NHSM Determination from Empire 5/7/2024

Wednesday, May 22, 2024 1:03 PM

Andrews, Edward S <edward.s.andrews@wv.gov>

Fwd: Empire Green Generation NHSM Self Determination

1 message

Andrews, Edward S <edward.s.andrews@wv.gov> Tue, May 7, 2024 at 6:16 AM
To: Beverly D Mckeone <beverly.d.mckeone@wv.gov>, Marycate Opila <opila.marycate@epa.gov>, "Supplee, Gwendolyn" <supplee.gwendolyn@epa.gov>, ott.steven@epa.gov

Steven,

I am forwarding Empire's determination as your office requested. See forwarded email with attachment.

Ed

Edward Andrews, P.E.
Engineer
WVDEP/Division of Air Quality
304-926-0499 Ext 41244
601 57th Street, SE
Charleston, WV 25304

---------- Forwarded message ---------
From: **Wood, Katie** <katie.wood@tetratech.com>
Date: Fri, May 3, 2024 at 3:09 PM
Subject: Empire Green Generation NHSM Self Determination
To: Edward Andrews <edward.s.andrews@wv.gov>
CC: Farley R Wood <fwood@empirede.com>

Ed,

Please find attached the Empire Green Generation NHSM self determination as we discussed.

Thanks,

Katie Wood* | Environmental Scientist
Direct **+1 (740) 298-9062** | Mobile **+1 (304) 559-9980** | katie.wood@tetratech.com
Formerly Katie Pugh, please note name change
Tetra Tech | *Leading with Science®* | OGA
47443 National Rd Suite 3 | St. Clairesville, OH 43950 | tetratech.com

Empire Green Generation NHSM 5-3-24.pdf
394K

Follow-up From EPA 5/6/2024

Wednesday, May 22, 2024 12:58 PM

Andrews, Edward S <edward.s.andrews@wv.gov>

RE: Re: Regulatory Interpretation Request Empire Green Generation LLC

1 message

Ott, Steven <Ott.Steven@epa.gov> Mon, May 6, 2024 at 3:16 PM
To: "edward.s.andrews@wv.gov" <edward.s.andrews@wv.gov>

Good afternoon,

I wanted to reach out and make sure this was received. Again, you have any questions please reach out at any time.

Thanks,

Steve

From: Ott, Steven
Sent: Tuesday, April 30, 2024 12:26 PM
To: edward.s.andrews@wv.gov
Cc: Hall, Kristen <hall.kristen@epa.gov>; Opila, MaryCate <Opila.MaryCate@epa.gov>; Supplee, Gwendolyn <Supplee.Gwendolyn@epa.gov>; Stankunas, Krystal <Stankunas.Krystal@epa.gov>; Adkins, Jesse D <jesse.d.adkins@wv.gov>; Beverly.d.mckeone@wv.gov
Subject: Re: Regulatory Interpretation Request Empire Green Generation LLC

Dear Mr. Andrews:

This is in response to your letter dated March 6th, 2023, requesting a regulatory interpretation (request) from the Administrator (EPA), regarding Empire Green Generation's (EGG) proposed modification to their Follansbee, WV facility. EGG proposed to cease processing medical waste and transition to processing plastics. To support the change of feedstock EGG proposed constructing a hydrochloric acid truck loading facility in conjunction with an appropriate scrubbing system. The proposed feedstock change would allow the facility to produce hydrochloric acid as an additional product of pyrolysis.

In the request the West Virginia Department of Environmental Protection, Division of Air Quality (WVDEP) posits multiple questions. EPA Region 3 has determined that a waste determination needs to be performed prior to further analysis (40 CFR 60.2175(v)).

40 CFR 258.2 defines solid waste to mean:

"…any garbage, or refuse, sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities, but does not include solid or dissolved materials in domestic sewage, or solid or dissolved materials in irrigation return flows or industrial discharges that are point sources subject to permit under 33 U.S.C. 1342…"

The permit modification application submitted to WVDEP, by EGG, on page 29 states that the plastic will be received and processed prior to being delivered to Empire Green Generation's Follansbee, WV facility. This may be covered under "… other discarded material…" of 40 CFR 258.2.

EGG needs to perform a waste analysis for their plastic feedstock, in accordance with the requirements of 40 CFR 241 to be fully evaluated under 40 CFR Part 60 Subpart CCCC. The material must be "Sufficiently processed" (40 CFR 241.3(b)(4)) and meet the following legitimacy criteria as described in 40 CFR 241.3(d)(1): The material is managed as a valuable commodity, the material has a meaningful heating value, and the material has levels of contamination comparable or less than a similar traditional fuel, which the [pyrolysis] unit is designed to burn.

A guide and flowchart for 40 CFR 241 is available at www.epa.gov/rcra/non-hazardous-secondary-material-nhsm-guide-wastenon-waste-determinations and is also attached.

EPA has additional questions needed to determine the applicability of 40 CFR Part 60 Subparts AAAA, CCCC, and EEEE however, the Waste Determination is the first step needed and once completed we request that WVDEP share the results of the determination with Region 3 so we can continue our review or your request.

Please feel free to reach out if you have any questions.

Best regards,

Steve Ott

Steve Ott
Air Inspector
ECAD
US EPA Mid-Atlantic Region
Phone 215-814-2267
Email ott.steven@epa.gov

NHSM Determination 5/3/2024

Wednesday, May 22, 2024 12:59 PM

Andrews, Edward S <edward.s.andrews@wv.gov>

Empire Green Generation NHSM Self Determination

1 message

Wood, Katie <katie.wood@tetratech.com> Fri, May 3, 2024 at 3:09 PM
To: Edward Andrews <edward.s.andrews@wv.gov>
Cc: Farley R Wood <fwood@empirede.com>

Ed,

Please find attached the Empire Green Generation NHSM self determination as we discussed.

Thanks,

Katie Wood* | Environmental Scientist
Direct **+1 (740) 298-9062** | Mobile **+1 (304) 559-9980** | katie.wood@tetratech.com
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Empire Green Generation NHSM 5-3-24.pdf
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Empire
Green Ge...

Empire Green Generation Non-Hazardous Secondary Material Self Determination

Empire Green Generation is self-determining that the feedstock material for their proposed pyrolysis plastic processing facility would be exempt from treatment as a solid waste. This is based on the Non-Hazardous Secondary Material Rule (NHSM) and the feedstock is not a solid waste, in accordance with 40 CFR 241.3(b). The site-specific self-determination requirements under 40 CFR 241.3(b) are:

- The facility generating or combusting an NHSM determines if they will make a waste or nonwaste determination for an NHSM: (1) used as fuel managed within the control the generator, (2) used as an ingredient, or (3) used as a fuel or an ingredient produced from processed discarded NHSM.
- The NHSM must meet the legitimacy criteria of 40 CFR 241.3(d).
- See the flow chart and additional information below (Figure 1).

Figure 1

Empire Green Generation Non-Hazardous Secondary Material Self Determination

Question 1 – Is the material a traditional fuel or clean cellulosic biomass?

Answer 1 – *No, the feedstock is not considered a traditional fuel or clean cellulosic biomass as defined in 40 CFR Part 241.2.*

Question 2: Is the material a categorical non-waste?

Answer 2: *No, the feedstock is not considered a categorical non-waste as defined in 40 CFR Part 241.4.*

Question 3: Is the material managed within the control of the generator?

Answer 3: *Yes, 40 CFR Part 241.2 defines "within control of the generator" as meaning that "the non-hazardous secondary material is generated and burned in combustion units at the generating facility; or that such material is generated and burned in combustion units at different facilities, provided the facility combusting the non-hazardous secondary material is controlled by the generator; or both the generating facility and the facility combusting the non-hazardous secondary material are under the control of the same person as defined in this section." While Empire Green Generations NHSM is not burning or combusting the plastics, the generating facility and the facility (pyrolysis) the non-hazardous secondary material are under the control of the same person as defined in this section.*

Question 4: Does the material satisfy all three legitimacy criteria?

Answer 4: *Yes, the feedstock does meet the legitimacy criteria, as specified in 40 CFR Part 241.3(d)(2)., as follows:*

1. The NHSM must be managed as a valuable commodity based on the following factors:
    a. The storage of the non-hazardous secondary material prior to use must not exceed reasonable time frames: *This is met at the facility calls for a maximum storage time of 7 days.*
    b. Where there is an analogous fuel, the non-hazardous secondary material must be managed in a manner consistent with the analogous fuel or otherwise be adequately contained to prevent releases to the environment: *The plastic feedstock is comprised of synthetic polymers made up of repeating hydrocarbon molecules. The pyrolysis process breaks down the complex molecules into its component hydrocarbon molecules to create syngas. Polyvinyl chloride (PVC) plastic can be processed which will liberate chlorine molecules that are collected and processed into salable hydrochloric acid.*
2. The non-hazardous secondary material must provide a useful contribution to the production or manufacturing process. The non-hazardous secondary material provides a useful contribution if it contributes a valuable ingredient to the product or intermediate or is an effective substitute for a commercial product. *The feedstock material is the basis for the synthesis gas (syngas) that is created in the pyrolysis unit. The feedstock material is also the basis for making Hydrochloric Acid which will be sold.*
3. The non-hazardous secondary material must be used to produce a valuable product or intermediate. The product or intermediate is valuable if:
    a. The non-hazardous secondary material is sold to a third part. *The NHSM is used by the Generator as an ingredient to produce syngas and hydrochloric acid that is sold to a 3rd party, and generates electricity for self-consumption.*
    b. Or the non-hazardous secondary material is used as an effective substitute for a commercial product or as in an ingredient or intermediate in an industrial

process. The NHSM is used as a substitute for crude oil in the production of syngas which is used to run the unit.

4. The non-hazardous secondary material must result in products that contain contaminant at levels that are comparable in concentration to or lower than those found in traditional products that are manufactured without the non-hazardous secondary material. Empire Green Generation has an agreement with the end buyer to produce the hydrochloric acid to the industry standards with a threshold of percent weight of hydrochloric at a minimum of 30% and a maximum of 32%, iron ppm maximum of 7, organics at a non-detect, Mercury at non-detect, Specific Gravity of minimum of 1.1526 maximum 1.1628 and a pH less than 7. The syn-gas produced, which will be used to run the plant is derived from the same base material as the traditional fuel. This product comparable or lower than traditional fuel for contaminants.

The Green Generation process does not combust the feedstock material, but rather uses pyrolysis to process the material in a non-combustible environment, it meets the legitimacy criteria specified in 40 CFR 241 to be classified as a NHSM based on the answers listed above.

Request for NHSM Determination 4/30/2024

Wednesday, May 22, 2024 1:02 PM

Andrews, Edward S <edward.s.andrews@wv.gov>

Fwd: Regulatory Interpretation Request Empire Green Generation LLC

1 message

Andrews, Edward S <edward.s.andrews@wv.gov> Tue, Apr 30, 2024 at 12:46 PM
To: "Wood, Katie" <katie.wood@tetratech.com>, Farley Wood <fwood@empirede.com>, Bernard Brown <bbrown@empirede.com>

In our RIR to R3, EPA found that EGG needs to conduct a waste determination needs to be completed before the Administrator can respond to the DAQ's RIR.

Please provide waste/non-waste determination of the proposed plastic feedstock for EGG's pyrolysis units at the Folloasnbee Facility by no later than May 15, 2024.

Should you have any questions about this request, please contact me.

Thanks,

Ed

--
Edward Andrews, P.E.
Engineer
WVDEP/Division of Air Quality
304-926-0499 Ext 41244
601 57th Street, SE
Charleston, WV 25304

---------- Forwarded message ---------
From: **Ott, Steven** <Ott.Steven@epa.gov>
Date: Tue, Apr 30, 2024 at 12:25 PM
Subject: Re: Regulatory Interpretation Request Empire Green Generation LLC
To: edward.s.andrews@wv.gov <edward.s.andrews@wv.gov>
Cc: Hall, Kristen <hall.kristen@epa.gov>, Opila, MaryCate <Opila.MaryCate@epa.gov>, Supplee, Gwendolyn <Supplee.Gwendolyn@epa.gov>, Stankunas, Krystal <Stankunas.Krystal@epa.gov>, Adkins, Jesse D <jesse.d.adkins@wv.gov>, beverly.d.mckeone <beverly.d.mckeone@wv.gov>

Dear Mr. Andrews:

This is in response to your letter dated March 6th, 2023, requesting a regulatory interpretation (request) from the Administrator (EPA), regarding Empire Green Generation's (EGG) proposed modification to their Follansbee, WV facility. EGG proposed to cease processing medical waste and transition to processing plastics. To support the change of feedstock EGG proposed constructing a hydrochloric acid truck loading facility in conjunction with an appropriate scrubbing system. The proposed feedstock change would allow the facility to produce hydrochloric acid as an additional product of pyrolysis.

In the request the West Virginia Department of Environmental Protection, Division of Air Quality (WVDEP) posits multiple questions. EPA Region 3 has determined that a waste determination needs to be performed prior to further analysis (40 CFR 60.2175(v)).

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Please feel free to reach out if you have any questions.

Best regards,

Steve Ott

Steve Ott
Air Inspector
ECAD
US EPA Mid-Atlantic Region
Phone 215-814-2267
Email ott.steven@epa.gov

NHSM Guide for Waste Non-Waste Determinations.pdf
686K

EPA Request for waste/non-determination 4/30/2024

Wednesday, May 22, 2024 12:57 PM

Andrews, Edward S <edward.s.andrews@wv.gov>

Re: Regulatory Interpretation Request Empire Green Generation LLC

1 message

Ott, Steven <Ott.Steven@epa.gov> Tue, Apr 30, 2024 at 12:25 PM
To: "edward.s.andrews@wv.gov" <edward.s.andrews@wv.gov>
Cc: "Hall, Kristen" <hall.kristen@epa.gov>, "Opila, MaryCate" <Opila.MaryCate@epa.gov>, "Supplee, Gwendolyn" <Supplee.Gwendolyn@epa.gov>, "Stankunas, Krystal" <Stankunas.Krystal@epa.gov>, "Adkins, Jesse D" <jesse.d.adkins@wv.gov>, "beverly.d.mckeone" <beverly.d.mckeone@wv.gov>

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Please feel free to reach out if you have any questions.

Best regards,

Steve Ott

Steve Ott

Air Inspector

ECAD

US EPA Mid-Atlantic Region

Phone 215-814-2267

Email ott.steven@epa.gov

NHSM Guide for Waste Non-Waste Determinations.pdf
686K

Checking In 3/21/2024

Wednesday, March 27, 2024 2:09 PM

Andrews, Edward S <edward.s.andrews@wv.gov>

Checking In

1 message

Wood, Katie <katie.wood@tetratech.com> Thu, Mar 21, 2024 at 1:23 PM
To: Edward Andrews <edward.s.andrews@wv.gov>

Hey Ed,

Just wanted to check in and see if you needed anything further for Empire.

Thanks,

Katie

Katie Wood* | Environmental Scientist
Direct **+1 (740) 298-9062** | Mobile **+1 (304) 559-9980** | katie.wood@tetratech.com
Formerly Katie Pugh, please note name change
Tetra Tech | *Leading with Science®* | OGA
47443 National Rd Suite 3 | St. Clairesville, OH 43950 | tetratech.com

Further Discussion 3/11/2024

Wednesday, March 27, 2024 2:08 PM

Andrews, Edward S <edward.s.andrews@wv.gov>

Re: Empire Discussion

1 message

Andrews, Edward S <edward.s.andrews@wv.gov> Mon, Mar 11, 2024 at 1:26 PM
To: "Farley R. Wood, P.E." <fwood@empirede.com>
Cc: "Wood, Katie" <katie.wood@tetratech.com>, Malcolm Kingston <design@technotherm.co.za>

Thanks for the follow up with my concerns about the process.

I will provide either a my understanding of the decay of PVC and formation of HCl with recovery or an illustration/flow diagram with which we can have a discussion about.

Thanks
Ed

On Mon, Mar 11, 2024 at 1:15 PM Farley R. Wood, P.E. <fwood@empirede.com> wrote:

> Ed,
>
> See my comments below:
>
> 
>
>
> Farley R. Wood, P.E.
> Vice President of Engineering
>
> Main Office (304) 935-5851
> Mobile: (304) 650-2023
> Teams: Click Here
>
> fwood@empirede.com
> www.empirediversifiedenergy.com
>
> **From:** Wood, Katie <katie.wood@tetratech.com>
> **Sent:** Friday, March 8, 2024 3:15 PM
> **To:** Farley R. Wood, P.E. <fwood@empirede.com>
> **Subject:** FW: Empire Discussion
>
>

From: Andrews, Edward S <edward.s.andrews@wv.gov>
Sent: Friday, March 8, 2024 3:10 PM
To: Wood, Katie <katie.wood@tetratech.com>
Subject: Re: Empire Discussion

Katie,

I have looked over the latest request to my questions.

