Watertube boilers are used for a variety of applications, ranging from providing large amounts of process steam, to providing hot water or steam for space heating, to generating high-temperature, high-pressure steam for producing electricity. Furthermore, watertube boilers can be distinguished either as field erected units or packaged units.

Field erected boilers are boilers that are constructed on site and comprise the larger sized watertube boilers. Generally, boilers with heat input levels greater than 100 MMBtu/hr, are field erected. Field erected units usually have multiple burners and, given the customized nature of their construction, also have greater operational flexibility and NO_x control options. Field erected units can also be further categorized as wall-fired or tangential-fired. Wall-fired units are characterized by multiple individual burners located on a single wall or on opposing walls of the furnace while tangential units have several rows of air and fuel nozzles located in each of the four corners of the boiler.

Package units are constructed off-site and shipped to the location where they are needed. While the heat input levels of packaged units may range up to 250 MMBtu/hr, the physical size of these units are constrained by shipping considerations and generally have heat input levels less than 100 MMBtu/hr. Packaged units are always wall-fired units with one or more individual burners. Given the size limitations imposed on packaged boilers, they have limited operational flexibility and cannot feasibly incorporate some NO_x control options.

Firetube boilers are designed such that the hot combustion gases flow through tubes, which heat the water circulating outside of the tubes. These boilers are used primarily for space heating systems, industrial process steam, and portable power boilers. Firetube boilers are almost exclusively packaged units. The two major types of firetube units are Scotch Marine boilers and the older firebox boilers. In cast iron boilers, as in firetube boilers, the hot gases are contained inside the tubes and the water being heated circulates outside the tubes. However, the units are constructed of cast iron rather than steel. Virtually all cast iron boilers are constructed as package boilers. These boilers are used to produce either low-pressure steam or hot water, and are most commonly used in small commercial applications.

Natural gas is also combusted in residential boilers and furnaces. Residential boilers and furnaces generally resemble firetube boilers with flue gas traveling through several channels or tubes with water or air circulated outside the channels or tubes.

1.4.3 Emissions[3-4]

The emissions from natural gas-fired boilers and furnaces include nitrogen oxides (NO_x), carbon monoxide (CO), and carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), volatile organic compounds (VOCs), trace amounts of sulfur dioxide (SO_2), and particulate matter (PM).

Nitrogen Oxides -

Nitrogen oxides formation occurs by three fundamentally different mechanisms. The principal mechanism of NO_x formation in natural gas combustion is thermal NO_x. The thermal NO_x mechanism occurs through the thermal dissociation and subsequent reaction of nitrogen (N_2) and oxygen (O_2) molecules in the combustion air. Most NO_x formed through the thermal NO_x mechanism occurs in the high temperature flame zone near the burners. The formation of thermal NO_x is affected by three furnace-zone factors: (1) oxygen concentration, (2) peak temperature, and (3) time of exposure at peak temperature. As these three factors increase, NO_x emission levels increase. The emission trends due to changes in these factors are fairly consistent for all types of natural gas-fired boilers and furnaces. Emission levels vary considerably with the type and size of combustor and with operating conditions (e.g., combustion air temperature, volumetric heat release rate, load, and excess oxygen level).

The second mechanism of NO_x formation, called prompt NO_x, occurs through early reactions of nitrogen molecules in the combustion air and hydrocarbon radicals from the fuel. Prompt NO_x reactions occur within the flame and are usually negligible when compared to the amount of NO_x formed through the thermal NO_x mechanism. However, prompt NO_x levels may become significant with ultra-low-NO_x burners.

The third mechanism of NO_x formation, called fuel NO_x, stems from the evolution and reaction of fuel-bound nitrogen compounds with oxygen. Due to the characteristically low fuel nitrogen content of natural gas, NO_x formation through the fuel NO_x mechanism is insignificant.

Carbon Monoxide -

The rate of CO emissions from boilers depends on the efficiency of natural gas combustion. Improperly tuned boilers and boilers operating at off-design levels decrease combustion efficiency resulting in increased CO emissions. In some cases, the addition of NO_x control systems such as low NO_x burners and flue gas recirculation (FGR) may also reduce combustion efficiency, resulting in higher CO emissions relative to uncontrolled boilers.

Volatile Organic Compounds -

The rate of VOC emissions from boilers and furnaces also depends on combustion efficiency. VOC emissions are minimized by combustion practices that promote high combustion temperatures, long residence times at those temperatures, and turbulent mixing of fuel and combustion air. Trace amounts of VOC species in the natural gas fuel (e.g., formaldehyde and benzene) may also contribute to VOC emissions if they are not completely combusted in the boiler.

Sulfur Oxides -

Emissions of SO_2 from natural gas-fired boilers are low because pipeline quality natural gas typically has sulfur levels of 2,000 grains per million cubic feet. However, sulfur-containing odorants are added to natural gas for detecting leaks, leading to small amounts of SO_2 emissions. Boilers combusting unprocessed natural gas may have higher SO_2 emissions due to higher levels of sulfur in the natural gas. For these units, a sulfur mass balance should be used to determine SO_2 emissions.

Particulate Matter -

Because natural gas is a gaseous fuel, filterable PM emissions are typically low. Particulate matter from natural gas combustion has been estimated to be less than 1 micrometer in size and has filterable and condensable fractions. Particulate matter in natural gas combustion are usually larger molecular weight hydrocarbons that are not fully combusted. Increased PM emissions may result from poor air/fuel mixing or maintenance problems.

Greenhouse Gases -[6-9]

CO_2, CH_4, and N_2O emissions are all produced during natural gas combustion. In properly tuned boilers, nearly all of the fuel carbon (99.9 percent) in natural gas is converted to CO_2 during the combustion process. This conversion is relatively independent of boiler or combustor type. Fuel carbon not converted to CO_2 results in CH_4, CO, and/or VOC emissions and is due to incomplete combustion. Even in boilers operating with poor combustion efficiency, the amount of CH_4, CO, and VOC produced is insignificant compared to CO_2 levels.

Formation of N_2O during the combustion process is affected by two furnace-zone factors. N_2O emissions are minimized when combustion temperatures are kept high (above 1475°F) and excess oxygen is kept to a minimum (less than 1 percent).