Some things are making sense(e.g, formation of HCl from the pyrolysis unit).

However, I am still a little confused on how the gaseous HCl in the synthetic gas is going to be stripped out with the gas cleaning trains without a significant amount of water being entrained into the cleaned synthetic gas stream.

The Cl gas will be liberated in the pre-pyrolysis unit and removed before the feed enters the pyrolysis unit, where the syngas is produced.

I saw that there was some HCl estimated from the scrubber in the revised application but I did not receive any attachments in your February 21 email (tanks/HCl calculations).

Katie will forward to you.

Here are some of my concerns/questions that I still have:

A)1) Make up the PVC in the plastic feedstock. At 100% PVC, about 15.5 gallons per minute of 20% HCl could potentially be produced. At this rate, the storage capacity would be exceeded in one day.

We cannot run 100% PVC feed to the plant. We are limited to 15%, and should produce a maximum of 5,500 gallons per day of HCl.

We also have the option of running less than 15% to reduce HCl production, or not run any PVC to effectively stop HCl production.

A)2) Operating temperature range of the pyrolysis unit.

The pre-pyrolysis units operating temperature is 320° C (608° F). The operating temperature of the pyrolysis unit is 830° C (1,526° F).

A)3) Will oils/tars still be produced? One of the references in the provided paper noted the formation of methane, ethane, ethyne, 1-butane, hydrogen, chlorine, and benzene, which are in the form of CnHm. None of these compounds

are close to C14

Oils/tars will be produced. We have an oil/water separator on the HCl circuit, and a larger oil/water separator on each of the three gas cleanup trains.

The collected oil/tars are pumped to a central collection tank where the product is used as fuel in the combustion chamber of the pyrolysis units.

B) I am assuming the gas cleaning trains are going to be used to extract the gaseous HCl out of the synthetic gas. How does EGG plan on doing this and what properties are going to be monitored?

I am envisioning that the scrubber would be blown down once the circulating water reached a HCl conc of 20% or sg of 1.1. This needs to be spelled out.

The Cl gas will be collected and removed from the system prior to the generation of syngas.

C) Venting the HCl scrubber to the RTO might be the simplest approach. Operating pressures and water/HCl carryover might adversely affect the life and performance of the RTO. Please see Note 3 on DWG Poly Scrub Basis 5'x5' scrubber that the vessel is designed for 1.9 SpG Mat'l @ 100 F/Atmos Pressure.

The HCl fumes will pass through the scrubber which is 99% efficient. There will not be any water carryover.

There will be high dilution of the very low concentration HCl fumes returning to the RTO that the designers of the system feel any adverse effects to life cycle or performance would be negligible.

Stipping gasous HCl with water is going to generate a significant amount of heat energy.

The HCl system has two chiller units included in the circuit. One for the gasses entering the spray tower, and a second for the liquid leaving the tower.

Plus connecting the vent line to the RTO is going to reduce the operating pressure below atmospheric (negative pressure).

That is correct. We want negative pressure from the HCl scrubber to the RTO to prevent leakage.

D) Classification of the plastic feedstock is either a fuel/raw ingredient in accordance with 40 CFR 241.

Good

On Fri, Mar 1, 2024 at 10:23 AM Wood, Katie <katie.wood@tetratech.com> wrote:

> Ed,
>
> We have some answers to your questions below in red. Please let me know if you would like to discuss.
>
> Thanks,
>
> Katie
>
> ---
>
> **From:** Andrews, Edward S <edward.s.andrews@wv.gov>
> **Sent:** Friday, February 23, 2024 2:24 PM
> **To:** Wood, Katie <katie.wood@tetratech.com>; Farley Wood <fwood@empirede.com>
> **Subject:** Re: Empire Discussion
>
> ⚠ **CAUTION:** This email originated from an external sender. Verify the source before opening links or attachments. ⚠
>
> Using Chlorine gas and water reaction to produce HCl also produces a by-product of HOCl (hypochlorous acid). https://www.bing.com/search?q=chlorine+gas+water+reaction&qs=UT&pq=chlorine+gas+water+reaction&sc=10-27&cvid=1D306673308642F9BCEE5D950B9BFB08&FORM=QBRE&sp=1&ghc=1&lq=0 The process does not produce any Chlorine gas, it produces Chloride gas so no HOCL is produced. I have attached a paper provided by Technotherm for futher information
>
> Question is: Will Empire separate hypochlorous acid from the HCl or send it out as it? As per above no HOCL will be produced
>
> Will the emissions of HCl go through a separate release point than the RTO stack? If it is a separate stack, I need the stack id and stack parameters of this point. No all emissions will go through the RTO
>
> Also, I will need the calculations to support your emission estimate of HCl and concentration of HCl in the effluent release to the atmosphere from the production/storage/loading out of HCl. Calculations attached, these were included in the last submittal
>
> Ed
>
> On Thu, Feb 22, 2024 at 1:00 PM Wood, Katie <katie.wood@tetratech.com> wrote:
>
> > ---

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Phone Conference ID: 114 016 353#

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--
Edward Andrews, P.E.
Engineer
WVDEP/Division of Air Quality
304-926-0499 Ext 41244
601 57th Street, SE
Charleston, WV 25304

--
Edward Andrews, P.E.
Engineer
WVDEP/Division of Air Quality
304-926-0499 Ext 41244
601 57th Street, SE

Charleston, WV 25304

External Email. Please make sure you trust this sender before clicking on any links or opening attachments. Learn why this is important

--
Edward Andrews, P.E.
Engineer
WVDEP/Division of Air Quality
304-926-0499 Ext 41244
601 57th Street, SE
Charleston, WV 25304

Scrubber Forms 3/11/2024

Wednesday, March 27, 2024 2:05 PM

Andrews, Edward S <edward.s.andrews@wv.gov>

RE: Empire Discussion

1 message

Wood, Katie <katie.wood@tetratech.com> Mon, Mar 11, 2024 at 1:09 PM
To: "Andrews, Edward S" <edward.s.andrews@wv.gov>
Cc: Farley R Wood <fwood@empirede.com>

Ed,

Attached is the emission control sheet for the scrubber. Farley is pulling together answers for you questions below and will be sending over shortly.

Thanks,

Katie

From: Andrews, Edward S <edward.s.andrews@wv.gov>
Sent: Friday, March 8, 2024 3:10 PM
To: Wood, Katie <katie.wood@tetratech.com>
Subject: Re: Empire Discussion

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A)1) Make up the PVC in the plastic feedstock. At 100% PVC, about 15.5 gallons per minute of 20% HCl could potentially be produced. At this rate, the storage capacity would be exceeded in one day.

A)2) Operating temperature range of the pyrolysis unit.

A)3) Will oils/tars still be produced? One of the references in the provided paper noted the formation of methane, ethane, ethyne, 1-butane, hydrogen, chlorine, and benzene, which are in the form of CnHm. None of these compounds are close to C14

B) I am assuming the gas cleaning trains are going to be used to extract the gaseous HCl out of the synthetic gas. How does EGG plan on doing this and what properties are going to be monitored?

I am envisioning that the scrubber would be blown down once the circulating water reached a HCl conc of 20% or sg of 1.1. This needs to be spelled out.

C) Venting the HCl scrubber to the RTO might be the simplest approach. Operating pressures and water/HCl carryover might adversely affect the life and performance of the RTO. Please see Note 3 on DWG Poly Scrub Basis 5'x5' scrubber that the vessel is designed for 1.9 SpG Mat'l @ 100 F/Atmos Pressure.

Stipping gasous HCl with water is going to generate a significant amount of heat energy.

Plus connecting the vent line to the RTO is going to reduce the operating pressure below atmospheric (negative pressure).

D) Classification of the plastic feedstock is either a fuel/raw ingredient in accordance with 40 CFR 241.

On Fri, Mar 1, 2024 at 10:23 AM Wood, Katie <katie.wood@tetratech.com> wrote:

> Ed,
>
> We have some answers to your questions below in red. Please let me know if you would like to discuss.
>
> Thanks,
>
> Katie

From: Andrews, Edward S <edward.s.andrews@wv.gov>
Sent: Friday, February 23, 2024 2:24 PM
To: Wood, Katie <katie.wood@tetratech.com>; Farley Wood <fwood@empirede.com>
Subject: Re: Empire Discussion

Using Chlorine gas and water reaction to produce HCl also produces a by-product of HOCl (hypochlorous acid). https://www.bing.com/search?q=chlorine+gas+water+reaction&qs=UT&pq=chlorine+gas+water+reaction&sc=10-27&cvid=1D306673308642F9BCEE5D950B9BFB08&FORM=QBRE&sp=1&ghc=1&lq=0 The process does not produce any Chlorine gas, it produces Chloride gas so no HOCL is produced. I have attached a paper provided by Technotherm for futher information

Question is: Will Empire separate hypochlorous acid from the HCl or send it out as it? As per above no HOCL will be produced

Will the emissions of HCl go through a separate release point than the RTO stack? If it is a separate stack, I need the stack id and stack parameters of this point. No all emissions will go through the RTO

Also, I will need the calculations to support your emission estimate of HCl and concentration of HCl in the effluent release to the atmosphere from the production/storage/loading out of HCl. Calculations attached, these were included in the last submittal

Ed

On Thu, Feb 22, 2024 at 1:00 PM Wood, Katie <katie.wood@tetratech.com> wrote:

Microsoft Teams meeting

Join on your computer, mobile app or room device

Click here to join the meeting

Meeting ID: 248 808 531 032
Passcode: Gbfah4

Download Teams | Join on the web

Or call in (audio only)

+1 213-357-2812,,114016353# United States, Los Angeles

Phone Conference ID: 114 016 353#

Find a local number | Reset PIN

Learn More | Meeting options

--
Edward Andrews, P.E.
Engineer
WVDEP/Division of Air Quality
304-926-0499 Ext 41244
601 57th Street, SE
Charleston, WV 25304

--
Edward Andrews, P.E.
Engineer
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601 57th Street, SE
Charleston, WV 25304

M-3.pdf
2632K

M-3

Attachment M
Air Pollution Control Device Sheet
(WET COLLECTING SYSTEM-SCRUBBER)

Control Device ID No. (must match Emission Units Table):

Equipment Information

1. Manufacturer: Poly Processing Model No. 5' X 5' Scrubber	2. Method: ☐ Packed Bed ☐ Venturi ☐ Spray Tower ☐ Cyclone ☐ Mechanical ☐ Orifice ☒ Other, specify
3. Provide diagram(s) of unit describing capture system with duct arrangement and size of duct, air volume, capacity, horsepower of movers. If applicable, state hood face velocity and hood collection efficiency.	
4. Provide a scale diagram of the scrubber showing internal construction. Please include packing type and size, spray configurations, baffle plates, and mist eliminators.	
5. What type of liquid entrainment eliminators or system will be used? Submit a schematic diagram showing thickness, mesh, and material of construction.	
6. Describe the scrubber's construction material: Polyethelene (XLPE tank with PVC internals and exterior piping. Water with NaOH is added to the vessel above the set level. Vent gas from the HCl tank passes through the gas diffuser where HCl fumes are neutralized before the scrubbed gas is vented from the top.	
7. What will be the power requirements of the collector? Fan NO HP Inlet scrubbing liquid pump: NA HP	
8. What type of fan(s) will be used? Type of fan blade: None Number of blades: None Diameter of blade: None in. Also supply a fan curve for each fan to be used.	
9. Estimated gas pressure drop at maximum flow rate: 1 inches H_2O	

Scrubbing Liquor Characteristics

10. Scrubbing Liquor

Composition	Weight %
1 Water	99
2 NaOH	1
3	
4	

11. Scrubbing liquor losses (evaporation, etc.):
0.5 gal/1000 ACF gas

12. Liquor pressure to scrubber: 0.25 PSIA

13. Pressure drop through scrubber: 6 in. H_2O

14. Source of liquor (explain):
Batch liquid added to tank

15. Liquor flow rates to scrubber:
Design maximum: 1,000 gal/min
Average expected: 500 gal/min

16. Describe system to be used to supply liquor to collector:
Manual drain and re-fill process

17. Give the expected solids content of the liquor:
No suspended solids will be created. The system will convert HCl gas vapors will react with NaOH to form water (H_2O) and solid (NaCl). Water will be changed out well before NaCl concentration reaches saturation.

18. If the liquor is to be recirculated, describe any treatment performed:

19. Data for Venturi Scrubber:	20. Data for Packed Towers:
Throat Dimensions: NA (Specify Units)	Type of Packing: NA
Throat Velocity: Na ft/sec	Superficial Gas Velocity through Bed:

Gas Stream Characteristics

21. Gas flow into the collector:	22. Gas stream temperature:
1000 ACF @ 20 °F and 14.2 PSIA	Inlet: ambient °F
	Outlet: ambient °F
23. Gas flow rate:	24. Particulate Grain Loading in grains/scf:
Design Maximum: 135 ACFM	Inlet: NA
Average Expected: 67 ACFM	Outlet: NA

25. Emission rate of each pollutant (specify) into and out of collector:

Pollutant	IN		OUT		Guaranteed Minimum Collection Efficiency
	lb/hr	grains/acf	lb/hr	grains/acf	
A HCl	0.03lb/hr		0.0003lb/hr		99
B					
C					
D					
E					

26. Type of pollutant(s) controlled: ☐ SO_x ☐ Odor
☐ Particulate (type): ☒ Other: HCl

27. By what method were the uncontrolled emissions calculated? ☒ Material Balance ☐ Stack Test
☐ Pilot Test ☐ Other:

28. Dimensions of stack: Height 4'-9" ft. Diameter 5'-1" ft.

29. Supply an equilibrium curve and/or solubility data (at various temperatures) for the proposed system.

30. Supply a curve showing proposed collection efficiency versus gas volume from 25 to 100 percent of design rating of collector.

Particulate Distribution

31. Complete the table:	Particle Size Distribution at Inlet to Collector	Fraction Efficiency of Collector
Particulate Size Range (microns)	Weight % for Size Range	Weight % for Size Range
0 – 2	NA, vapor to liquid solvent conversion.	
2 – 4		
4 – 6		
6 – 8		
8 – 10		
10 – 12		
12 – 16		
16 – 20		
20 – 30		
30 – 40		
40 – 50		
50 – 60		
60 – 70		
70 – 80		
80 – 90		
90 – 100		
>100		

32. Describe any air pollution control device inlet and outlet gas conditioning processes (e.g., gas cooling, gas reheating, gas humidification):

33. Describe the collection material disposal system:
Neutralized HCl gas will become a salt brine that will be disposed of in accordance with local, state (PADEP), and federal regulations.

34. Have you included **Wet Collecting (Scrubber) Control Device** in the Emissions Points Data Summary Sheet? Yes

35. **Proposed Monitoring, Recordkeeping, Reporting, and Testing**
Please propose monitoring, recordkeeping, and reporting in order to demonstrate compliance with the proposed operating parameters. Please propose testing in order to demonstrate compliance with the proposed emissions limits.

MONITORING:	RECORDKEEPING:
REPORTING:	TESTING:

MONITORING:	Please list and describe the process parameters and ranges that are proposed to be monitored in order to demonstrate compliance with the operation of this process equipment or air control device.
RECORDKEEPING:	Please describe the proposed recordkeeping that will accompany the monitoring.
REPORTING:	Please describe any proposed emissions testing for this process equipment on air pollution control device.
TESTING:	Please describe any proposed emissions testing for this process equipment on air pollution control device.

36. **Manufacturer's Guaranteed Capture** Efficiency for each air pollutant.

37. **Manufacturer's Guaranteed Control Efficiency** for each air pollutant.
0.99%

38. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty.

Attachment L
EMISSIONS UNIT DATA SHEET
BULK LIQUID TRANSFER OPERATIONS

Furnish the following information for each new or modified bulk liquid transfer area or loading rack, as shown on the *Equipment List Form* and other parts of this application. This form is to be used for bulk liquid transfer operations such as to and from drums, marine vessels, rail tank cars, and tank trucks.

Identification Number (as assigned on *Equipment List Form*):	
1. Loading Area Name:	
2. Type of cargo vessels accommodated at this rack or transfer point (check as many as apply): ☐ Drums ☐ Marine Vessels ☐ Rail Tank Cars ☒ Tank Trucks	
3. Loading Rack or Transfer Point Data:	
Number of pumps	
Number of liquids loaded	2
Maximum number of marine vessels, tank trucks, tank cars, and/or drums loading at one time	1
4. Does ballasting of marine vessels occur at this loading area? ☐ Yes ☐ No ☒ Does not apply	
5. Describe cleaning location, compounds and procedure for cargo vessels using this transfer point:	
6. Are cargo vessels pressure tested for leaks at this or any other location? ☐ Yes ☐ No If YES, describe:	

7. Projected Maximum Operating Schedule (for rack or transfer point as a whole):

Maximum	Jan. - Mar.	Apr. - June	July - Sept.	Oct. - Dec.
hours/day				
days/week				

weeks/quarter				

8. Bulk Liquid Data *(add pages as necessary)*:							
Pump ID No.							
Liquid Name		HCL					
Max. daily throughput (1000 gal/day)		5k					
Max. annual throughput (1000 gal/yr)		1300					
Loading Method [1]		sub					
Max. Fill Rate (gal/min)		1000					
Average Fill Time (min/loading)		500					
Max. Bulk Liquid Temperature (°F)		75					
True Vapor Pressure [2]							
Cargo Vessel Condition [3]							
Control Equipment or Method [4]							
Minimum control efficiency (%)							
Maximum Emission Rate	Loading (lb/hr)						
	Annual (lb/yr)						
Estimation Method [5]							

[1] BF = Bottom Fill SP = Splash Fill SUB = Submerged Fill

[2] At maximum bulk liquid temperature

[3] B = Ballasted Vessel, C = Cleaned, U = Uncleaned (dedicated service), O = other (describe)

[4] List as many as apply (complete and submit appropriate ***Air Pollution Control Device Sheets***):CA = Carbon Adsorption LOA = Lean Oil AdsorptionCO = Condensation SC = Scrubber (Absorption)CRA = Compressor-Refrigeration-Absorption TO = Thermal Oxidation or Incineration
CRC = Compression-Refrigeration-Condensation VB = Dedicated Vapor Balance (closed system)
O = other (describe)

[5] EPA = EPA Emission Factor as stated in AP-42
MB = Material Balance

TM = Test Measurement based upon test data submittal
O = other (describe)

9. **Proposed Monitoring, Recordkeeping, Reporting, and Testing**
Please propose monitoring, recordkeeping, and reporting in order to demonstrate compliance with the proposed operating parameters. Please propose testing in order to demonstrate compliance with the proposed emissions limits.

MONITORING	RECORDKEEPING
REPORTING	TESTING

MONITORING. PLEASE LIST AND DESCRIBE THE PROCESS PARAMETERS AND RANGES THAT ARE PROPOSED TO BE MONITORED IN ORDER TO DEMONSTRATE COMPLIANCE WITH THE OPERATION OF THIS PROCESS EQUIPMENT OPERATION/AIR POLLUTION CONTROL DEVICE.

RECORDKEEPING. PLEASE DESCRIBE THE PROPOSED RECORDKEEPING THAT WILL ACCOMPANY THE MONITORING.

REPORTING. PLEASE DESCRIBE THE PROPOSED FREQUENCY OF REPORTING OF THE RECORDKEEPING.

TESTING. PLEASE DESCRIBE ANY PROPOSED EMISSIONS TESTING FOR THIS PROCESS EQUIPMENT/AIR POLLUTION CONTROL DEVICE.

10. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty

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101 Fairview Avenue
Pittsburgh, PA 15238

Email: sales@v-syst.com
Web: www.v-syst.com

Telephone: 412-826-9200
Fax: 412-826-9192

Quote #2023-560-H-R

July 26, 2023

Mr. Farley R. Wood, P.E.
Vice President of Engineering
Empire Diversified Energy
1400 Main Street
Follansbee, WV 26037

Subject: Chemical System - Scrubber -- Quote #2023-560-H-R

Dear Mr. Wood,

Please find attached our proposal for the above referenced equipment/project. We appreciate the opportunity to provide a quote for this opportunity.

You will also find our most recent line card attached for your reference. I hope you will think of us during your next project. If you would have any questions or require additional information, please give us a call at (412) 826-9200.

Sincerely,

Russell C. Huffmyer
President & CEO
V-Systems, Inc.
101 Fairview Avenue
Pittsburgh, PA 15238

Enclosure

ansr

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101 Fairview Avenue
Pittsburgh, PA 15238

Email: sales@v-syst.com
Web: www.v-syst.com

Telephone: 412-828-9300
Fax: 412-828-2152

Quotation:

Project Name:	Chemical System - Scrubber	**Contact Name:**	Farley Wood
Company Name:	Empire Diversified Energy	**Email/Fax:**	fwood@empiredx.com
		Phone:	304-914-2624
Address/Street:	1400 Main Street	**Date:**	July 21, 2023 / Revised July 26, 2023
City/State/Zip:	Follansbee, WV 26037	**Quote Number:**	2023-560-H-R

Thank you for the opportunity to provide you with the following quote:

Quantity	Item Description	Net Price Each	Total Net Price
Two: Scrubber Tank			
1	PolyScrub Scrubber Tank, 700 Open Top, Rated: 1.90 Specific Gravity Wall Thickness, Material: Crosslinked Polyethylene (XLPE)+, Color: Natural (yellowish white) • (1) Lid/Manway - 61" Cover Assembly Open Top /Stainless Steel/Pe • (1) Vent - 6" U-Vent PVC • (1) Outlet / Overflow - 1" Scrubber Outlet/Overflow PVC/Itharge Viton /c-276 • (1) Scrubber - 6" Scrubber Assembly PVC/Itharge Viton • (1) Fill - 1" Bulkhead Fitting Assembly Socket x thread PVC/Itharge Viton • Warranty - 5 Years, Full Replacement, Non-Prorated Includes Product Engineering / Permitting Support for Permit Application	$16,500.00	$16,500.00
Two: Tank			
1	10,305-Gallon Vertical Tank, Rated: 1.90 Specific Gravity Wall Thickness, Material: Crosslinked Polyethylene (XLPE)+, Color: Natural (yellowish white) • (1) Lid/Manway - 24" Manway Cover 24" Fume Tight /Stainless Steel/pe • (1) Fill - 2" Bulkhead Fitting Assembly Socket x thread PVC/EPDM • (2) Dome Fitting - 2" Bulkhead Fitting Assembly Socket x thread PVC/EPDM • (3) Sidewall Fitting - 2" Bolted Flange Fitting Socket PVC/c-276/EPDM • (1) Vent - 6" U-vent with Bolted Flange PVC/c-276/EPDM • WARRANTY:5 Years, Full Replacement, Non-Prorated	$39,675.00	$39,675.00

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Pittsburgh, PA 15238

Email: sales@v-syst.com
Web: www.v-syst.com

Telephone: 412-826-9200
Fax: 412-826-2162

Tag: Pump			
2	March Model # TE-10K-MD 3PH 10 HP - Inlet: 3"MPT, Outlet: 2"MPT, Wet End: Natural Kynar (Front Housing, Rear Housing), Glass Filled Kynar (Impeller) with 6.625" Impeller Trim, Viton (Gasket), Carbon (Bushing), Ceramic (Shaft, Thrust Washers), and driven by a 10 HP, 3500 RPM, 3/60/230/460, TEFC Motor **Note:** • Lead Time is currently 1 Week, A.R.O. • FOB out of March in IL (must ship by LTL due to size and weight)	$7,920.00	$15,840.00
Tag: VFD[x]			
2	Xylem, Variable Frequency Drives, 10 HP, 460-3-60, NEMA 3R, BACnet **Note:** • Lead Time is currently at 7 Weeks, A.R.O.	$7,780.00	$15,560.00
Tag: Chem Feed Skid			
1	SS1-C_FLOOR_050_PVCEPDM_PD PP/PE Prominent Skid for solenoid driven pumps, (20"W x 16"D x 40"H) 1/2" PVC/EPDM socket weld pipe and fittings Wye strainer 500ml PVC calibration column 164ml CPVC/EPDM pulsation dampeners Pressure relief valves Pressure gauge with isolator Back pressure valve Plumbing and components rated at 150 PSI regardless of pump pressure. • (1) GMXA0708PVT2Q000UDC1300EN Prominent Gamma/X 2 GPH/102PSI, PVDF/PTFE, bleed valve w/spring, 4-20mA output • (1) Prominent CP1 ONE PUMP 120VAC SCADA PANEL	$21,505.00	$21,505.00
		Total Quoted Amount:	$109,080.00

QUOTED BY: RUSS HUFFMYER

If you need further information concerning the products that have been included in the quote, please feel free to contact me at 412-826-9200 and/or rhuffmyer@v-syst.com.

We appreciate the opportunity to provide you with this quote and look forward to working with you on this important project.

Thank you,

Russell C. Huffmyer
President & CEO

ansr

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101 Fairview Avenue
Pittsburgh, PA 15238

Email: sales@v-syst.com
Web: www.v-syst.com

Telephone: 412-828-9300
Fax: 412-828-2152

THIS QUOTATION OR SELLER'S ACCEPTANCE OF THIS ORDER IS EXPRESSLY LIMITED TO, AND EXPRESSLY MADE CONDITIONAL ON, BUYER'S ACCEPTANCE OF THE V-SYSTEMS-TEC, INC. STANDARD TERMS AND CONDITIONS OF SALE. A COPY OF THESE TERMS AND CONDITIONS IS AVAILABLE AT https://v-syst.com/terms-and-conditions-of-sale-and-service. SELLER OBJECTS TO ANY DIFFERENT OR ADDITIONAL TERMS.

General Comments

Warranty applies per Sales & Service Terms and Conditions if the following are met:

- Equipment installed per industry standards and manufacturer instruction manual.
- Operation of equipment in accordance with manufacturer instruction manual.
- Maintenance and lubrication per manufacturer instruction manual. Note, maintenance log showing dates required.
- Equipment must be stored per manufacturer instruction manual and protected from the weather.

If warranty items occur, V-Systems needs to be contacted in writing before any repairs are made, whereas a mutual course of action will be performed. Equipment cannot be disassembled without V-Systems being present.

Acknowledged and Accepted by Buyer:

Name: _____ *Tax Exempt? Yes____ No____

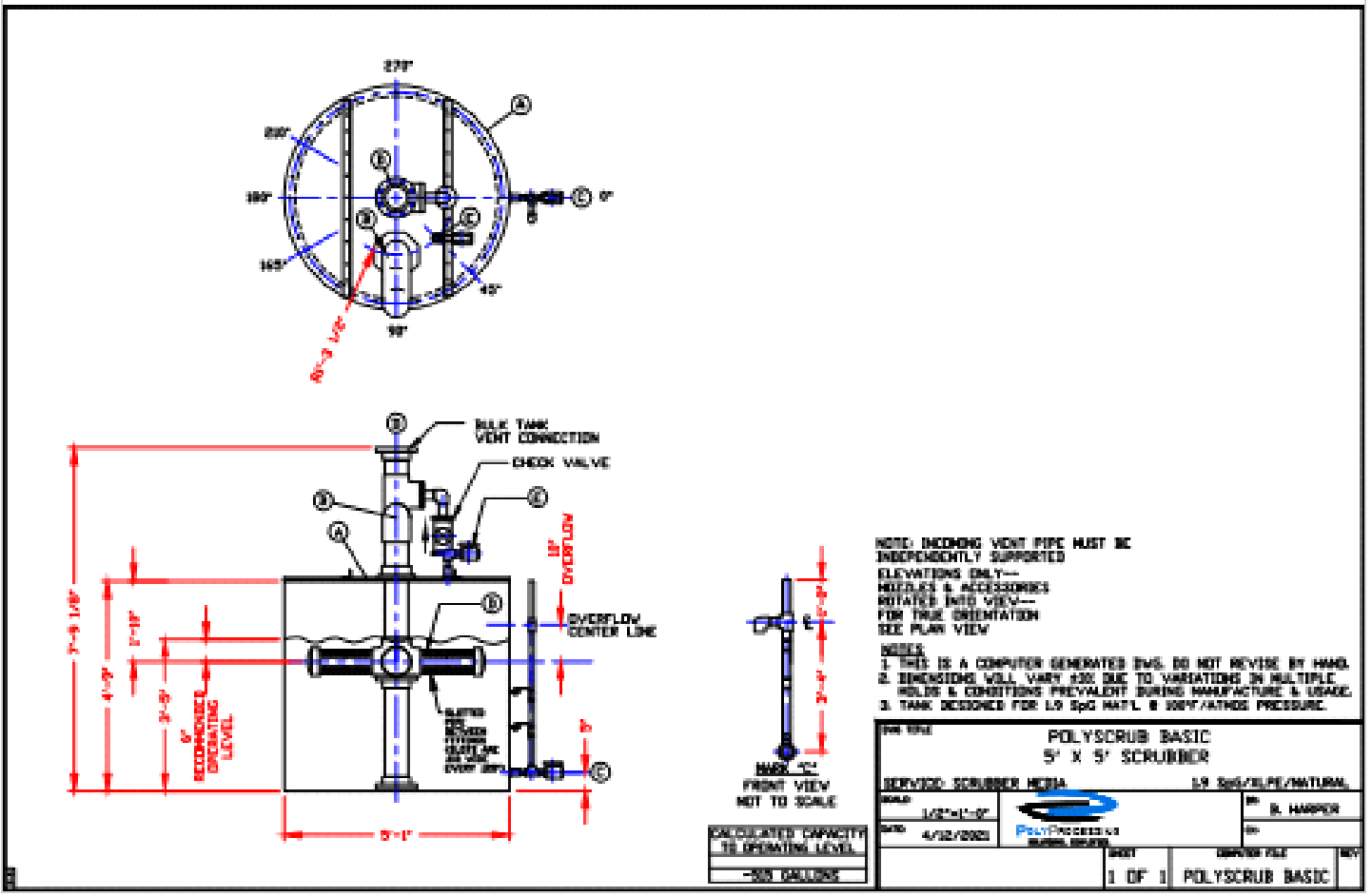
Signature: _____ PO #: _____

Date: _____ Ship To: _____

_____

_____

*IF APPLICABLE, please send a copy of your company's tax-exempt form. Otherwise, our accounting department will assume that this order is taxable.