Methane emissions are highest during low-temperature combustion or incomplete combustion, such as the start-up or shut-down cycle for boilers. Typically, conditions that favor formation of N_2O also favor emissions of methane.

1.4.4 Controls[4,10]

NO_x Controls -

Currently, the two most prevalent combustion control techniques used to reduce NO_x emissions from natural gas-fired boilers are flue gas recirculation (FGR) and low NO_x burners. In an FGR system, a portion of the flue gas is recycled from the stack to the burner windbox. Upon entering the windbox, the recirculated gas is mixed with combustion air prior to being fed to the burner. The recycled flue gas consists of combustion products which act as inerts during combustion of the fuel/air mixture. The FGR system reduces NO_x emissions by two mechanisms. Primarily, the recirculated gas acts as a dilutent to reduce combustion temperatures, thus suppressing the thermal NO_x mechanism. To a lesser extent, FGR also reduces NO_x formation by lowering the oxygen concentration in the primary flame zone. The amount of recirculated flue gas is a key operating parameter influencing NO_x emission rates for these systems. An FGR system is normally used in combination with specially designed low NO_x burners capable of sustaining a stable flame with the increased inert gas flow resulting from the use of FGR. When low NO_x burners and FGR are used in combination, these techniques are capable of reducing NO_x emissions by 60 to 90 percent.

Low NO_x burners reduce NO_x by accomplishing the combustion process in stages. Staging partially delays the combustion process, resulting in a cooler flame which suppresses thermal NO_x formation. The two most common types of low NO_x burners being applied to natural gas-fired boilers are staged air burners and staged fuel burners. NO_x emission reductions of 40 to 85 percent (relative to uncontrolled emission levels) have been observed with low NO_x burners.

Other combustion control techniques used to reduce NO_x emissions include staged combustion and gas reburning. In staged combustion (e.g., burners-out-of-service and overfire air), the degree of staging is a key operating parameter influencing NO_x emission rates. Gas reburning is similar to the use of overfire in the use of combustion staging. However, gas reburning injects additional amounts of natural gas in the upper furnace, just before the overfire air ports, to provide increased reduction of NO_x to NO_2.

Two postcombustion technologies that may be applied to natural gas-fired boilers to reduce NO_x emissions are selective noncatalytic reduction (SNCR) and selective catalytic reduction (SCR). The SNCR system injects ammonia (NH_3) or urea into combustion flue gases (in a specific temperature zone) to reduce NO_x emission. The Alternative Control Techniques (ACT) document for NO_x emissions from utility boilers, maximum SNCR performance was estimated to range from 25 to 40 percent for natural gas-fired boilers.[12] Performance data available from several natural gas fired utility boilers with SNCR show a 24 percent reduction in NO_x for applications on wall-fired boilers and a 13 percent reduction in NO_x for applications on tangential-fired boilers.[11] In many situations, a boiler may have an SNCR system installed to trim NO_x emissions to meet permitted levels. In these cases, the SNCR system may not be operated to achieve maximum NO_x reduction. The SCR system involves injecting NH_3 into the flue gas in the presence of a catalyst to reduce NO_x emissions. No data were available on SCR performance on natural gas fired boilers at the time of this publication. However, the ACT Document for utility boilers estimates NO_x reduction efficiencies for SCR control ranging from 80 to 90 percent.[12]

Emission factors for natural gas combustion in boilers and furnaces are presented in Tables 1.4-1, 1.4-2, 1.4-3, and 1.4-4.[11] Tables in this section present emission factors on a volume basis (lb/10^6 scf). To convert to an energy basis (lb/MMBtu), divide by a heating value of 1,020 MMBtu/10^6 scf. For the purposes of developing emission factors, natural gas combustors have been organized into three general categories: large wall-fired boilers with greater than 100 MMBtu/hr of heat input, boilers and residential furnaces with less than 100 MMBtu/hr of heat input, and tangential-fired boilers. Boilers within these categories share the same general design and operating characteristics and hence have similar emission characteristics when combusting natural gas.

Emission factors are rated from A to E to provide the user with an indication of how "good" the factor is, with "A" being excellent and "E" being poor. The criteria that are used to determine a rating for an emission factor can be found in the Emission Factor Documentation for AP-42 Section 1.4 and in the introduction to the AP-42 document.

1.4.5 Updates Since the Fifth Edition

The Fifth Edition was released in January 1995. Revisions to this section are summarized below. For further detail, consult the Emission Factor Documentation for this section. These and other documents can be found on the Emission Factor and Inventory Group (EFIG) home page (http://www.epa.gov/ttn/chief).

Supplement D, March 1998

- Text was revised concerning Firing Practices, Emissions, and Controls.
- All emission factors were updated based on 482 data points taken from 151 source tests. Many new emission factors have been added for speciated organic compounds, including hazardous air pollutants.

July 1998 - minor changes

- Footnote D was added to table 1.4-3 to explain why the sum of individual HAP may exceed VOC or TOC, the web address was updated, and the references were reordered.

Table 1.4-1. EMISSION FACTORS FOR NITROGEN OXIDES (NO_x) AND CARBON MONOXIDE (CO) FROM NATURAL GAS COMBUSTION[a]

Combustor Type (MMBtu/hr Heat Input) [SCC]	NO_x[b]		CO	
	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating
Large Wall-Fired Boilers (>100) [1-01-006-01, 1-02-006-01, 1-03-006-01]				
Uncontrolled (Pre-NSPS)[c]	280	A	84	B
Uncontrolled (Post-NSPS)[c]	190	A	84	B
Controlled - Low NO_x burners	140	A	84	B
Controlled - Flue gas recirculation	100	D	84	B
Small Boilers (<100) [1-01-006-02, 1-02-006-02, 1-03-006-02, 1-03-006-03]				
Uncontrolled	100	B	84	B
Controlled - Low NO_x burners	50	D	84	B
Controlled - Low NO_x burners/Flue gas recirculation	32	C	84	B
Tangential-Fired Boilers (All Sizes) [1-01-006-04]				
Uncontrolled	170	A	24	C
Controlled - Flue gas recirculation	76	D	98	D
Residential Furnaces (<0.3) [No SCC]				
Uncontrolled	94	B	40	B

[a] Reference 11. Units are in pounds of pollutant per million standard cubic feet of natural gas fired. To convert from $lb/10^6$ scf to $kg/10^6$ m^3, multiply by 16. Emission factors are based on an average natural gas higher heating value of 1,020 Btu/scf. To convert from $lb/10^6$ scf to lb/MMBtu, divide by 1,020. The emission factors in this table may be converted to other natural gas heating values by multiplying the given emission factor by the ratio of the specified heating value to this average heating value. SCC = Source Classification Code. ND = no data. NA = not applicable.