270°
180°
165°
90°
45°
0°
BULK TANK VENT CONNECTION
CHECK VALVE
OVERFLOW
OVERFLOW CENTER LINE
RECOMMENDED OPERATING LEVEL
5'-1"
FRONT VIEW
NOT TO SCALE
NOTE: INCOMING VENT PIPE MUST BE INDEPENDENTLY SUPPORTED
ELEVATIONS ONLY— NOZZLES & ACCESSORIES ROTATED INTO VIEW— FOR TRUE ORIENTATION SEE PLAN VIEW
NOTES:
1. THIS IS A COMPUTER GENERATED DWG. DO NOT REVISE BY HAND.
2. DIMENSIONS WILL VARY ±3% DUE TO VARIATIONS IN MULTIPLE MOLDS & CONDITIONS PREVALENT DURING MANUFACTURE & USAGE.
3. TANK DESIGNED FOR 1.9 SpG MAT'L @ 200°F/ATMOS PRESSURE.
CALCULATED CAPACITY TO OPERATING LEVEL
~925 GALLONS
POLYSCRUB BASIC
5' X 5' SCRUBBER
SERVICE: SCRUBBER MEDIA
1.9 SpG/ELPE/NATURAL
1/2"=1'-0"
4/12/2021
B. HARPER
1 OF 1
POLYSCRUB BASIC

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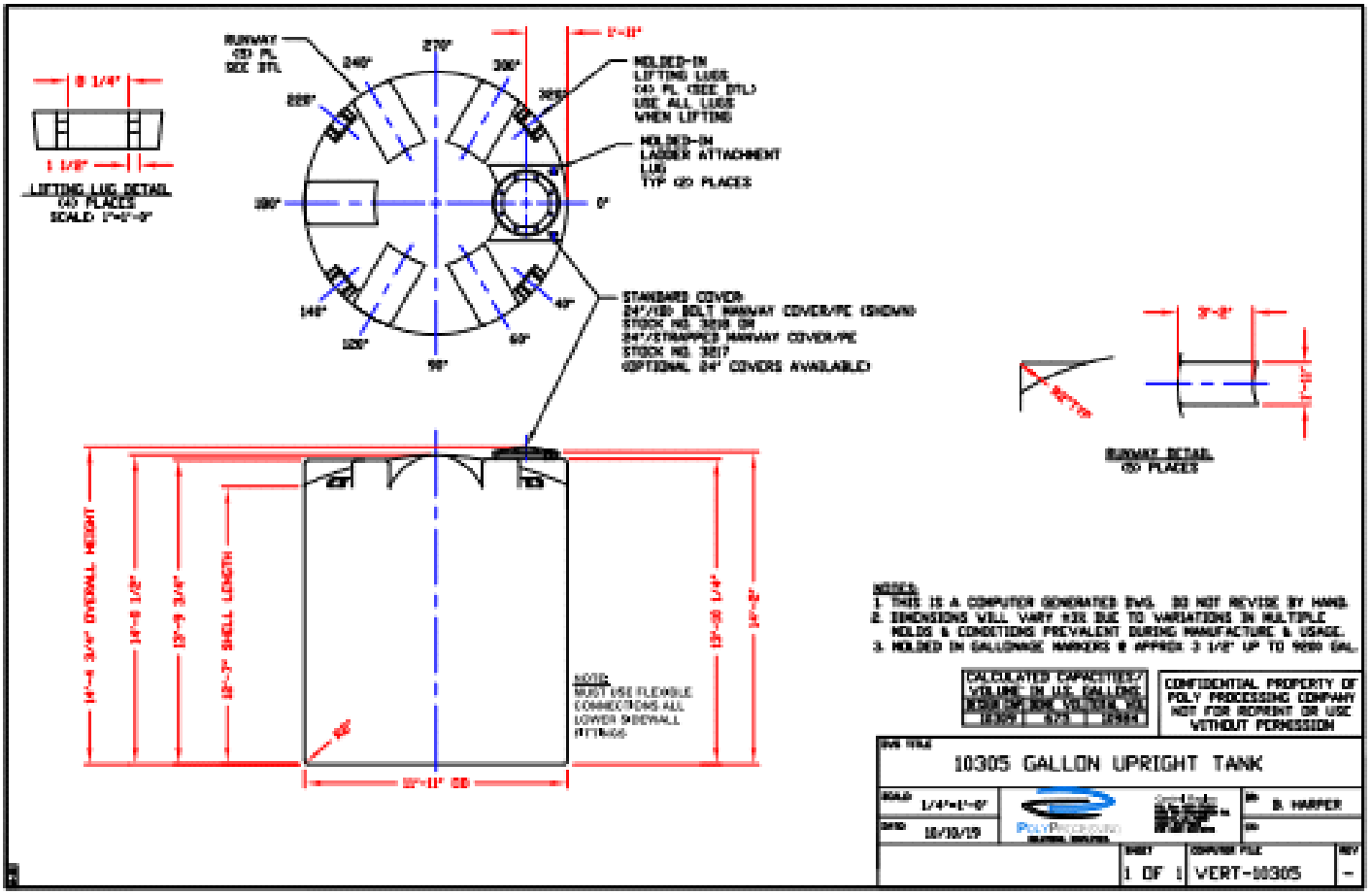
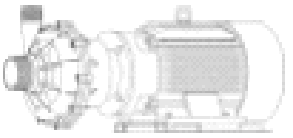


MARCH PUMPS

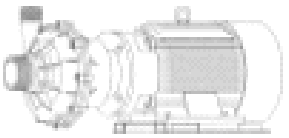
TE-10K-MD, TE-10P-MD

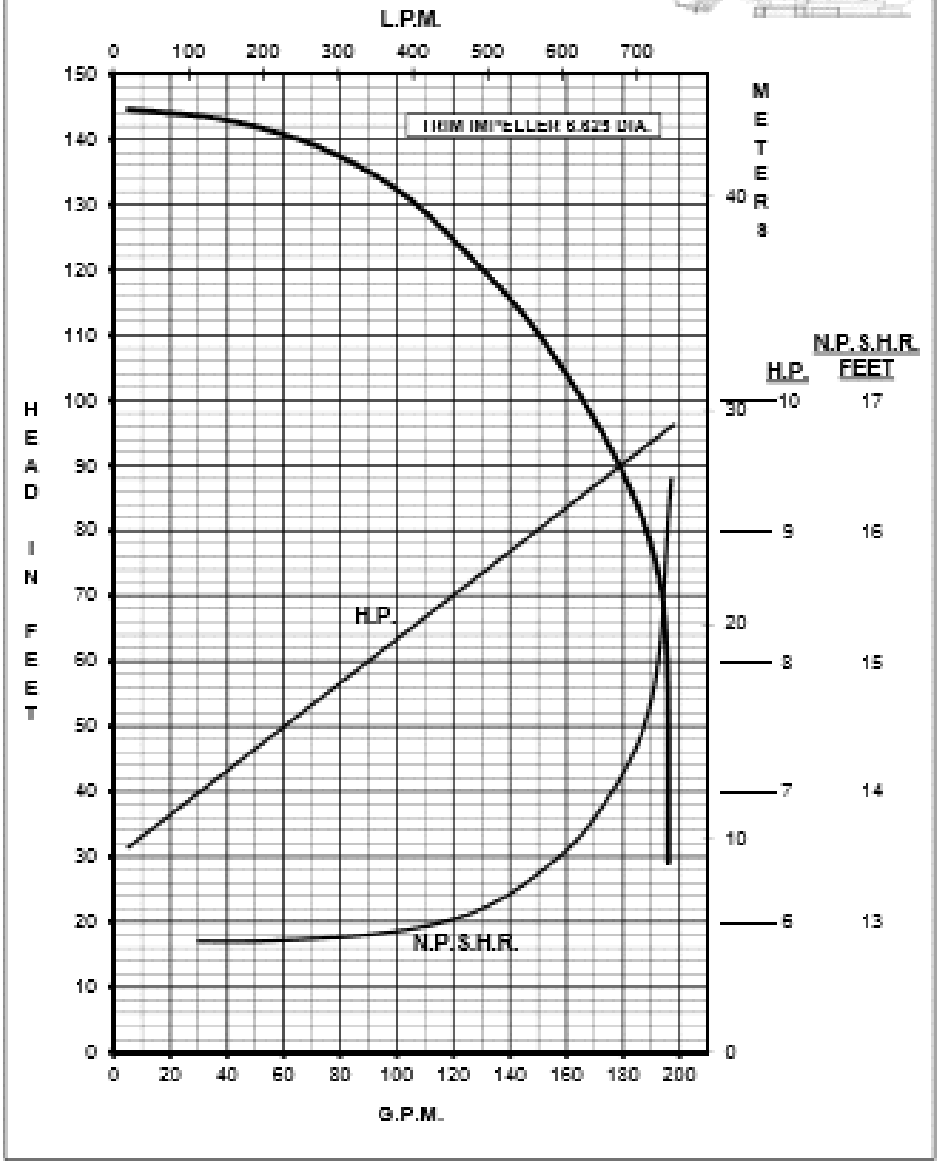
3PH 60HZ TRIM CURVES



MARCH PUMPS

TE-10K-MD, TE-10P-MD
TRIM IMPELLER 6.625 DIA.
3PH 60HZ





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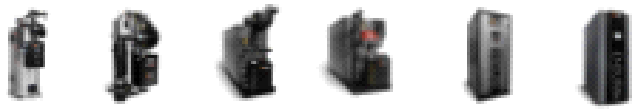
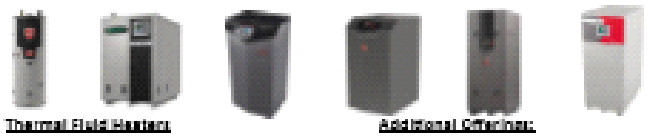


Steam Boilers
- Efficiencies up to 88%
- Low Pressure & High Pressure Applications
- Firetube Design
- Natural Gas, Propane, #2 Fuel Oil, True Dual Fuel (NG & #2 Oil)
- Size Range: 4 to 2500 HP

Hydronic Boilers
- Efficiencies up to 99.1%
- Condensing, Neo-Condensing, & Non-Condensing Boilers
- Firetube & Watertube Designs
- Natural Gas, Propane, #2 Fuel Oil, True Dual Fuel (NG & #2 Oil)
- Size Range from 55,000 to 12,000,000 BTU(s)

Additional Offerings:
- Thermal Fluid Heaters
- Ancillary Equipment
- Custom Engineered Systems

Lochinvar



Hydronic Boilers
- Models from 55,000 to 8.0 Million Btu/Hr
- Up to 96.2% Thermal Efficiency
- Up to 25:1 Turndown Ratio
- Featuring CONX-US® Remote Connectivity and SMART TOUCH™ Operating Control

Thermal Fluid Heaters
- Models from 125,000 to 4,000,000 Btu/Hr
- Up to 89% Thermal Efficiency
- Up to 10:1 Turndown Ratio
- Direct Vent Flexibility up to 150 Ft.
- SMART TOUCH™ Operating Control and CONX-US® Remote Connect

Additional Offerings:
- High Efficiency Condensing Type
- Non- Condensing Boilers
- Pool Heaters
- Buffer Tanks, Storage Tanks
- Ancillary Equipment
- Custom Engineered Systems

ARMSTRONG

Pumps: (Commercial)
- Base Mounted
- Circulating
- Vertical Split Case
- Dual Arm
- Vertical In-Line Centrifugal

Fire Pumps: (Commercial)
- Electric & Diesel Driven Systems
- Horizontal Split Case
- Vertical In-Line
- Vertical Turbine
- Skid & House System Packages
- Design Envelope Fire Pump Unit

Performance Range:
- Up to 18,000 US GPM flow
- Up to 500 Ft. head

Temperature:
- 200 Degrees Fahrenheit

Power Range/Sizes:
- 1/12 HP to 1250 HP
- 3/4" to 20"
- Fire Pump Systems of 50 GPM up to 3,000 GPM

Additional Offerings:
- Hydronic Specialties
- Heat Exchangers
- Expansion Tanks
- Glycol Feeders

Parts and Service:

When you need Start-up, Repair, or Aftermarket Parts, it's essential to rely on factory trained service professionals who not only understand the capabilities of your equipment but the complex nature of your business. V-Systems provides comprehensive and professional service & laser alignment for pumps, boilers, equipment, and systems.

Contact:

www.v-syst.com

sales@v-syst.com

412-826-9100

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Products: Boiler Feed Units, Condensate Pump Systems, DA Systems, Vacuum Systems, and Flash Tanks

Performance: 1/2 HP to 50 HP

CRANE PUMPS & SYSTEMS

Products: Submersible Non-Clog Pumps, Effluent Pumps, Grinder Pumps, Motor and Electric-Driven Self Priming Pumps, Fountain Pumps, Portable Trash Pumps, and Pump Parts

Performance: 1/4 HP to 200 HP

SPIROTHERM

Products: Air & Dirt Separators, Air Vents, Dirt/Sediment Removal Devices, and Hydraulic Separators

Size: 1/2" to 36"

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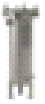

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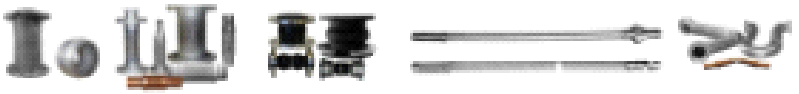

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About Us	Facilities & Equipment	Bottom Line
Warren Design & Build is a multi-disciplined machine shop and engineering design services company. We specialize in emergency repairs of part and machines, as well as building custom machines. Our team is comprised of 10 machinists, 4 welders, 4 mechanical and electrical design engineers with in-house PLC and computer systems programming capability.	Located in Warren Ohio, WDB's 38,000 square foot corporate facility houses a variety of engineering, machining, assembly, and fabricating capabilities. Our large assembly area can handle everything from a single station to a full assembly line with all utilities available utilizing ceiling drops from electrical bus bar and pneumatic lines covering most of the floor space. Located in the Northeast Ohio Manufacturing Corridor we also have the availability to outsource many special processes that can be brought onboard on short notice to assist in peak design periods or on special projects.	With WDB's unique position of having all Design, Machining, Paint, Mechanical and Electrical Assembly under one roof, our engineering team has the ability to assist in all aspects of the program build cycle to ensure design integrity; and when necessary, capture all changes and updates as required by manufacturing, and/or requested by the customer, in a very economical time frame. With some of Northeast Ohio's most talented, experienced, and highly trained engineering and manufacturing staff we can help guide you with suggestions and input that will help maximize your project's efficiency, while often lowering costs.

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AJ Degon, a subsidiary of Custom Machine and Design is a multi-disciplined machine shop and engineering design services company. We specialize in emergency machining services and repairs of parts and machines, as well as building custom machines. Our team is comprised of 4 machinists, 1 welder and 1 mechanical design engineer. Additionally, we partner with our sister company, Warren Design & Build for many other services.	Located in McKees Rocks PA, AJ Degon's 8,000 square foot facility houses a variety of engineering, machining, assembly, and fabricating capabilities. Located near downtown Pittsburgh, we also have the availability to outsource many special processes that can be brought onboard on short notice to assist in peak design periods or on special projects.	With AJ Degon's unique position of having all Design, Machining, Paint, Mechanical and Electrical Assembly under one roof, our engineering team has the ability to assist in all aspects of the program build cycle to ensure design integrity; and when necessary, capture all changes and updates as required by manufacturing, and/or requested by the customer, in a very economical time frame. With some of Pittsburgh's most talented, experienced, and highly trained engineering and machining staff we can help guide you with suggestions and input that will help maximize your project's efficiency, while often lowering costs.

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NHSM Response to RIR 3/7/2024

Wednesday, March 27, 2024 2:03 PM

Andrews, Edward S <edward.s.andrews@wv.gov>

RE: Regulatory Interpretation Request - EGG

2 messages

Morrison, Jacqueline <Morrison.Jacqueline@epa.gov> Thu, Mar 7, 2024 at 3:32 PM
To: "edward.s.andrews@wv.gov" <edward.s.andrews@wv.gov>
Cc: "Supplee, Gwendolyn" <Supplee.Gwendolyn@epa.gov>

Hi Ed,

Thanks for sending. We will get back to you, but I'd assume that the response from the waste perspective will be similar to when we last considered this facility last year.

Thank you.

Jacquie

Jacqueline Morrison

RCRA Programs Section, Hazardous Waste

Land, Chemicals, & Redevelopment Division

Mail Code 3LD31

US EPA Mid-Atlantic Region

Address: Four Penn Center,

1600 John F. Kennedy Boulevard,

Philadelphia, PA 19103-2852

Phone: 215-814-5664

Email: **morrison.jacqueline@epa.gov**

From: Andrews, Edward S <edward.s.andrews@wv.gov>
Sent: Wednesday, March 06, 2024 3:35 PM
To: Willson, Matthew (he/him/his) <Willson.Matthew@epa.gov>; Morrison, Jacqueline <Morrison.Jacqueline@epa.gov>
Subject: Fwd: Regulatory Interpretation Request - EGG

Caution: This email originated from outside EPA, please exercise additional caution when deciding whether to open attachments or click on provided links.

FYI on a Regulatory Interpretation Request

Thanks,

Ed

---------- Forwarded message ---------
From: **Andrews, Edward S** <edward.s.andrews@wv.gov>
Date: Wed, Mar 6, 2024 at 2:54 PM
Subject: Regulatory Interpretation Request - EGG
To: Cristina Fernandez <fernandez.cristina@epa.gov>, Supplee, Gwendolyn <supplee.gwendolyn@epa.gov>, Marycate Opila <opila.marycate@epa.gov>
Cc: Beverly D Mckeone <beverly.d.mckeone@wv.gov>, Crowder, Laura M <laura.m.crowder@wv.gov>

Please see the attached file (Reg_Inter_Req_for_EGG) from the WVDEP/DAQ Regulatory Interpretation Request regarding Empire Green Generation's proposed pyrolysis units processing plastic feedstock.

Should you or your staff have any questions about this request, please let me know.

Thanks,

Ed

--

Edward Andrews, P.E.

Engineer

WVDEP/Division of Air Quality

304-926-0499 Ext 41244

601 57th Street, SE

Charleston, WV 25304

--

Edward Andrews, P.E.

Engineer

WVDEP/Division of Air Quality

304-926-0499 Ext 41244

601 57th Street, SE

Charleston, WV 25304

Andrews, Edward S <edward.s.andrews@wv.gov> Fri, Mar 8, 2024 at 7:38 AM
Draft To: "Morrison, Jacqueline" <Morrison.Jacqueline@epa.gov>
Cc: "Supplee, Gwendolyn" <supplee.gwendolyn@epa.gov>, Krystal <Stankunas.Krystal@epa.gov>

Please keep in mind that the facility has elected to change from processing medical waste to plastic feedstock. I have been trying to get them to perform a waste/non-waste determination of this plastic feedstock in accordance with Part 241.

EGG keeps pushing back with a State House bill that defined "advance recycling" and 'high temperature under WV
[Quoted text hidden]

Follow-up on Timing for the RIR 3/7/2024

Wednesday, March 27, 2024 2:02 PM

Andrews, Edward S <edward.s.andrews@wv.gov>

Re: Regulatory Interpretation Request - EGG

1 message

Andrews, Edward S <edward.s.andrews@wv.gov> Thu, Mar 7, 2024 at 2:32 PM
To: "Supplee, Gwendolyn" <Supplee.Gwendolyn@epa.gov>
Cc: Beverly D Mckeone <beverly.d.mckeone@wv.gov>, "Stankunas, Krystal" <Stankunas.Krystal@epa.gov>

Gwen,

We understand that this is fairly complicated and that we expected multiple different offices to be called on to provide input to our request.

Please keep in mind that EGG has a permit to process medical waste using the same equipment. The other real changes to the process is adding the HCl tanks and loadout station.
So, EGG will be applying pressure at some point to get their application moving forward in the near future.

We expect to send EGG an additional information request based on your office's response.

At some point, we will have to move this application forward to some sort of decision with or without a response.

Please provide us some sort of response by no later than March 29.

Thanks,
Ed

On Thu, Mar 7, 2024 at 1:11 PM Supplee, Gwendolyn <Supplee.Gwendolyn@epa.gov> wrote:

> Hi Ed,
>
> We need to coordinate with our RCRA program as well as potentially Headquarters (either for RCRA or CAA requirements) and that coordination can take some time. Since the application hasn't been deemed complete yet, would it be OK if we try to get a response to West Virginia by the end of March? We'll try to get a response sooner if we can.
>
> Many thanks.
>
> -gwen
>
> **Gwendolyn K. Supplee (She, her, hers)**
> **Senior Permit Specialist/Life Scientist**
> **U.S. Environmental Protection Agency, Region 3**
> **Permits Branch (3AD10)**

Air & Radiation Division

Phone 215-814-2763

Email supplee.gwendolyn@epa.gov

From: Andrews, Edward S <edward.s.andrews@wv.gov>
Sent: Thursday, March 07, 2024 10:54 AM
To: Supplee, Gwendolyn <Supplee.Gwendolyn@epa.gov>
Cc: Beverly D Mckeone <beverly.d.mckeone@wv.gov>; Stankunas, Krystal <Stankunas.Krystal@epa.gov>
Subject: Re: Regulatory Interpretation Request - EGG

Gwendolyn,

WVDEP/DAQ received the initial application on December 1, 2023, and a revised application was received January 23, 2024. Currently, this application has not been deemed complete at this time.

Therefore, the regulatory clock has not started yet.

We would like some sort of response from your office within 2 weeks. A response to our request will dictate our future request for additional information from this applicant (EGG).

Should you have any questions about this, please do not hesitate to contact me.

Thanks

Ed

On Thu, Mar 7, 2024 at 10:30 AM Supplee, Gwendolyn <Supplee.Gwendolyn@epa.gov> wrote:

> Ed-
>
> Can you tell us when the application was received and what date the permitting decision must be made by? In looking at WV's R13 rule, it looks like a permit must be issued within 90 days of the completeness determination? Is my interpretation correct? We're trying to determine when WV needs a response by.

Many thanks,

-gwen

Gwendolyn K. Supplee (She, her, hers)

Senior Permit Specialist/Life Scientist

U.S. Environmental Protection Agency, Region 3

Permits Branch (3AD10)

Air & Radiation Division

Phone 215-814-2763

Email supplee.gwendolyn@epa.gov

From: Andrews, Edward S <edward.s.andrews@wv.gov>
Sent: Wednesday, March 06, 2024 2:55 PM
To: Fernandez, Cristina <Fernandez.Cristina@epa.gov>; Supplee, Gwendolyn <Supplee.Gwendolyn@epa.gov>; Opila, MaryCate <Opila.MaryCate@epa.gov>
Cc: Beverly D Mckeone <beverly.d.mckeone@wv.gov>; Crowder, Laura M <laura.m.crowder@wv.gov>
Subject: Regulatory Interpretation Request - EGG

Please see the attached file (Reg_Inter_Req_for_EGG) from the WVDEP/DAQ Regulatory Interpretation Request regarding Empire Green Generation's proposed pyrolysis units processing plastic feedstock.

Should you or your staff have any questions about this request, please let me know.

Thanks,

Ed

--

Edward Andrews, P.E.

Engineer

WVDEP/Division of Air Quality

304-926-0499 Ext 41244

601 57th Street, SE

Charleston, WV 25304

--
Edward Andrews, P.E.
Engineer
WVDEP/Division of Air Quality
304-926-0499 Ext 41244
601 57th Street, SE
Charleston, WV 25304

Regulatory Interpretation Request 3/6/2024

Wednesday, March 27, 2024 2:00 PM

Andrews, Edward S <edward.s.andrews@wv.gov>

Regulatory Interpretation Request - EGG

1 message

Andrews, Edward S <edward.s.andrews@wv.gov> Wed, Mar 6, 2024 at 2:54 PM
To: Cristina Fernandez <fernandez.cristina@epa.gov>, "Supplee, Gwendolyn" <supplee.gwendolyn@epa.gov>, Marycate Opila <opila.marycate@epa.gov>
Cc: Beverly D Mckeone <beverly.d.mckeone@wv.gov>, "Crowder, Laura M" <laura.m.crowder@wv.gov>
Bcc: Brian S Tephabock <Brian.S.Tephabock@wv.gov>, Eric Blend <eric.n.blend@wv.gov>

Please see the attached file (Reg_Inter_Req_for_EGG) from the WVDEP/DAQ Regulatory Interpretation Request regarding Empire Green Generation's proposed pyrolysis units processing plastic feedstock.

Should you or your staff have any questions about this request, please let me know.

Thanks,
Ed

--
Edward Andrews, P.E.
Engineer
WVDEP/Division of Air Quality
304-926-0499 Ext 41244
601 57th Street, SE
Charleston, WV 25304

2 attachments

R13-3555 Modification_Application_EGG - Redacted_Final Rev.pdf
22432K

Reg_Interp_Request_for_EGG.pdf
400K

Reg_Interp
_Request...

west virginia department of environmental protection

Division of Air Quality
601 57th Street, SE
Charleston, WV 25304
(304) 926-0475

Harold D. Ward, Cabinet Secretary
dep.wv.gov

March 6, 2023

Ms. Christina Fernandez
Director
U.S. EPA - Region 3
Air and Radiation Division
Four Penn Center
1600 John F. Kennedy Boulevard
Philadelphia, PA 19103-2852

Re: Regulatory Interpretation Request
Empire Green Generation LLC
Facility ID: 009-00141
Permit No.: R13-3555A
Follansebee, WV

Dear Director:

The West Virginia Department of Environmental Protection - Division of Air Quality (DAQ) respectfully requests an regulatory interpretation from the Administrator regarding Empire Green Generation's (EGG) proposed modification of their Follansbee, West Virginia Facility to any regulation developed under Section 129 of the Clean Air Act.

Specifically, the DAQ is requesting an regulatory interpretation as to whether all streams, or only the liquid and solid streams, exiting the pyrolysis process need to be evaluated under 40 CFR 241 to determine applicability under 40 CFR 60, Subpart CCCC, if the plastic feedstock to the pyrolysis process has been determined to be a fuel or raw material under 40 CFR 241.

The DAQ does not believe that EGG pyrolysis trains or downstream emission units (e.g., engines, dryer, and vitrifier) would be affected sources under Subpart AAAA and EEEE because the plastic feedstock does not meet the definition of municipal solid waste and the Follansbee Facility is not an institutional facility.

Background Information

In 2022, Empire Green Generation LLC (EGG) proposed to the DAQ to construct and operate two pyrolysis trains with gas cleaning sections to process and convert up to 70 tons per day of medical waste into tar (liquids), char (solids) and synthetic gas.

The DAQ issued Permit R13-3555 to EGG on March 2, 2023. During the DAQ review of the Application, the DAQ determined that EGG's proposed pyrolysis trains meet the criteria of a "pyrolysis unit" as defined in 40 CFR 60.51c and therefore the proposed pyrolysis trains are excluded emission units from Subpart Ec.

Proposed Modification

On December 1, 2023, EGG filed a modification application with the DAQ. EGG proposed to replace the medical waste feedstock with plastic feedstock. In a revised application (January 23, 2024, Submission), EGG noted that the feedstock will be sourced from recyclers, manufacturing, and plastic producers. This pre-processed plastic feedstock will be shipped to EGG's Follansbee, WV facility as feedstock for the pyrolysis trains.

EGG noted that this modification only requires the addition of a hydrochloric acid truck loading facility with associated scrubber system. This feedstock change will allow the pyrolysis trains to generate hydrochloric acid in addition to other products (tars, char, and synthetic gas).

The processing capacity of these pyrolysis trains will remain the same at 35 tons of plastic feedstock per day per pyrolysis train (70 Tons per day total).

Regulatory Considerations

EGG commenced construction of the pyrolysis trains in 2023, which is after the applicability date of Subparts AAAA (August 30, 1999); CCCC (June 4, 2010); and EEEE (December 9, 2004). Therefore, EGG's pyrolysis trains meet the definition of new affected units.

Given the design capacity of the two pyrolysis trains, these units do not meet the capacity criteria of a large municipal waste combustion unit as defined under Subpart Eb and therefore, the units are not subject to Subpart Ec.

The DAQ determined that the four spark ignition engines are affected sources with regard to Subpart JJJJ during the review of Permit R13-3555. However, the DAQ was unable to determine the applicable emission standard to which the permit engines were subject. Condition 5.1.1. of Permit R13-3555 required EGG to seek a determination from the EPA to determine which emission standard would be applicable for these four engines.

The vitrifiers (process heaters) for the pyrolysis trains may be affected sources under Subpart Dc of Part 60 and Subpart JJJJJJ of Part 63. Applicability status for these process heaters would be affected by the outcome of this determination. These units are designed to fire gaseous fuel (synthetic gas), liquid fuel (tars), propane for startup operations only, or a combination of synthetic gas and tars with a maximum heat input of 100 MMBtu/hr.

Past Determinations and Other Permitting Actions

Prior to submitting this determination, the DAQ searched the Applicability Determination Index (ADI) for similar determinations, and identified the following:

Table 1 - Similar Applicability Determinations

EPA Office	Control Number	Date	Reference
Region 5	9700062	10/11/1996	60.14, 60.15, 60.5, 60.51b,
Region 6	NR06	02/07/1985	52.21(b), 60.50, 60.51(b)
Region 7	9600096	12/02/1996	60.50b
Region 10	E010	04/12/1977	60.50, 60.51
OSSE	E009	01/19/1977	60.50
Region 1	M140002	12/04/2012	40 CFR 60, Subpart EEEE
Region 9	1000019	03/30/2010	40 CFR 60, Subpart AAAA
Region 10	1500025	08/31/2010	40 CFR 60, Subpart AAAA
Region 4	1700010	03/02/2017	40 CFR 60, Subpart CCCC
Region 5	1800003	01/22/2018	40 CFR 60, Subpart CCCC

The DAQ is aware of several determinations by other State Agencies, listed below:

Table 2 - List of Similar State Actions

State Agency	Company/Permittee Name	Permit No.	Date	Outcome
Indiana Department of Environmental Management	Fulcrum Centerpoint LLC	089-44042-00660	08/16/2022	Meet exemption under 60.1020(h)
North Carolina Environmental Quality	Braven Environmental LLC	10672R00	9/25/2020	No Reference
Indiana Department of Environmental Management	Brightmark Plastics Renewal Indiana 2 LLC	151-45294-00067	06/29/2022	Meet exemption under 60.1020(h)
Ohio Environmental Protection Agency	SOBE Thermal Energy Systems, LLC	P0132799	02/14/2024	Scrap Tires are classified as non-waste per 40CFR241. Not Applicable to any incinerator rules

The DAQ is aware of EPA's decision to not remove the phrase "pyrolysis/combustion unit" for the definition of *municipal waste combustion unit* in Subparts AAAA and EEEE of Part 60.[1]

The DAQ is working under the assumption that EGG's plastic feedstock is non-hazardous per 40 CFR 262.

First Question: ***Should EGG's plastic feedstock be viewed as waste or non-waste?***

The DAQ believes that the proper way to answer this question is for EGG/EGG's plastic feedstock provider to make a waste/non-waste determination of this plastic feedstock in accordance with 40 CFR 241. Based on EGG's application and additional responses regarding this question, EGG may have determined or believe that the plastic feedstock is a non-waste. EGG has not provided any information that DAQ would view as an official determination in accordance with 40 CFR 241.

[1] Standards of Performance for New Stationary Sources and Emission Guidelines for Existing Sources: Other Solid Waste Incineration Units Review; Withdrawal of Proposed Provision Removing Pyrolysis/Combustion Units, 88 Fed. Reg. 36524 (June 5, 2023).

DAQ looked at the definitions that pertain to waste under potentially applicable subparts, which are as follows:

"Solid waste" is defined under Subpart EEEE as

"*means any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, agricultural operations, and from community activities, but does not include solid or dissolved material in domestic sewage, or solid or dissolved materials in irrigation return flows or industrial discharges that are point sources subject to permits under section 402 of the Federal Water Pollution Control Act, as amended (33 U.S.C. 1342), or source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954, as amended (42 U.S.C. 2014).*"[3]

Subpart CCCC refers to "solid waste" as defined in 40 CFR 241.2, which refers to 40 CFR 258.2. 40 CFR 258.2 defines to "*means any garbage, or refuse, sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities, but does not include solid or dissolved materials in domestic sewage, or solid or dissolved materials in irrigation return flows or industrial discharges that are point sources subject to permit under 33 U.S.C. 1342, or source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954, as amended (68 Stat. 923).*"

Subparts AAAA do not define "*solid waste*" or reference waste as determined under 40 CFR 241. This subpart defines "*municipal solid waste or municipal-type solid waste*"

"*means household, commercial/retail, or institutional waste. Household waste includes material discarded by residential dwellings, hotels, motels, and other similar permanent or temporary housing. Commercial/retail waste includes material discarded by stores, offices, restaurants, warehouses, nonmanufacturing activities at industrial facilities, and other similar establishments or facilities. Institutional waste includes materials discarded by schools, by hospitals (nonmedical), by nonmanufacturing activities at prisons and government facilities, and other similar establishments or facilities. Household, commercial/retail, and institutional waste does include yard waste and refuse-derived fuel. Household, commercial/retail, and institutional waste does not include used oil; sewage sludge; wood pallets; construction, renovation, and demolition wastes (which include railroad ties and telephone poles); clean wood; industrial process or manufacturing wastes; medical waste; or motor vehicles (including motor vehicle parts or vehicle fluff).*"

Both of these definitions, "solid waste" and "municipal solid waste", contain the phrase "*other discarded materials*". Therefore, a waste determination must be conducted on the plastic feedstock to be introduced into the pyrolysis trains in accordance with 40 CFR 241.3.

The concern the DAQ has with the plastic feedstock is that EGG did not generate the plastic feedstock and thus, the original end user and/or generator had discarded this plastic material at some point.

Second Question: If the plastic feedstock is determined to be fuel or ingredients in accordance with 40 CFR 241.3, then would the EGG pyrolysis trains be exempt from Section 129 of the CAA (e.g. subject to Subpart AAAA, CCCC, or Subpart EEEE)?

Initially, the DAQ does not believe the pyrolysis trains, (e.g., engines and process heaters) would be subject to Section 129 and therefore Subparts AAAA, CCCC and EEEE would not be applicable to EGG's emission units.

Given the plastic material was discarded by the original end user or generator, the initial waste determination only pertains to the cracking/decomposition of plastic feedstock from the pyrolysis trains and all streams exiting the pyrolysis train should be re-evaluated in accordance with 40 CFR 241.3.