[b] Expressed as NO_2. For large and small wall fired boilers with SNCR control, apply a 24 percent reduction to the appropriate NO_X emission factor. For tangential-fired boilers with SNCR control, apply a 13 percent reduction to the appropriate NO_X emission factor.

[c] NSPS=New Source Performance Standard as defined in 40 CFR 60 Subparts D and Db. Post-NSPS units are boilers with greater than 250 MMBtu/hr of heat input that commenced construction modification, or reconstruction after August 17, 1971, and units with heat input capacities between 100 and 250 MMBtu/hr that commenced construction modification, or reconstruction after June 19, 1984.

TABLE 1.4-2. EMISSION FACTORS FOR CRITERIA POLLUTANTS AND GREENHOUSE GASES FROM NATURAL GAS COMBUSTION[a]

Pollutant	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating
CO_2[b]	120,000	A
Lead	0.0005	D
N_2O (Uncontrolled)	2.2	E
N_2O (Controlled-low-NO_X burner)	0.64	E
PM (Total)[c]	7.6	D
PM (Condensable)[c]	5.7	D
PM (Filterable)[c]	1.9	B
SO_2[d]	0.6	A
TOC	11	B
Methane	2.3	B
VOC	5.5	C

[a] Reference 11. Units are in pounds of pollutant per million standard cubic feet of natural gas fired. Data are for all natural gas combustion sources. To convert from $lb/10^6$ scf to $kg/10^6$ m^3, multiply by 16. To convert from $lb/10^6$ scf to 1b/MMBtu, divide by 1,020. The emission factors in this table may be converted to other natural gas heating values by multiplying the given emission factor by the ratio of the specified heating value to this average heating value. TOC = Total Organic Compounds. VOC = Volatile Organic Compounds.

[b] Based on approximately 100% conversion of fuel carbon to CO_2. $CO_2[lb/10^6 \text{ scf}] = (3.67)(CON)(C)(D)$, where CON = fractional conversion of fuel carbon to CO_2, C = carbon content of fuel by weight (0.76), and D = density of fuel, 4.2×10^4 $lb/10^6$ scf.

[c] All PM (total, condensible, and filterable) is assumed to be less than 1.0 micrometer in diameter. Therefore, the PM emission factors presented here may be used to estimate PM_{10}, $PM_{2.5}$ or PM_1 emissions. Total PM is the sum of the filterable PM and condensible PM. Condensible PM is the particulate matter collected using EPA Method 202 (or equivalent). Filterable PM is the particulate matter collected on, or prior to, the filter of an EPA Method 5 (or equivalent) sampling train.

[d] Based on 100% conversion of fuel sulfur to SO_2.
Assumes sulfur content is natural gas of 2,000 grains/10^6 scf. The SO_2 emission factor in this table can be converted to other natural gas sulfur contents by multiplying the SO_2 emission factor by the ratio of the site-specific sulfur content (grains/10^6 scf) to 2,000 grains/10^6 scf.

TABLE 1.4-3. EMISSION FACTORS FOR SPECIATED ORGANIC COMPOUNDS FROM NATURAL GAS COMBUSTION[a]

CAS No.	Pollutant	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating
91-57-6	2-Methylnaphthalene[b, c]	2.4E-05	D
56-49-5	3-Methylcholanthrene[b, c]	<1.8E-06	E
	7,12-Dimethylbenz(a)anthracene[b,c]	<1.6E-05	E
83-32-9	Acenaphthene[b,c]	<1.8E-06	E
203-96-8	Acenaphthylene[b,c]	<1.8E-06	E
120-12-7	Anthracene[b,c]	<2.4E-06	E
56-55-3	Benz(a)anthracene[b,c]	<1.8E-06	E
71-43-2	Benzene[b]	2.1E-03	B
50-32-8	Benzo(a)pyrene[b,c]	<1.2E-06	E
205-99-2	Benzo(b)fluoranthene[b,c]	<1.8E-06	E
191-24-2	Benzo(g,h,i)perylene[b,c]	<1.2E-06	E
207-08-9	Benzo(k)fluoranthene[b,c]	<1.8E-06	E
106-97-8	Butane	2.1E+00	E
218-01-9	Chrysene[b,c]	<1.8E-06	E
53-70-3	Dibenzo(a,h)anthracene[b,c]	<1.2E-06	E
25321-22-6	Dichlorobenzene[b]	1.2E-03	E
74-84-0	Ethane	3.1E+00	E
206-44-0	Fluoranthene[b,c]	3.0E-06	E
86-73-7	Fluorene[b,c]	2.8E-06	E
50-00-0	Formaldehyde[b]	7.5E-02	B
110-54-3	Hexane[b]	1.8E+00	E
193-39-5	Indeno(1,2,3-cd)pyrene[b,c]	<1.8E-06	E
91-20-3	Naphthalene[b]	6.1E-04	E
109-66-0	Pentane	2.6E+00	E
85-01-8	Phenanathrene[b,c]	1.7E-05	D
74-98-6	Propane	1.6E+00	E

TABLE 1.4-3. EMISSION FACTORS FOR SPECIATED ORGANIC COMPOUNDS FROM NATURAL GAS COMBUSTION (Continued)

CAS No.	Pollutant	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating
129-00-0	Pyrene[b, c]	5.0E-06	E
108-88-3	Toluene[b]	3.4E-03	C

[a] Reference 11. Units are in pounds of pollutant per million standard cubic feet of natural gas fired. Data are for all natural gas combustion sources. To convert from $lb/10^6$ scf to $kg/10^6$ m^3, multiply by 16. To convert from $1b/10^6$ scf to lb/MMBtu, divide by 1,020. Emission Factors preceeded with a less-than symbol are based on method detection limits.

[b] Hazardous Air Pollutant (HAP) as defined by Section 112(b) of the Clean Air Act.

[c] HAP because it is Polycyclic Organic Matter (POM). POM is a HAP as defined by Section 112(b) of the Clean Air Act.