This is the real question: Would EGG need to conduct a waste determination for each of the exiting streams from the pyrolysis trains (e.g., "tars", "oil", "ash and char", and "synthetic gas") in accordance with 40 CFR 241.3?

The definition of "*solid waste*" at 40 CFR 258.a states,

"*Solid waste means any garbage, or refuse, sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities, but does not include solid or dissolved materials in domestic sewage, or solid or dissolved materials in irrigation return flows or industrial discharges that are point sources subject to permit under 33 U.S.C. 1342, or source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954, as amended (68 Stat. 923).*"

Thus, the DAQ does not believe that EGG's cleaned synthetic gas would need to be evaluated because the gas is not stored in a container. EGG's process consumes the synthetic gas as fuel to provide process heat for their process and generates electricity for the facility.

Third Question: EGG plans to route the ash and char stream to the vitrifier (process heater) to be oxidized into products of combustion. Would the vitrifier be subject to Subpart CCCC or EEEE?

The raw synthetic gas generated will exit the pyrolysis train through off-take with the ash and fixed carbon being collected in a deceleration chamber. The ash and fixed carbon, which is also referred to as "char", will be injected into the vitrifier. The vitrifier is best described as a retort or process heater with the purpose of providing process heat for the respective pyrolysis train. In the process description in EGG's modification application, the high temperatures in the vitrifier should be above the eutectic temperature of the ash and char to be combusted into CO_2 and H_2O.

The DAQ believes the synthetic gas stream and tar stream should be considered a fuel and the chlorine/chloride stream a raw ingredient for the production of hydrochloric acid. However, the injection of the ash and char into the vitrifiers should be viewed as incineration. The question is: because EGG generated the ash and char, would the vitrifiers be subject to Subpart CCCC as a CISWI unit.

The DAQ does not believe that the vitrifiers could be classified as an OWSI unit because the Follansbee facility is not an institutional facility generating this waste and the initial plastic feedstock does not meet the definition of "municipal solid waste." Therefore, based on the definitions under 40 CFR 60.2977 the vitrifier(s) is not an "other solid waste incineration unit".

Furthermore, the DAQ does not believe that EGG's vitrifiers qualify for any of the exclusions in Subpart CCCC (e.g. cogeneration facilities, small power production facilities).

Fourth Question, Would the vitrifiers be considered an "energy recovery unit" or a "commercial and industrial solid waste incineration unit" under Subpart CCCC?

The vitrifiers are required to provide process heat for the pyrolysis units with the exhaust used to dry the incoming plastic feedstock of excess moisture in the dryer section. EGG plans to use the generated "tars" and "cleaned synthetic gas" as fuels for the vitrifiers.

If EGG elected not to oxidize the ash and char stream in the vitrifiers (i.e, send the ash & char off-site for proper disposal), then would the vitrifiers be subject to Subpart CCCC?

To aid you and your staff in this determination, a redacted copy of EGG's modification application is attached. The DAQ's permit file for R13-3555, EGG's application on processing medical waste using pyrolysis, can be viewed in our Application Xtender at: https://documents.dep.wv.gov/AppXtender/DataSources/DEPAX16/account/loginRef=Lw==.

Instructions on using our Application Xtender are located at: https://dep.wv.gov/Data/Documents/AX-instructions.pdf.

Should you need to discuss this matter further, please do not hesitate to contact me by email at edward.s.andrews@wv.gov or phone at 304-926-0499 extension 41244..

Sincerely,

Edward S. Andrews, P.E.

Digitally signed by: Edward S. Andrews, P.E.
DN: CN = Edward S. Andrews, P.E. email = edward.s.andrews@wv.gov C = US O = WVDEP/Division of Air Quality OU = Permitting
Date: 2024.03.06 11:39:41 -05'00'

Edward S. Andrews, P.E.
Engineer

cc:
Laura Crowder, Director, WV DAQ
Beverly McKeone, NSR Program Manager, WV DAQ
MaryCate Opila, opila.marycate@epa.gov
Gwendolyn Supplee, Supplee.Gwendolyn@epa.gov

HCl Discussion 3/1/2024

Wednesday, March 27, 2024 1:38 PM

Andrews, Edward S <edward.s.andrews@wv.gov>

RE: Empire Discussion

1 message

Wood, Katie <katie.wood@tetratech.com> Fri, Mar 1, 2024 at 10:23 AM
To: "Andrews, Edward S" <edward.s.andrews@wv.gov>
Cc: Farley Wood <fwood@empirede.com>

Ed,

We have some answers to your questions below in red. Please let me know if you would like to discuss.

Thanks,

Katie

From: Andrews, Edward S <edward.s.andrews@wv.gov>
Sent: Friday, February 23, 2024 2:24 PM
To: Wood, Katie <katie.wood@tetratech.com>; Farley Wood <fwood@empirede.com>
Subject: Re: Empire Discussion

Using Chlorine gas and water reaction to produce HCl also produces a by-product of HOCl (hypochlorous acid). https://www.bing.com/search?q=chlorine+gas+water+reaction&qs=UT&pq=chlorine+gas+water+reaction&sc=10-27&cvid=1D306673308642F9BCEE5D950B9BFB08&FORM=QBRE&sp=1&ghc=1&lq=0 The process does not produce any Chlorine gas, it produces Chloride gas so no HOCL is produced. I have attached a paper provided by Technotherm for futher information

Question is: Will Empire separate hypochlorous acid from the HCl or send it out as it? As per above no HOCL will be produced

Will the emissions of HCl go through a separate release point than the RTO stack? If it is a separate stack, I need the stack id and stack parameters of this point. No all emissions will go through the RTO

Also, I will need the calculations to support your emission estimate of HCl and concentration of HCl in the effluent release to the atmosphere from the production/storage/loading out of HCl. Calculations attached, these were included in the last submittal

Ed

On Thu, Feb 22, 2024 at 1:00 PM Wood, Katie <katie.wood@tetratech.com> wrote:

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Edward Andrews, P.E.

Engineer

WVDEP/Division of Air Quality

304-926-0499 Ext 41244

601 57th Street, SE

Charleston, WV 25304

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WASTES: Solutions, Treatments and Opportunities
1st International Conference
September 12th – 14th 2011

KINETIC STUDY OF THERMAL DE-CHLORINATION OF PVC-CONTAINING WASTE

A. Castro[1,2,a], C. Carneiro[1], C. Vilarinho[2], D. Soares[2], C. Maçães[3], C. Sousa[3] and F. Castro[2]
[1] CVR - Centre for Waste Valorization, Guimarães, Portugal
[2] CT2M - Centre for Mechanical and Materials Technologies, Mechanical Engineering Department, University of Minho, Guimarães, Portugal
[3] Endutex - textile coatings, SA
[a] acastro@cvrresiduos.pt

ABSTRACT
With the increasing of plastics content in solid waste, both municipal and industrial, also increases the interest in its use as an energy source.
Some of these wastes are an important potential source of energy and might be valorized using the pyrolysis or gasification processes. However, the presence of high chlorine contents in its composition prevents its management by a thermal process, as consequence of toxic compounds production and their release to the atmosphere.
The present work asses a possible process for treating PVC-containing wastes in an environmentally friendly way. It is based on the effective de-chlorination of PVC-containing wastes through a pyrolysis process at low temperature before the carbonaceous residue from PVC-containing wastes being subject to a subsequent thermal treatment for energetic valorization.

Keywords: Pyrolysis, thermal degradation, PVC-containing waste, energy valorization;

INTRODUCTION

The presence of organic compounds on wastes, especially plastics, is considered an important source of energy. However, most of these plastics contain polyvinyl chloride (PVC), causing recycling problems when it is considered a thermal valorization process for its treatment [1], preventing the use of those residues on these processes, which main goal is the energy recovery [2,3]. A possible solution is to remove the chlorine from PVC-containing waste through a pyrolysis process before being subjected to a thermal treatment, for energetic valorization.

Pyrolysis is one of the applied techniques for energetic valorization and is defined as a process of irreversible chemical modification of compounds under the action of heat and in the absence of oxygen, causing thermal degradation [1]. The reaction involved in this process is endothermic and the characteristics of the obtained products are function of the waste composition and of several operating factors, such as the temperature, pressure and residence time in the pyrolysis reactor.

The pyrolysis process is considered by several authors [2 - 8] as a possible technique for the

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The pyrolysis process is considered by several authors [2 - 8] as a possible technique for the energy recovery from PVC-containing wastes, through the thermal degradation of the chlorine

molecule. PVC pyrolysis involves significant cross-linked reactions with the formation of polyaromatic structures (possibly chlorinated) and a carbonaceous residue (char) [9]. Thus, it is possible to break down this molecule, allowing the chlorine recovery as hydrochloric acid or chloride [10], with potential economic gains.

However, the presence of poly(vinyl chloride) in wastes composition confines their management by thermal valorization processes as consequence of environmental problems and corrosion of the equipment. In fact, high levels of chlorine in wastes composition are responsible for the formation of hydrochloric acid, chlorine gas and dioxins [11]. Therefore, a preview thermal treatment by a pyrolysis process to remove the chlorine from PVC-containing wastes will be a suitable step if done prior to an energy recovery process to produce a synthesis gas.

Considering thermogravimetric analysis, it is assumed that the degradation of PVC occurs between 200 and 400 ºC [2, 12]. At 250 ºC, the decomposition of PVC has already been initiated, reaching a maximum at approximately 300 ºC. At 350 ºC the amount of chlorine present in PVC waste is less than 0.1%, which means that at this temperature, 99.5% of the whole chlorine has already been released [2]. At the end of the process of chlorine removal, a residual amount of chlorine remains on the waste [9].

The C-Cl bonds in the structure of PVC have a relatively lower binding energy than the C-C and C-H bonds, which justifies that the bonds of chlorine are the first to be broken, thus starting the thermal degradation of PVC. The de-chlorination of PVC is a free radicals chain reaction therefore requiring low activation energy to start, occurring at low temperatures [4, 7].

De-chlorination of PVC wastes is a mandatory step for any treatment process, able to recover energy from these wastes. In fact, from the decomposition of PVC, one polymeric fraction can be obtained with high energetic value:

$$C_2H_3Cl \rightarrow HCl + C_2H_2 \quad (I)$$

As a matter of fact, products from the decomposition will be of the type C_nH_n.

This work aims the contemplation of new valorization processes and use of PVC-containing wastes. For the PVC molecule de-chlorination, tests were performed at low temperature pyrolysis and subsequent gasification of the remaining fraction in order to produce a synthesis gas with high energetic potential.

EXPERIMENTAL WORK

In this work, the kinetics of thermal de-chlorination has been studied, by simultaneous DTA/TGA determinations, under inert atmosphere. With all the experimental data obtained a multivariate

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$$\ln r = 31{,}3 - \frac{16130}{T} + 1{,}020 \ln[HCl] \qquad \text{with } r^2 = 0{,}9912$$

This allows considering that reaction as a first order one with activation energy of 133800 J/mol ± 780 J/mol.

For the kinetic study, a DTA/TGA (SDT 2960 from TA Instruments) testing at different temperatures has been carried out in order to determine the relationship between the rate of PVC de-chlorination and the temperature of the thermal treatment, under an inert atmosphere. It was used a commercial pure PVC powder with the chemical formula C_2H_3Cl, in which 56,7% is chlorine. The reference is VICAR S 950 and it is a vinyl chloride homopolymer produced by a suspension polymerization process.

Experiments have conducted up to 5 different maximum temperatures: 250, 275, 300, 325 and 400 °C, with a heating rate of 10 °C per minute until the desired temperature is reached. After reaching this temperature, a stage has been done during 360 minutes. Heat flux (weight corrected heat flow in W/g) and weight of sample, has been continuously recorded.

DTA/TGA testing performed indicates that the temperature of 340 °C enables the removal of 88 % of the chlorine present in the PVC material. The resulting de-chlorinated fraction, carbonaceous residue, has also been characterized and it is mainly constituted by carbon. This carbonaceous residue was testing up to 500°C in DTA/DTA and was verified that the combustion reaction of the carbonaceous material is complete at 493°C demonstrating potential as a fuel source to a following gasification in order to produce a synthesis gas with high energetic potential.

To characterize the sample of PVC used and the carbonaceous residue formed, it has been used an TruSpec Elemental Determinator, model TruSpec CHN, of Leco with a burn time of 452 seconds and an Philips Analytical sequential X-ray fluorescence (XRF) Spectrometer model X'Unique II.

Table 1. Comparison between the chemical composition (in wt%) of PVC sample used and the carbonaceous residue obtained from pyrolysis at 340 °C.

	PVC (initial sample)	PVC (Carbonaceous residue)
Carbon	38,4	89

Carbon	38,4	89
Hydrogen	4,9	7
Chlorine	56,7	0,07

Through table 1, we are able to conclude that the de-chlorinated fraction obtained at 340ºC is mainly constituted by carbon presenting residual chlorine content, 0,07 %.

Tests were performed in the laboratory and pilot scale, where the variables temperature, pressure and residence time inside the reactor were studied, as well as its influence on the reaction products obtained.

The pilot plant consists in a reactor where the pyrolysis occurs, with a stainless steel body heated by electrical resistance and a column of water where the gas is bubbled, as exemplified in figure 1. Measuring instruments such as thermocouples and pressure gauges are used to control the conditions (temperature and pressure) inside the reactor.

The fixation of the released chlorine is obtained by water absorption, forming HCl (hydrochloric acid), CaCl2 (calcium chloride) and also NaCl (sodium chloride), when the aqueous solution, containing CaO (calcium oxide) or NaOH (sodium hydroxide), respectively.

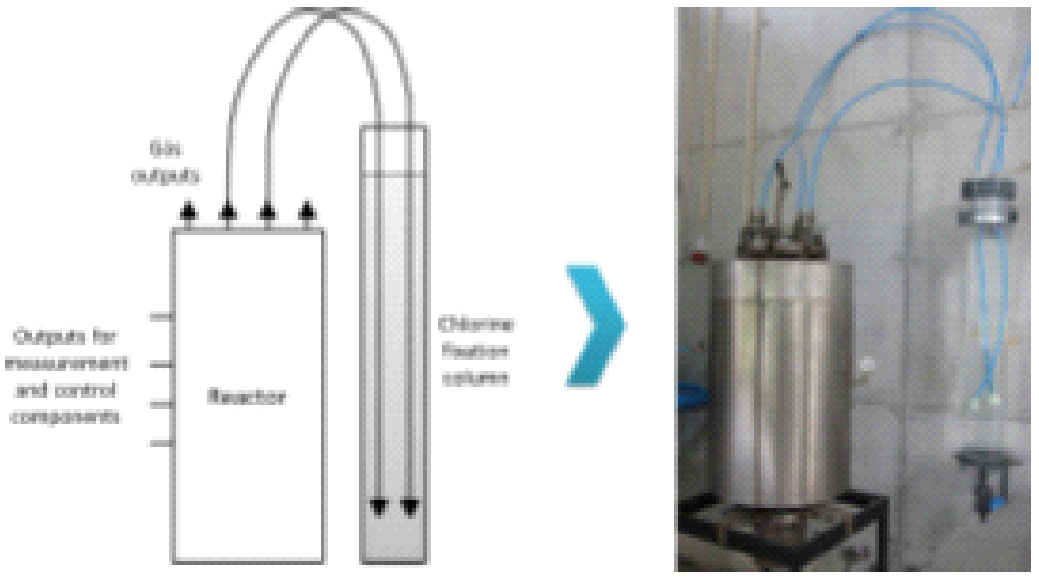

Figure 1: Scheme of pilot scale used for the tests.

Initially, a slight vacuum is created to remove the oxygen inside the reactor, then the test is initiated and divided into two stages. The first stage is a low-temperature pyrolysis or carbonization, where the de-chlorination of the PVC-containing waste reaction occurs, the released chlorine is recovered

initially, a slight vacuum is created to remove the oxygen inside the reactor, then the test is initiated and divided into two stages. The first stage is a low-temperature pyrolysis or carbonization, where the de-chlorination of the PVC-containing waste reaction occurs, the released chlorine is recovered in the column in the form of hydrochloric acid, sodium chloride or calcium chloride. After the first stage is completed, second stage, takes place, then the carbonaceous residue (without chlorine) resulting from the first stage, is energetically valorized, at temperatures above 550 ° C.