[d] The sum of individual organic compounds may exceed the VOC and TOC emission factors due to differences in test methods and the availability of test data for each pollutant.

TABLE 1.4-4. EMISSION FACTORS FOR METALS FROM NATURAL GAS COMBUSTION[a]

CAS No.	Pollutant	Emission Factor ($lb/10^6$ scf)	Emission Factor Rating
7440-38-2	Arsenic[b]	2.0E-04	E
7440-39-3	Barium	4.4E-03	D
7440-41-7	Beryllium[b]	<1.2E-05	E
7440-43-9	Cadmium[b]	1.1E-03	D
7440-47-3	Chromium[b]	1.4E-03	D
7440-48-4	Cobalt[b]	8.4E-05	D
7440-50-8	Copper	8.5E-04	C
7439-96-5	Manganese[b]	3.8E-04	D
7439-97-6	Mercury[b]	2.6E-04	D
7439-98-7	Molybdenum	1.1E-03	D
7440-02-0	Nickel[b]	2.1E-03	C
7782-49-2	Selenium[b]	<2.4E-05	E
7440-62-2	Vanadium	2.3E-03	D
7440-66-6	Zinc	2.9E-02	E

[a] Reference 11. Units are in pounds of pollutant per million standard cubic feet of natural gas fired. Data are for all natural gas combustion sources. Emission factors preceeded by a less-than symbol are based on method detection limits. To convert from $lb/10^6$ scf to $kg/10^6$ m^3, multiply by l6. To convert from $lb/10^6$ scf to 1b/MMBtu, divide by 1,020.

[b] Hazardous Air Pollutant as defined by Section 112(b) of the Clean Air Act.

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Combustion of Fuels - Carbon Dioxide Emission

Environmental emission of carbon dioxide CO_2 when combustion fuels like coal, oil, natural gas, LPG and bio energy

To calculate the Carbon Dioxide - CO_2 - emission from a fuel, the carbon content of the fuel must be multiplied with the ratio of molecular weight of CO_2 (44) to the molecular weight of Carbon (12) -> 44 / 12 = 3.7

Carbon Dioxide emission from burning a fuel can be calculated as

$$q_{CO2} = c_f / h_f \; M_{CO2} / M_m \qquad [1]$$

where

q_{CO2} = specific CO_2 emission [kg_{CO2}/kWh]
c_f = specific carbon content in the fuel [kg_C/kg_{fuel}]
h_f = specific energy content in the fuel [kWh/kg_{fuel}]
M_C = Molecular weight Carbon [kg/kmol Carbon]
M_{CO2} = Molecular weight Carbon Dioxide [kg/kmol CO_2]

Emission of CO_2 from combustion of some common fuels are indicated in the table below.

Note! Heat loss - 55-75% - in power generation is not included in the numbers.

See also Heat of combustion , Fuels - Higher and Lower Calorific Values and Fossil and alternative fuels - energy content .

Fuel	Liquid density	Specific carbon content	Specific Energy content		Specific CO_2 emission (amount of fuel basis)			Specific CO_2 emission (amount of energy basis)		
	kg/l	kg_C/kg_{fuel}	kWh/kg_{fuel}	Btu/lb_{fuel}	Kg_{CO2}/kg_{fuel}	Kg_{CO2}/gal_{fuel}	lb_{CO2}/gal_{fuel}	kg_{CO2}/kWh	kg_{CO2}/GJ	lb_{CO2}/mill Btu

Fuel	Liquid density	Specific carbon content	Specific Energy content		Specific CO_2 emission (amount of fuel basis)			Specific CO_2 emission (amount of energy basis)		
	kg/l	kg_C/kg_{fuel}	kWh/kg_{fuel}	Btu/lb_{fuel}	Kg_{CO2}/kg_{fuel}	Kg_{CO2}/gal_{fuel}	lb_{CO2}/gal_{fuel}	kg_{CO2}/kWh	kg_{CO2}/GJ	$lb_{CO2}/mill\ Btu$
Methane (natural gas)		0.75	15.4	23900	2.75			0.18	50	115
Propane	0.510	0.82	13.8	21300	2.99	5.78	12.7	0.22	60	140
Butane	0.564	0.83	13.6	21100	3.03	6.47	14.3	0.22	62	144
LPG (wt of C3=C4)	0.537	0.82	13.7	21200	3.01	6.12	13.5	0.22	61	142
Gasoline	0.737	0.90	12.9	19900	3.30	9.20	20.3	0.26	71	165.3
Kerosene (Jet)	0.821	0.82	12.0	18500	3.00	9.33	20.6	0.25	70	162.5
Diesel	0.846	0.86	12.7	19605	3.15	10.1	22.3	0.25	69	160.8
Heavy fuel oil (No.6/Bunker C)	0.980	0.85	11.6	18000	3.11	11.6	25.5	0.27	75	173.3
Petroleum coke		0.89	9.4	14500	3.26	14.7	32.4	0.35	97	225.1
Coal:										227.3
Anthracite		0.92	9.0	14000	3.37			0.37	104	229.5
Bituminous		0.65	8.4	13000	2.38			0.28	79	231.7
Subbituminous		0.4	6.8	10500	1.47			0.22	60	233.9
Lignite		0.3	3.9	6000	1.10			0.28	79	236.1
Coke		0.77	7.2	11200	2.82			0.39	108	251.5
Peat (dry)[1)]		0.52	4.7	7300	1.91			0.40	112	260.7
Ethanol fuel (E100)[2)]	0.789	0.52	8.3	12800	1.91	5.71	12.6	0.23	64	149.6
Methanol fuel (M100)[2)]	0.791	0.37	5.5	8500	1.37	4.11	9.1	0.25	70	162.2
Biodiesel (B100)[2)]	0.880	0.78	11.3	17400	2.85	9.48	20.9	0.25	70	162.8
Wood [1) 2)]		0.50	4.5	7000	1.83			0.41	113	263.1
Bio energy [2)]								0 [2)]		

[1)] Commonly viewed as a Bio fuel.

[2)] Bio Energy is produced from biomass derived from any renewable organic plant, including

- dedicated energy crops and trees
- agricultural food and feed crops
- agricultural crop wastes and residues
- wood wastes
- aquatic plants

- animal wastes
- municipal wastes and other waste materials

Emissions of CO_2 can contribute to climate change. Combustion of bio energy don't add to the total emission of carbon dioxide as long as the burned bio mass don't exceed the renewed production (within a reasonable time), or it is not transformed in processes requiring CO_2-forming energy. The recycling of carbon from wood combustion is virtually instantaneous and continuous and it is also common to regard the net supply of CO_2 to the atmosphere from combustion of wood close to zero.

If the time of renewed production of the organic material is long (typically 50 year++), the the positive climate effect can be questioned. The renewed production rate of wood and peat varies with geography and climate.

A variety of **bio fuels** can be made from bio mass resources, including

- ethanol
- methanol
- biodiesel
- Fischer-Tropsch diesel
- gaseous fuels like hydrogen or methane

Production of all these bio fuels requires energy, and the total CO_2 gain depend on how much CO_2-releasing energy that is necessary to transform the bio mass to bio fuel. Biodiesel production via Fischer-Tropsch synthesis is typically a high energy demanding process, and the CO_2 gain compared to conventional diesel is low if the processing is run with energy with high CO_2 emissions.

Related Topics

- **Environment** - Climate, meteorology, sun, wind and environmental resources
- **Combustion** - Boiler house topics - fuels like oil, gas, coal, wood - chimneys, safety valves, tanks - combustion efficiency
- **Material Properties** - Material properties for gases, fluids and solids - densities, specific heats, viscosities and more

Related Documents

- **Alternative Fuels Properties** - Properties of alternative fuels like Biodiesel, E85, CNG and more
- **Atmospheric Carbon Dioxide Concentration** - Annual Carbon Dioxide concentration 1959 - 2015
- **Carbon dioxide - Density and Specific Weight** - Online calculator, figures and tables showing density and specific weight of carbon dioxide, CO_2, at temperatures ranging from -50 to 775 °C (-50 to 1400 °F) at atmospheric and higher pressure - Imperial and SI Units
- **Carbon dioxide - Prandtl Number** - Figures and table showing changes in Prandtl number for carbon dioxide with changes in temperature and pressure

- **Carbon Dioxide - Thermophysical Properties** - Chemical, physical and thermal properties of carbon dioxide. Phase diagram included.
- **Carbon Dioxide Properties** - Properties of saturated liquid Carbon Dioxide - CO_2 - density, specific heat, kinematic viscosity, thermal conductivity and Prandtl number
- **Carbon Dioxide Properties - Imperial Units** - Properties of saturated liquid Carbon Dioxide - CO_2 - density, specific heat, kinematic viscosity, thermal conductivity and Prandtl number
- **Classification of Coal** - Classification of coal based on volatile matter and cooking power of clean material
- **CO_2 Calculator - Emissions from Trains** - Calculator for CO_2 emissions from trains, comparing with alternative forms of transportation (as plane, bus, conventional and electrical cars)
- **CO_2 Calculator - Emissions from Airplanes** - Calculator for CO_2 emissions from planes, comparing with alternative forms of transportation (as train, bus, conventional and electrical cars)
- **CO_2 Calculator - Emissions from Cars** - Calculator for CO_2 emissions from different kind of cars (gasoline, diesel, LPG, electrical), comparing with alternative forms of transportation (as airplane, bus and train)
- **Combustion Efficiency and Excess Air** - Optimizing boilers efficiency is important to minimize fuel consumption and unwanted excess to the environment
- **Combustion of Fuels and Nitrogen Oxides (NO_x) Emission** - Emission of Nitrogen Oxides - NO_x - with combustion of fuels like oil, coal, propane and more
- **Energy Content in Biomasses used as Fuel** - Some biom fuels and their energy content
- **Fossil and Alternative Fuels Energy Content** - Listing of net (low) and gross (high) energy content in fossil and alternative fuels, together with a description of energy content measurement
- **Fuel Consumption Converter** - Convert between fuel consumption units like *US MPG, Imperial MPG, litre/nm, litre/100 km* and *km/litre*
- **Fuels - Combustion Air and Flue Gases** - Combustion air and flue gas for common fuels - coke, oil, wood, natural gas and more
- **Fuels - Higher and Lower Calorific Values** - Higher and lower calorific values (heating values) for some common fuels - coke, oil, wood, hydrogen and others
- **Gas Vent Termination - Clearance Tolerances** - Clearance tolerance per roof slope for gas vent terminations - vent caps
- **Gaseous Fuels and their Chemical Composition** - Chemical composition of some common gaseous fuels - like coal gas, natural gas, propane and more
- **Heat, Work and Energy** - Heat, work and energy tutorial - essentials as specific heat
- **Heating Fuels - Comparing Costs** - Cost comparison formulas for heating fuels like Natural Gas, Propane LP Gas, Fuel Oil and Electricity
- **Optimal Combustion Process - Fuels and Excess Air** - Stable and efficient combustion conditions require correct mixture of fuels and oxygen
- **Paraffins and Alkanes - Combustion Properties** - Heating values, air/fuel ratios, flame speed, flame temperatures, ignition temperatures, flash points and flammability limits
- **Standard Grade Coal - Heat Value** - Standard grades coal and heating values
- **Waste Fuel** - Heat values of fuel from waste products

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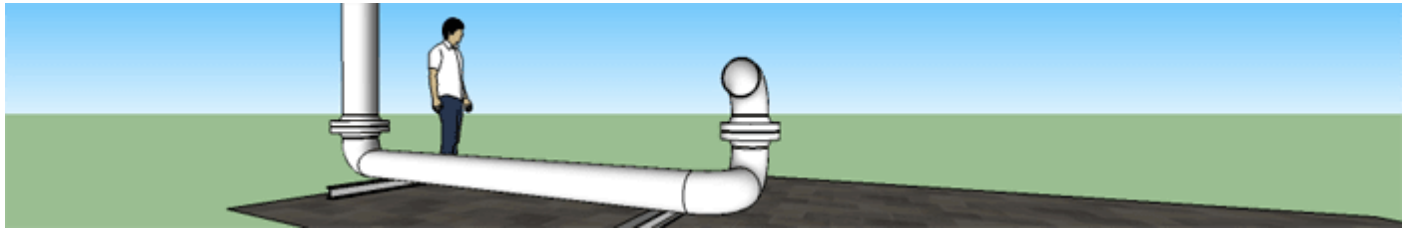

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Griffith Consulting, LLC.