The residence time in the reactor was tested by the pressure differences, viewed through the pressure gauge in the reactor. Thus, the reaction starts in vacuum and is assumed as completed when the pressure reaches zero, i.e. atmospheric pressure. During the reaction, when the pressure is 0,5 bar above atmospheric pressure, it is enough for the syngas formed inside the reactor can bubble in column. After all the gas is released, then the pressure drops to zero on the gauge, i.e., atmospheric pressure, thus giving the information that the reaction is complete.

All materials used in building a pilot plant must be well chosen, because of corrosion of materials and isolation. The absence of leakage or entry of gases must also be controlled, since the produced gases are toxic and cannot leak to the atmosphere, and also because as pyrolysis is a process that must take place in anoxic environment, thus it should be affected by any entry of oxidizing agents.

The main reaction product is a synthesis gas for burning to produce heat.

CONCLUSIONS

In this work, the kinetics of the reaction of thermal decomposition of PVC were studied, leading to the development of a kinetic model, with the expression ln r = 31,3 - 16100/T + 1,020 ln C (HCl). This model was obtained for the decomposition temperatures lower than 340 ºC, in which almost all chlorine is removed from the pure PVC through the chemical reaction described, with an activation energy of 133800 J/mol, value very close to the one obtained by others researchers [4].

The kinetic model was verified in laboratorial trials, and it was observed a reduction of 88 % of the chlorine contained in PVC, making it suitable to be used in a recovery process to obtain a synthesis gas.

During the pyrolysis treatment, released chlorine can be fixed in the form of aqueous solution of hydrochloric acid, calcium chloride or sodium chloride. This process shall constitute an attractive route, envisaging environmental benefits, thereby avoiding deleterious effects of toxic gas emissions.

In this study, we propose a methodology to remove chlorine from PVC-containing wastes allowing the valorization of the chlorine-free remaining fraction. A double benefit can thus be achieved as it not only saves the cost of landfilling but also produces an value added syngas.

It is concluded that for PVC-containing waste, the solution can pass through a full treatment

not only saves the cost of landfilling but also produces an value added syngas.

It is concluded that for PVC-containing waste, the solution can pass through a full treatment consisting of two phases. Where the first is to remove the chlorine from the PVC molecule and the second is to valorize the remaining fraction.

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[12] Karayildirim, T.; Yanik, J.; Yuksel, M.; Saglam, M.; Vasile, C.; Bockhorn, H. (2006) "The effect of some fillers on PVC degradation", Journal of Analytical and Applied Pyrolysis, 75, pp 112-119

HCl Production Questions 3/1/2024

Wednesday, March 6, 2024 1:48 PM

Andrews, Edward S <edward.s.andrews@wv.gov>

RE: Empire Discussion

1 message

Wood, Katie <katie.wood@tetratech.com> Fri, Mar 1, 2024 at 10:23 AM
To: "Andrews, Edward S" <edward.s.andrews@wv.gov>
Cc: Farley Wood <fwood@empirede.com>

Ed,

We have some answers to your questions below in red. Please let me know if you would like to discuss.

Thanks,

Katie

From: Andrews, Edward S <edward.s.andrews@wv.gov>
Sent: Friday, February 23, 2024 2:24 PM
To: Wood, Katie <katie.wood@tetratech.com>; Farley Wood <fwood@empirede.com>
Subject: Re: Empire Discussion

⚠ **CAUTION:** This email originated from an external sender. Verify the source before opening links or attachments. ⚠

Using Chlorine gas and water reaction to produce HCl also produces a by-product of HOCl (hypochlorous acid). https://www.bing.com/search?q=chlorine+gas+water+reaction&qs=UT&pq=chlorine+gas+water+reaction&sc=10-27&cvid=1D306673308642F9BCEE5D950B9BFB08&FORM=QBRE&sp=1&ghc=1&lq=0 The process does not produce any Chlorine gas, it produces Chloride gas so no HOCL is produced. I have attached a paper provided by Technotherm for futher information

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Ed

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Edward Andrews, P.E.

Engineer

WVDEP/Division of Air Quality

304-926-0499 Ext 41244

601 57th Street, SE

Charleston, WV 25304

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A. Castro[1,2,a], C. Carneiro[1], C. Vilarinho[2], D. Soares[2], C. Maçães[3], C. Sousa[3] and F. Castro[2]
[1] CVR - Centre for Waste Valorization, Guimarães, Portugal
[2] CT2M - Centre for Mechanical and Materials Technologies, Mechanical Engineering Department, University of Minho, Guimarães, Portugal
[3] Endutex - textile coatings, SA
[a] acastro@cvresiduos.pt

ABSTRACT
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Some of these wastes are an important potential source of energy and might be valorized using the pyrolysis or gasification processes. However, the presence of high chlorine contents in its composition prevents its management by a thermal process, as consequence of toxic compounds production and their release to the atmosphere.
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The presence of organic compounds on wastes, especially plastics, is considered an important source of energy. However, most of these plastics contain polyvinyl chloride (PVC), causing recycling problems when it is considered a thermal valorization process for its treatment [1], preventing the use of those residues on these processes, which main goal is the energy recovery [2,3]. A possible solution is to remove the chlorine from PVC-containing waste through a pyrolysis process before being subjected to a thermal treatment, for energetic valorization.

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EXPERIMENTAL WORK

In this work, the kinetics of thermal de-chlorination has been studied, by simultaneous DTA/TGA determinations, under inert atmosphere. With all the experimental data obtained a multivariate regression of ln (r) has been performed in function of 1/T and ln ([HCl]). The kinetic model has been calculated just for points where temperature was lower than 340 ºC, and the obtained model is:

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This allows considering that reaction as a first order one with activation energy of 133800 J/mol ± 780 J/mol.

For the kinetic study, a DTA/TGA (SDT 2960 from TA Instruments) testing at different temperatures has been carried out in order to determine the relationship beteween the rate of PVC de-chlorination and the temperature of the thermal treatment, under an inert atmosphere. It was used a commercial pure PVC powder with the chemical formula C_2H_3Cl, in which 56,7% is chlorine. The reference is VICIR S 950 and it is a vinyl chloride homopolymer produced by a suspension polymerization process.

Experiments have conducted up to 5 different maximum temperatures: 250, 275, 300, 325 and 400 °C, with a heating rate of 10 °C per minute until the desired temperature is reached. After reaching this temperature, a stage has been done during 360 minutes. Heat flux (weight corrected heat flow in W/g) and weight of sample, has been continuously recorded.

DTA/TGA testing performed indicates that the temperature of 340 °C enables the removal of 88 % of the chlorine present in the PVC material. The resulting de-chlorinated fraction, carbonaceous residue, has also been characterized and it is mainly constituted by carbon. This carbonaceous residue was testing up to 500°C in DTA/DTA and was verified that the combustion reaction of the carbonaceous material is complete at 423°C demonstrating potential as a fuel source to a following gasification in order to produce a synthesis gas with high energetic potential.

To characterize the sample of PVC used and the carbonaceous residue formed, it has been used an TruSpec Elemental Determinator, model TruSpec CHN, of Leco with a burn time of 452 seconds and an Philips Analytical sequential X-ray fluorescence (XRF) Spectrometer model X'Unique II.

Table 1. Comparison between the chemical composition (in wt%) of PVC sample used and the carbonaceous residue obtained from pyrolysis at 340 °C.

	PVC (Initial sample)	PVC (Carbonaceous residue)
Carbon	38,4	89
Hydrogen	4,9	7
Chlorine	56,7	0,07

Chlorine	58,7	0,07

Through table 1, we are able to conclude that the de-chlorinated fraction obtained at 340°C is mainly constituted by carbon presenting residual chlorine content, 0,07 %.

Tests were performed in the laboratory and pilot scale, where the variables temperature, pressure and residence time inside the reactor were studied, as well as its influence on the reaction products obtained.

The pilot plant consists in a reactor where the pyrolysis occurs, with a stainless steel body heated by electrical resistance and a column of water where the gas is bubbled, as exemplified in figure 1. Measuring instruments such as thermocouples and pressure gauges are used to control the conditions (temperature and pressure) inside the reactor.

The fixation of the released chlorine is obtained by water absorption, forming HCl (hydrochloric acid), CaCl2 (calcium chloride) and also NaCl (sodium chloride), when the aqueous solution, containing CaO (calcium oxide) or NaOH (sodium hydroxide), respectively.

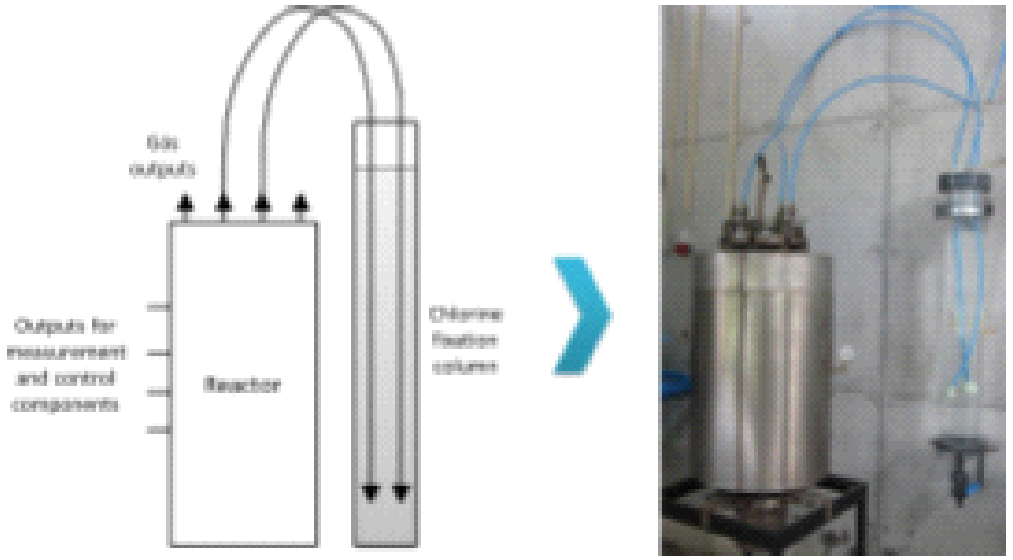

Figure 1: Scheme of pilot scale used for the tests.

Initially, a slight vacuum is created to remove the oxygen inside the reactor, then the test is initiated and divided into two stages. The first stage is a low-temperature pyrolysis or carbonization, where the de-chlorination of the PVC-containing waste reaction occurs, the released chlorine is recovered in the column in the form of hydrochloric acid, sodium chloride or calcium chloride. After the first stage is completed, second stage, takes place, then the carbonaceous residue (without chlorine) resulting from the first stage, is energetically valorized, at temperatures above 550 ° C.

The residence time in the reactor was tested by the pressure differences, viewed through the pressure gauge in the reactor. Thus, the reaction starts in vacuum and is assumed as completed when the pressure reaches zero, i.e. atmospheric pressure. During the reaction, when the pressure

The residence time in the reactor was tested by the pressure differences, viewed through the pressure gauge in the reactor. Thus, the reaction starts in vacuum and is assumed as completed when the pressure reaches zero, i.e. atmospheric pressure. During the reaction, when the pressure is 0,5 bar above atmospheric pressure, it is enough for the syngas formed inside the reactor can bubble in column. After all the gas is released, then the pressure drops to zero on the gauge, i.e., atmospheric pressure, thus giving the information that the reaction is complete.

All materials used in building a pilot plant must be well chosen, because of corrosion of materials and isolation. The absence of leakage or entry of gases must also be controlled, since the produced gases are toxic and cannot leak to the atmosphere, and also because as pyrolysis is a process that must take place in anoxic environment, thus it should be affected by any entry of oxidizing agents.

The main reaction product is a synthesis gas for burning to produce heat.

CONCLUSIONS

In this work, the kinetics of the reaction of thermal decomposition of PVC were studied, leading to the development of a kinetic model, with the expression ln r = 31,3 - 16100/T + 1,020 ln C (HCl). This model was obtained for the decomposition temperatures lower than 340 °C, in which almost all chlorine is removed from the pure PVC through the chemical reaction described, with an activation energy of 133800 J/mol, value very close to the one obtained by others researchers [4].

The kinetic model was verified in laboratorial trials, and it was observed a reduction of 88 % of the chlorine contained in PVC, making it suitable to be used in a recovery process to obtain a synthesis gas.

During the pyrolysis treatment, released chlorine can be fixed in the form of aqueous solution of hydrochloric acid, calcium chloride or sodium chloride. This process shall constitute an attractive route, envisaging environmental benefits, thereby avoiding deleterious effects of toxic gas emissions.

In this study, we propose a methodology to remove chlorine from PVC-containing wastes allowing the valorization of the chlorine-free remaining fraction. A double benefit can thus be achieved as it not only saves the cost of landfilling but also produces an value added syngas.

It is concluded that for PVC-containing waste, the solution can pass through a full treatment consisting of two phases. Where the first is to remove the chlorine from the PVC molecule and the second is to valorize the remaining fraction.

References

[1] Lewis, F.; Ablow, C. (1978) "Pyrogas From Biomass". Presented to a conference on capturing

References

[1] Lewis, F.; Ablow, C. (1975) "Pyrogas From Biomass". Presented to a conference on capturing the sun through bioconversion, Washington, D.C., Shoreham Americana Hotel. Stanford research institute.

[2] Zevenhoven, R.; Axelsen, E.; Hupa, M. (2002) "Pyrolysis of waste-derived fuel mixtures containing PVC", Fuel, 81, pp 507-510.

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[12] Karayildirim, T.; Yanik, J.; Yuksel, M.; Saglam, M.; Vasile, C.; Bockhorn, H. (2006) "The effect of some fillers on PVC degradation", Journal of Analytical and Applied Pyrolysis, 75, pp 112-119

HCl Spec

Friday, February 23, 2024 4:18 PM

Product Specifications

luriatic Acid, 20 DEG Baume (HCL 32)

Item	Specification
	APHA
Color, Max	15.0
Degrees Baume DEG Baume @60F	20.0-20.8
	Parts Per Million
Arsenic, Max (AS)	0.1
Bromide, Max (BR)	50.0
Calcium, Max (CA)	2.0
Free Chlorine, Max (CL2)	3.0
Fluoride, Max (F)	2.0
Iron, Max (FE)	0.5
Non-Volatile Residue, Max (NVR)	15.0
Organics, Max	1.0
Lead, Max (PB)	0.2
Sulfate, Max	10.0
	Percent by Weight
Hydrogen Chloride	31.5-32.9

Approved 07.12.199

Westlake Chemical

Response to HCl questions 2/21/2024

Wednesday, February 21, 2024 8:49 AM

Andrews, Edward S <edward.s.andrews@wv.gov>

FW: Empire's Revised Modification App

1 message

Wood, Katie <katie.wood@tetratech.com> Wed, Feb 21, 2024 at 8:33 AM
To: Edward Andrews <edward.s.andrews@wv.gov>

Ed,

Please see responses below for the HCL for the process. I will follow up on the plastic feedstock as fuel here shortly.

Thanks,

Katie

From: Farley R. Wood, P.E. <fwood@empirede.com>
Sent: Tuesday, February 20, 2024 2:14 PM
To: Wood, Katie <katie.wood@tetratech.com>
Subject: RE: Empire's Revised Modification App

⚠ **CAUTION:** This email originated from an external sender. Verify the source before opening links or attachments. ⚠

Katie,

Please see below:

Farley R. Wood, P.E.
Vice President of Engineering

Main Office (304) 935-5851
Mobile: (304) 650-2023
Teams: Click Here

fwood@empirede.com
www.empirediversifiedenergy.com

From: Wood, Katie <katie.wood@tetratech.com>
Sent: Tuesday, February 20, 2024 11:36 AM

To: Farley R. Wood, P.E. <fwood@empirede.com>
Subject: FW: Empire's Revised Modification App

You don't often get email from katie.wood@tetratech.com. Learn why this is important

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From: Andrews, Edward S <edward.s.andrews@wv.gov>
Sent: Tuesday, February 20, 2024 10:16 AM
To: Wood, Katie <katie.wood@tetratech.com>
Subject: Re: Empire's Revised Modification App

⚠ **CAUTION:** This email originated from an external sender. Verify the source before opening links or attachments. ⚠

Katie,

I will need additional information about the HCl production/storage/loading out rack to develop the appropriate permit requirements.

How will the HCl be produced and at what concentration? Absorption and cooling of chlorine gas into demineralized water in a spray tower. The target concentration of hydrochloric acid is 31.45% (20° Baume').