Proposal

Regenerative Thermal Oxidizer

Proposal 211021b-Rev1

for

BIOENERGY DEVCO

for

BIC Biogas

Seaford, Delaware

October 28, 2021

Griffith Consulting, LLC.
2125 Bustard Road, Lansdale, PA 19446 ● 610-222-4530 ● fax: 610-222-4531● cgriffith@gclequipment.com

Regenerative Thermal Oxidizer (RTO)

General:
Regenerative Thermal Oxidizer (RTO) with 5000 scfm capacity to be designed by GCL to reduce emissions. The 2-bed RTO is designed to provide high methane destruction.

Application Description

Chesapeake Utilities captures biogas from a digester and then purifies it using a proprietary process. The process generates a tail gas stream that contains compounds that cannot be exhausted to atmosphere without further treatment. A regenerative thermal oxidizer is proposed that will take the tail gas and destroy the methane to a level of 98% or greater.

Permeate/Tail Gas Definition (from customer)

Permeate/Tail gas composition

Component	%	PPM	
Methane	1.41-5		Design for 0.5-6% Methane
Carbon dioxide	Balance		
Nitrogen	0.08		
Oxygen	0.60		
Water	0.4		
Hydrogen sulfide		0	To be removed by others prior to RTO
VOC		0	To be removed by others prior to RTO
Siloxanes		0	To be removed by others prior to RTO

Regen/permeate gas flow 126-720 scfm
Estimated Pressure 1 PSIG
Temperature 70°F

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Thermal Oxidation

Subjecting hydrocarbon compounds to an environment of high temperature and adequate oxygen causes the hydrocarbon molecules to breakdown and their component atoms to combine with oxygen. The hydrocarbons in the process stream are converted to carbon dioxide and water with the release of additional thermal energy inside the combustion chamber. The process of regenerative thermal oxidation operates with minimal auxiliary fuel, due to the high heat transfer efficiency of the system.

This section will describe the RTO system in general. More specific information of each of the described sub-systems is included below. The RTO consists of five main parts: a valve and manifold system, a two-chamber energy recovery system and one combustion chamber with a burner system.

Valve and Manifold System

The inlet and outlet manifold system consists of the ducting at the RTO which direct processed air in and out of the energy recovery chambers through the valve system.

The RTO system includes a valve system that switches flow from one direction to the other on a timed basis.

Energy Recovery System

The energy recovery chambers are the housing for the ceramic heat recovery media and serve as a heat exchanger for the system. The two ceramic beds operate under a swing bed direct heat exchange principle. By switching towers between inlet and outlet, the flow reversal preheats the air coming into the RTO and alternately cools the air leaving the RTO by direct heat exchange with the ceramic media. The process of heat recovery using direct heat exchange combined with flow reversal is called regeneration.

As the fume stream travels through the heated bed of ceramic media, it absorbs the heat energy stored in the ceramic media mass which pre-heats the stream. The fume stream then enters the combustion chamber, where heat energy is added from the burner to reach the system operating temperature. Once the fume stream temperature has been elevated to the operating set point, the hydrocarbons in the stream are destroyed. The clean exhaust stream then passes through a cooler energy recovery chamber. As the clean exhaust stream passes through the tower, the relatively cooler ceramic media mass absorbs and stores the heat energy of the exhaust stream. This tower then becomes a relatively hotter energy recovery tower. Once the heat energy transfer is completed, the flow through the chamber is reversed, so the incoming concentrated hydrocarbon process stream is then directed through the hotter energy recovery tower and absorbs the heat from the ceramic media. By using the reversal of exhaust flow through the ceramic beds, a minimal amount of thermal energy needs to be added to the incoming process stream to maintain the system's minimum operating temperature.

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RTO Heat Generation System Burner

The burner is spark ignited and is utilized to maintain the operational temperature of the combustion chamber above the minimal required control temperature to ensure adequate thermal oxidation. The burner is sized to maintain the oxidizer operational temperature at the full air volume during a zero-hydrocarbon loading condition and allow the expected system startup time from an ambient start to be no more than 60 minutes. The burner produces a reliable combustion flame with a controllable size, geometry, and heating characteristics. The burner combines the fuel and air in a manner to create a flammable stream of the gas with the proper velocity to create a steady combustion flame. The fuel and air pressures supplied to the burner allow a flame of variable size and heat input. The burner flame is continuously monitored to guarantee proper combustion when fuel is being supplied to the burner. The burner has an automatic ignition source to initiate the combustion process as required. The burner is designed to allow a large enough heating capacity to bring the combustion chamber up to operating temperature during startup. During normal operation, the burner is able to maintain a controllable flame with minimum fuel flow to provide only the minimum energy required to maintain combustion chamber temperature and minimize the potential for NOx generation.

Hot-side Bypass

This option is for solvent loading that is greater than what is required for self-sustained operation of the oxidizer to increase solvent throughput. This option consists of a high temperature valve with refractory lining, high temperature alloy metal parts, 4-20 MA pneumatic actuator with heat shield, and internally insulated bypass duct.

Fuel Train

The fuel train provides a controllable supply of natural gas to the burner and ensures proper safety and redundant isolation of the fuel supply as required. The fuel train is piped and wired with the requisite components to ensure that it complies with NFPA codes and insurance approval requirements. The fuel train uses the signal it obtains from the control system to increase or decrease the gas pressure to the burner to control the heat input. The fuel train will completely isolate the RTO system from the fuel supply using redundant and proven isolations when required.

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Combustion Air System

The combustion air system provides the requisite pressure to ensure the proper air flow through the burner and provides a controllable supply of oxygen to the burner. The combustion air blower provides the motive force needed to supply the required flow of air to the burner. The control system signals for the combustion air and fuel train are dependent signals in order to provide the proper ratio of fuel and air to the burner.

RTO Fan and Motor

The RTO fan assembly provides the motive force to control the flow through the RTO system over the full range of designed volumetric flow. The RTO fan and motor can operate at variable speed using a variable frequency drive that controls the AC frequency of the power supplied to the motor. When the system is not processing a hydrocarbon exhaust stream, the RTO fan may operate at minimum flow to lower the amount of electricity required to operate the system. When the system is processing hydrocarbons, the RTO fan will automatically adjust from anywhere between the minimum and maximum flow rate based upon the amount of the inlet process stream flow. This is accomplished by monitoring and controlling the pressure of the system inlet ductwork. When the system detects a change in process exhaust flow by means of the ductwork pressure change, the RTO fan automatically compensates to change the flow through the system. The inlet pressure remains constant for minimal impact on the operation of the upstream process and the flow through the RTO system adjusts to ensure the minimum amount of energy required is used to clean the process stream.

Clean Air Stack

The clean air stack receives system exhaust from the RTO and directs it to atmosphere.

Control Panel

The control panel provides the primary user interface, monitors and records system parameters, processes the logic software and sequences, and supplies the safety and control signals to system components and interfacing systems.

The system instrumentation inputs, user inputs, and interfacing system inputs are passed to a Programmable Logic Controller (PLC) which automatically processes the information and efficiently controls the detailed operation of the RTO system. The PLC receives analog & discrete inputs from the various system devices and outputs analog & discrete signals to controlled devices. The program logic controls the overall system operation. All timing and alarm detection and annunciation controls reside in the PLC.

Alarms are generated by the PLC if any part of the system is found to not be operating properly. The PLC will automatically take the required level of initial control actions if a fault is detected to prevent the equipment from damage and to prevent inadvertent release of process contaminants if not properly processed through the abatement system. A separate, dedicated

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flame safety logic controller is used to control the safety features of the heat generation system to reinforce the protection from risks associated with the natural gas fuel source.

Instrumentation

The instrumentation includes the necessary pressure switches, thermocouples, solenoid valves and transmitters to control and safeguard the system.

RTO Details:

- Maximum design air plus tail gas flow- 5000 scfm
- Process gas turndown: 6:1
- Valve for flow direction changes through media
- Main process fan with 25 hp TEFC motor (480 volt/3 phase/60 Hz)
- Combustion air blower, 1.5 hp TEFC motor (480 volt/3 phase/60 Hz)
- Variable frequency drives, ABB
- Operating Temperatures RTO chamber 1500-1600°F
- Thermal Efficiency 93±2%
- Destruction Efficiency 98%
- Preliminary dimensions of RTO system: 8’W x 16’L x 25’H
- Preliminary weight of T.O. system: 45,000 lbs.
- Stack
    - Height: 25 feet
    - Diameter: 24”
    - CS/SS
    - Guyed
- Heat recovery media chambers
    - Two (2) heat recovery media chambers
    - 3/16” (4.8mm) thick CS plate, stiffened with angle iron
    - Refractory lining – 6” thick ceramic fiber modules
    - Heat recovery media bed supports
- Oxidation chamber
    - Sufficient residence time for methane destruction
    - Refractory lining – 6” thick ceramic fiber modules
- Specialty natural gas burner for incineration/thermal oxidation
    - Direct spark ignited
    - UV scanner for flame confirmation
    - Fully modulating firing to control RTO temperature

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- Natural gas control train
    - Manual valves
    - Pressure regulator
    - Pressure gauges
    - Safety shutoff valves
    - Natural gas control valve
- Pre-wired control panel
    - PLC – Allen-Bradley
    - Flame Safeguard with Indicating Lights
    - Ignition transformer
    - On-Off switch
    - High temperature shutdown switch
    - Temperature controller
- Type K thermocouples
- Flame arrestor on Permeate waste gas stream
    - Carbon steel body
    - Stainless steel center section
- Waste gas flow meter
    - To be shipped loose and installed in customer's Permeate gas line from the plant to the T.O.

Utilities

Electric Power:
- 480/3/60 power
- 120 Volts/1 phase/60 Hz for panel
- 20 amp circuit for controls

Natural Gas:
- Supply capacity: 2000 SCFH for burner (no pilot); 5 psig
- Expected usage during operation: 100 SCFH (dependent on combustible loading)

Instrument air:
- 5 scfm at 100 psig

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Scope by others

- Installation
- Automatic offgas shutoff valve
- Offgas supply piping
- Fuel supply and piping
- Insulation and heat tracing, as required
- All electrical (power and control wiring, conduits, tie-ins, terminations, etc.) installation work
- Ladders and platforms, as required. (GCL can quote this upon request)
- Compliance testing by independent third party to establish emissions compliance, as required.
- Provide any and all local, state or federal agency permits or special clearance requirements.
- Site preparation, as needed
- Concrete foundation or equipment pad design, supply and installation
- Instrument air
- Instrument air piping
- Fan balancing, as needed
- Other items not specifically stated as in GCL's scope of supply
- Start-up (offered as an option below)

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Pricing

Complete regenerative thermal oxidizer system as described above.....$393,710.00

Less Engineering order ..... -$27,500.00

Equipment price $366,210.00

FOB, shop

Freight and taxes not included.

Schedule

General Arrangement Drawing and P&ID	4-6 weeks ARO
Expected Delivery (FOB shop):	18-20 weeks ARO (total schedule including above deliverables)

This schedule is predicated on customer approval within a reasonable time frame. Delays in approval will extend the completion date by the time equal to the delay. Lengthy delays may result in rescheduling of manufacturing, which could result in a greater offset of shipping dates and increased prices as a result of raw material increases.

VALIDITY
All prices quoted herein are valid for acceptance within sixty (60) from the date of this proposal.

FREIGHT
Prices are in U. S. dollars, F.O.B. shipping point.

ACCEPTANCE
All orders are subject to acceptance by Griffith Consulting, LLC. (GCL) and availability of materials. Clerical errors are subject to correction. Ordered items may be subject to cancellation by GCL without notice.

TAXES AND FEES
All taxes including Federal, State or Local, which may become due as a result of this project shall be the purchaser's responsibility. All sales, use, excise and/or value added taxes as well as all duty, customs agent or broker fees, inspection or testing fees, air pollution permit fees, insurance, consular fees or any other tax which may be assessed by any government entity at any level shall be paid by the purchaser.

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TERMS OF PAYMENT

Periodic payments will be required throughout the course of this project. Invoices shall be submitted at intervals as indicated below with payment due upon receipt. The following is the suggested payment schedule for the delivery schedule noted above:

50% due at time of issuance of purchase order by customer
25% due upon submission by GCL of drawings for approval
15% due upon shipment of thermal oxidizer
10% due upon successful start-up of thermal oxidizer (initial lighting of burner), not to exceed 60 days from shipment

Initial payment is due with the purchase order and before work commences. Other invoices are payable at Net 30 Days unless otherwise indicated. A late charge of 1½% per month will apply to all unpaid balances. If shipments are delayed by buyer, payments are due when GCL is prepared to make such shipments.

STARTUP, TRAINING, AND SERVICE TERMS

Unless otherwise noted, prices quoted do not include services. GCL can provide service technicians, engineers, and other personnel as required to support startup, training, and service of equipment and systems furnished. Personnel to support these functions can be provided at a per diem rate of $1280 per day. Travel days and stand-by time will be charged at 8 hours per day. Travel occurring outside the normal 8-hour work day shall be billed at $160.00 per hour. Overtime in excess of 8 hours per day or 40 hours per week shall be charged 150% of the base rate. Likewise, work on Saturday and Sunday shall be at 150% of the base rate. Required work on holidays shall be at 200% of the base rate. When service extends over a period of weeks, personnel are returned to their base United States location for a weekend every two weeks at customer's expense. All actual living, travel, and other related expenses associated with service shall be invoiced at actual cost.

DELIVERY

Goods shall be delivered upon reasonable notice to purchaser, F.O.B. seller's plant, and title thereto and liability for loss and damage in transit or thereafter shall pass to purchaser upon seller's deliver of good to a carrier for shipment. Claims for damages in transit must be asserted against the carrier. Within ten (10) days after receipt of shipment, purchaser must report any shortage or damage not due to carrier, otherwise claims for such shortage or damage will be deemed waived.

LIABILITY & LIMITATION ON DAMAGES

In no event shall GCL be liable for purchaser's increased manufacturing costs, loss of profits or good will or any special, indirect, incidental or consequential damages. In no event shall GCL be liable for incidental, compensatory, punitive, consequential, indirect, special or other damages. GCL's aggregate liability with respect to a defective product and any contract between GCL and purchaser shall be limited to the amount paid to GCL for that product.

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ARBITRATION

Purchaser agrees that all claims, demands, disputes, controversies, and differences arising under any contract made between GCL and purchaser shall be settled exclusively by arbitration in accordance with the rules prevailing of the American Arbitration Association. Judgment on the award thus rendered shall be binding on the purchaser and may be entered in any court having jurisdiction thereof. Unless the parties agree otherwise in writing, such arbitration will be conducted in Montgomery County, Pennsylvania. In the event that GCL hires an attorney to assert any of its rights or defenses in connection herewith or to collect amount sue, Purchaser agrees to be responsible for all of GCL's legal fees and expenses as well as costs of collection.

FORCE MAJEURE

GCL shall not be responsible for default hereunder where such has been caused by an act of God, war, major disaster, terrorism, third-party criminal acts, insurrection, riot, flood, earthquake, fire, labor disturbance, labor shortages, inability to secure raw materials or failure of machinery for the manufacture of equipment, operation of statutes, laws, rules or rulings of any court or government, or any other cause beyond GCL's control.

CANCELLATIONS, CHANGES & RETURNS

All undelivered products may be canceled on purchaser only upon written approval of GCL. In the event of any cancellation by purchaser, purchaser shall pay to GCL its reasonable costs and expenses, plus GCL's usual rate of profit for similar work. Purchaser may not alter or modify its order or any part thereof without GCL's prior, written consent. GCL reserves the right to change the price, terms of payment and delivery dates for any products affected by any alterations or modification. No products may be returned without GCL's written authorization and products may be returned only on the terms specified in such authorization.

JURISDICTION

Contracts established based on this proposal shall be governed by laws of the State of Pennsylvania, venue Montgomery County.

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GUARANTEE

GCL guarantees the system to be furnished under the terms of this proposal to provide methane emissions control as specified. Accordingly, the guarantee for operation of this system is as follows:

GCL guarantees the Thermal oxidizer quoted herein to provide the above indicated destruction of listed combustibles as specified in the Performance Data section of this proposal. If required, this destruction will be measured utilizing EPA Method 25A to evaluate concentrations entering and leaving the Thermal oxidizer. In the event the unit fails to perform at this level, GCL will at its expense, modify the system in order to cause it to meet this guarantee. GCL shall be given the opportunity to review the operation of the Thermal oxidizer and the proposed test method prior to testing. GCL shall be given the opportunity to be present at purchaser's expense during testing to ensure Thermal oxidizer is operated in accordance with recommended operational parameters. This guarantee is based on emission data and operating parameters provided by customer. If conditions vary significantly from those represented, or if different constituents are present which affect the equipment or its operation, performance will be different.

WARRANTY

GCL warrants all labor and materials for one year after date of start-up, provided routine operating and maintenance procedures are followed per GCL's operating and maintenance instructions. GCL will repair or replace, at its option, items which fail during the one year warranty period. THIS EXPRESS LIMITED WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OR MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESIGNATION ON THE FACE HEREOF. Replacement shall include freight to plant site.

Notification of suspected warranty problems must be made, in writing, within five (5) days upon their occurrence. GCL shall be provided access to the equipment during normal working hours to evaluate and assist in correction of any deficiencies which may exist.

Warranties for purchased items, such as instrumentation, controls, valves, etc. shall be extended by GCL to customer on the same basis as the warranty provided to GCL by the original equipment manufacturer. Upon written notification of failure of such parts, GCL shall ship replacements to the appropriate facility. A memo invoice for the price of these replacement parts shall be issued by GCL to the facility. This invoice will be canceled upon return of the defective part so GCL can process such parts for its own credit as well.

GCL shall not be responsible for pluggage, corrosion, or other damage resulting from the introduction of materials or compounds not outlined in this proposal. Likewise, GCL shall not be responsible for a loss of capacity or excess utility usage as a result of buildup or deposits of materials not specifically addressed in this proposal.

GCL will not be responsible for premature failure or damage resulting from the introduction or materials not identified by purchaser into equipment covered by this warranty. This includes materials which may plug, foul, corrode, degrade or otherwise attack components or alter system performance.

GCL will not be responsible for consequential damages. GCL will not be responsible, nor pay for repairs to the proposed system while under warranty, unless such repairs are authorized by GCL in writing prior to commencement of such repairs.

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