How much HCl be stored on site (identify the tanks and dimensions of the tanks)? We will have two 10,305 gallon tanks for HCl storage. One for in spec HCl and one for out of spec HCL. Tank dimensions are 11' 11" diameter by 14' high.

The goal is to make in spec product, so the out of spec tank will hopefully be nearly empty most of the time. We will have a 1,500 gallon production tank (7'2" diameter by 5' 11" high) witch will be where quality analysis samples are regularly taken.

Based on the analysis the HCl will be routed to the in spec or out of spec tanks. HCl will be removed from the tanks on a daily basis by FSTI, an onsite tenant of the Port. Production and shipments will be roughly equal to minimize stored product.

Is the proposed scrubber going to be used to control the storage and loadout racks or just the loading rack? Both

Will the pyrolysis units need to process feedstock that contains PVC (polyvinyl chloride) type of plastic material to produce HCl? Yes, we have the ability to not produce HCl by keeping PVC out of the feed material.

Also, the reference to House Bill 4048 does not help me justify why the plastic feedstock should be treated as fuel?

Specifically, I need sufficient information from the application to indicate the plastic feedstock is not considered waste and therefore the facility (pyrolysis units) are not subject to Subpart AAAA, CCCC, and Subpart EEEE because the feedstock material is not waste.

Ed

On Wed, Feb 7, 2024 at 8:55 AM Wood, Katie <katie.wood@tetratech.com> wrote:

> Thanks Ed,
>
> Let me dive into this a little more and talk to them and I will reach out to discuss.
>
> Thanks,
>
> Katie
>
> ---
>
> **From:** Andrews, Edward S <edward.s.andrews@wv.gov>
> **Sent:** Tuesday, February 6, 2024 9:08 AM
> **To:** Wood, Katie <katie.wood@tetratech.com>
> **Subject:** Empire's Revised Modification App
>
> ⚠ **CAUTION:** This email originated from an external sender. Verify the source before opening links or attachments. ⚠
>
> Katie,
>
> It is still unclear to me how HCl is going to be generated and seperate from the pyrolysis process.
>
> I am not sure if I can just accept WV House Bill 4048 as proof that the material being processed is non-waste.
>
> I would like to discuss these issues further in the near future.
>
> Ed
>
> --
>
> Edward Andrews, P.E.

Engineer

WVDEP/Division of Air Quality

304-926-0499 Ext 41244

601 57th Street, SE

Charleston, WV 25304

--

Edward Andrews, P.E.

Engineer

WVDEP/Division of Air Quality

304-926-0499 Ext 41244

601 57th Street, SE

Charleston, WV 25304

Notary Public 2/5/24

Monday, February 5, 2024 1:43 PM

Sunbiz DIVISION of CORPORATIONS
an official State of Florida website

Notary Public | Service Providers Sign in

↵ Search Results

Remote Online Notary			
First Name:	PAMELA	**Address:**	4213 LAKE RICHMON DR
Middle Name:		**City:**	ORLANDO
Last Name:	BAEZ	**State:**	Florida
Notary ID:	1051095	**Zip:**	32811
Commission:	HH 186700	**Email:**	P.BAEZ820@GMAIL.C
RON Issue Date:	6/7/2023	**Phone:**	407-491-3362
Expire Date:	10/14/2025		

Service Provider		
Name	**Start Date**	**End Date**
NOTARIZE, INC.	Jun 01, 2023	

Secure Repository			
Name	**Start Date**	**End Date**	**Preferred Contact**

Questions or comments? Please contact us

R.A. Gray Building
500 South Bronough St
Tallahassee FL, 32399-0250
850-245-6500

Response to Inc lt 1/23/24

Thursday, January 25, 2024 9:36 AM

Andrews, Edward S <edward.s.andrews@wv.gov>

RE: Incomplete App Email for Permit App R13-3555A

1 message

Wood, Katie <katie.wood@tetratech.com> Tue, Jan 23, 2024 at 4:28 PM
To: "Andrews, Edward S" <edward.s.andrews@wv.gov>
Cc: Beverly D Mckeone <beverly.d.mckeone@wv.gov>, Brian S Taphalock <Brian.S.Taphalock@wv.gov>, Eric Bleml <eric.r.bleml@wv.gov>, Bernard Brown <bbrown@empireda.com>, Farley Wood <fwood@empireda.com>

Ed,

Please find attached the revised modification application for Empire Green Generation. Please find the response to your comments below in blue. Please don't hesitate to reach out if you have any questions.

Thank you,

Katie Wood* | Environmental Scientist
Direct +1 **(740) 266-9062** | Mobile **+1 (304) 559-0980** | katie.wood@tetratech.com
Formerly Katie Pugh, please note name change
Tetra Tech | Leading with Science® | OGA
47443 National Rd Suite 3 | St. Clairsville, OH 43950 | tetratech.com

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Please consider the environment before printing. Read more

From: Andrews, Edward S <edward.s.andrews@wv.gov>
Sent: Wednesday, December 20, 2023 2:34 PM
To: Bernard Brown <bbrown@empireda.com>; Farley Wood <fwood@empireda.com>; Wood, Katie <Katie.Pugh@tetratech.com>
Cc: Beverly D Mckeone <beverly.d.mckeone@wv.gov>; Brian S Taphalock <Brian.S.Taphalock@wv.gov>; Eric Bleml <eric.r.bleml@wv.gov>
Subject: Incomplete App Email for Permit App R13-3555A

⚠ **CAUTION:** This email originated from an external sender. Verify the source before opening links or attachments. ⚠

RE: Application Status: Incomplete
Empire Green Generation
Permit Application No. R13-3555A
Plant ID No. 009-00141

Mr. Brown:

Your application for a modification permit for a plastic recycling by pyrolysis facility was received by this Division on December 1, 2023, and assigned to the writer for review. Upon initial review of said application, it has been determined that the application as submitted is incomplete based on the following items:

1. Affidavit of Publication of Class I Legal Ad. Included in pdf

2. Discussion of the proposed physical change(s), if applicable, and/or change in the method of operation. Specifically, this discussion needs to either outline or go into detail regarding proposed/suggested changes to the permit, if applicable; type and source(s)/origin of the plastic feedstock going to be process by the facility; any processing/pretreating/sorting going to be conduct on the plastic prior to being introduce into the pyrolysis unit(s), if those preprocessing is going to occur off-site, it still needs to be identified and discussed; a discussion how the facility will switch back and forth in processing medical waste and plastic feedstock; and a discussion why processing the proposed plastic feedstock is not viewed as waste disposal through incineration in the context of the Clean Air Act and meet the criteria as a fuel(s) within the requirements and procedures of 40 CFR 241 - SOLID WASTES USED AS FUELS OR INGREDIENTS IN COMBUSTION UNITS. The only physical change is the in feedstock, there is no change in the process. Additional information about the pre-processing handling was added to section G process description. There will be no switching back and forth of feedstock, the facility will only be recycling plastics. A discussion of the regulatory requirements has been added to section D regulatory discussion.

3. Plot plan (Attachment E) needs to be updated to identify emission units and emission points. Emission units included in plot plan

4. Attachment J needs to be complete for each emission point. No additional emission points have been added

5. Attachments K and L need to be completed. The potential for leaking equipment (e.g., valves, pumps, compressors, connectors, pressure relief devices) needs to be quantified and documented in these two attachments. Attachments completed and incorporated in PDF

6. Each of the redacted pages that contain confidential business information (CBI) needs to be remarks "redacted copy - claim of confidentiality" in accordance with 45CSR31-3.4. Redacted pages updated to conform

In addressing issues 2 through 6 needs to be reflective within the redacted application as a single PDF file.

The emissions estimates appear to be identical to the emission estimates for processing medical waste with the same pyrolysis unit. Please review these estimates and revise as necessary and/or justify in detail why the emission will not change given the change in feedstocks. The emissions are not expected to change, the majority of the medical waste feedstock was anticipated to be plastics. There is not change to the process, just feedstock so the emission estimates remain the same.

Please address the above deficiencies in writing by no later than January 16, 2024. Application review will not commence until the application has been deemed to be technically complete. Failure to respond to this request in a timely manner may result in the denial of the application.

Should you have any questions, please contact Ed Andrews at (304) 926-0499 ext. 41244 or reply to this email.

--
Edward Andrews, P.E.
Engineer
WVDEP/Division of Air Quality
304-926-0499 Ext 41244
601 57th Street, SE
Charleston, WV 25304

R13-3555 Modification_Application_EGG - Redacted_Final Rev.pdf
224324

R13-3555 Modificati...

NSR (45CSR13) APPLICATION FORM

WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF AIR QUALITY
601 57th Street, SE
Charleston, WV 25304
(304) 926-0475
www.dep.wv.gov/daq

APPLICATION FOR NSR PERMIT AND TITLE V PERMIT REVISION (OPTIONAL)

PLEASE CHECK ALL THAT APPLY TO NSR (45CSR13) (IF KNOWN):
☐ CONSTRUCTION ☒ MODIFICATION ☐ RELOCATION
☐ CLASS I ADMINISTRATIVE UPDATE ☐ TEMPORARY
☐ CLASS II ADMINISTRATIVE UPDATE ☐ AFTER-THE-FACT

PLEASE CHECK TYPE OF 45CSR30 (TITLE V) REVISION (IF ANY):
☐ ADMINISTRATIVE AMENDMENT ☐ MINOR MODIFICATION
☐ SIGNIFICANT MODIFICATION
IF ANY BOX ABOVE IS CHECKED, INCLUDE TITLE V REVISION INFORMATION AS ATTACHMENT S TO THIS APPLICATION

FOR TITLE V FACILITIES ONLY: Please refer to "Title V Revision Guidance" in order to determine your Title V Revision options (Appendix A, "Title V Permit Revision Flowchart") and ability to operate with the changes requested in this Permit Application.

Section I. General

1. Name of applicant (as registered with the WV Secretary of State's Office): Empire Green Generation, LLC
2. Federal Employer ID No. (FEIN): 87-3157526
3. Name of facility (if different from above): Follansbee Operations
4. The applicant is the: ☐ OWNER ☐ OPERATOR ☒ BOTH
5A. Applicant's mailing address: 1400 Main Street, Follansbee, WV 26037
5B. Facility's present physical address: 601 Koppers Rd, Follansbee, WV 26037
6. West Virginia Business Registration. Is the applicant a resident of the State of West Virginia? ☒ YES ☐ NO
- If YES, provide a copy of the Certificate of Incorporation/Organization/Limited Partnership (one page) including any name change amendments or other Business Registration Certificate as Attachment A.
- If NO, provide a copy of the Certificate of Authority/Authority of L.L.C./Registration (one page) including any name change amendments or other Business Certificate as Attachment A.
7. If applicant is a subsidiary corporation, please provide the name of parent corporation:
8. Does the applicant own, lease, have an option to buy or otherwise have control of the proposed site? ☒ YES ☐ NO
- If YES, please explain: Own and Operate
- If NO, you are not eligible for a permit for this source.
9. Type of plant or facility (stationary source) to be constructed, modified, relocated, administratively updated or temporarily permitted (e.g., coal preparation plant, primary crusher, etc.): Plastics Recycling By Pyrolysis
10. North American Industry Classification System (NAICS) code for the facility: 562920
11A. DAQ Plant ID No. (for existing facilities only): 009 – 00141
11B. List all current 45CSR13 and 45CSR30 (Title V) permit numbers associated with this process (for existing facilities only): R13-3555

All of the required forms and additional information can be found under the Permitting Section of DAQ's website, or requested by phone.

12A.
- For Modifications, Administrative Updates or Temporary permits at an existing facility, please provide directions to the present location of the facility from the nearest state road.
- For Construction or Relocation permits, please provide directions to the proposed new site location from the nearest state road. Include a MAP as Attachment M.

Turn off of WV-2 onto Veterans Drive (0.6 miles). Turn right onto Koppers Road (0.3 miles). Facility location will be on the right.

12B. New site address (if applicable):
12C. Nearest city or town: Follansbee
12D. County: Brooke
12E. UTM Northing (KM): 40.539890
12F. UTM Easting (KM): -80.609429
12G. UTM Zone: 17T
13. Briefly describe the proposed change(s) at the facility:
The facility will be recycling plastics via pyrolysis instead of medical waste as originally permitted.
14A. Provide the date of anticipated installation or change: 1/2/2024
- If this is an After-the-Fact permit application, provide the date upon which the proposed change did happen:
14B. Date of anticipated Start-up if a permit is granted: 1/2/2024
14C. Provide a Schedule of the planned Installation of/Change to and Start-up of each of the units proposed in this permit application as Attachment C (if more than one unit is involved).
15. Provide maximum Projected Operating Schedule of activity/activities outlined in this application:
Hours Per Day: 24 Days Per Week: 7 Weeks Per Year: 52
16. Is demolition or physical renovation at an existing facility involved? ☐ YES ☒ NO
17. Risk Management Plans. If this facility is subject to 112(r) of the 1990 CAAA, or will become subject due to proposed changes (for applicability help see www.epa.gov/ceppo), submit your Risk Management Plan (RMP) to U. S. EPA Region III.
18. Regulatory Discussion. List all Federal and State air pollution control regulations that you believe are applicable to the proposed process (if known). A list of possible applicable requirements is also included in Attachment S of the application (Title V Permit Revision Information). Discuss applicability and proposed demonstration(s) of compliance (if known). Provide this information as Attachment S.

Section II. Additional attachments and supporting documents.

19. Include a check (payable to WVDEP – Division of Air Quality) with the appropriate application fee (per 45CSR22 and 45CSR13).
20. Include a Table of Contents as the first page of your application package.
21. Provide a Plot Plan, e.g. scaled map(s) and/or sketch(es) showing the location of the property on which the stationary source(s) is or is to be located as Attachment B. (Refer to *Plot Plan Guidance*).
- Indicate the location of the nearest occupied structure (e.g. church, school, business, residence).
22. Provide a Detailed Process Flow Diagram(s) showing each proposed or modified emissions unit, emission point and control device as Attachment F.
23. Provide a Process Description as Attachment G.
- Also describe and quantify, to the extent possible all changes made to the facility since the last permit review (if applicable).

All of the required forms and additional information can be found under the Permitting Section of DAQ's website, or requested by phone.

24. Provide Material Safety Data Sheets (MSDS) for all materials processed, used or produced as Attachment H.
– For chemical processes, provide a MSDS for each compound emitted to the air.

25. Fill out the Emission Units Table and provide it as Attachment I.

26. Fill out the Emission Points Data Summary Sheet (Table 1 and Table 2) and provide it as Attachment J.

27. Fill out the Fugitive Emissions Data Summary Sheet and provide it as Attachment K.

28. Check all applicable Emissions Unit Data Sheets listed below:

- [x] Bulk Liquid Transfer Operations
- [x] Haul Road Emissions
- [ ] Quarry
- [x] Chemical Processes
- [ ] Hot Mix Asphalt Plant
- [ ] Solid Materials Sizing, Handling and Storage Facilities
- [ ] Concrete Batch Plant
- [ ] Incinerator
- [ ] Grey Iron and Steel Foundry
- [x] Indirect Heat Exchanger
- [ ] Storage Tanks
- [ ] General Emission Unit, specify

Fill out and provide the Emissions Unit Data Sheet(s) as Attachment L.

29. Check all applicable Air Pollution Control Device Sheets listed below:

- [ ] Absorption Systems
- [ ] Baghouse
- [x] Flare
- [ ] Adsorption Systems
- [ ] Condenser
- [ ] Mechanical Collector
- [ ] Afterburner
- [ ] Electrostatic Precipitator
- [x] Wet Collecting System
- [ ] Other Collectors, specify

Fill out and provide the Air Pollution Control Device Sheet(s) as Attachment M.

30. Provide all Supporting Emissions Calculations as Attachment N, or attach the calculations directly to the forms listed in Items 28 through 31.

31. Monitoring, Recordkeeping, Reporting and Testing Plans. Attach proposed monitoring, recordkeeping, reporting and testing plans in order to demonstrate compliance with the proposed emissions limits and operating parameters in this permit application. Provide this information as Attachment O.

> Please be aware that all permits must be practically enforceable whether or not the applicant chooses to propose such measures. Additionally, the DAQ may not be able to accept all measures proposed by the applicant. If none of these plans are proposed by the applicant, DAQ will develop such plans and include them in the permit.

32. Public Notice. At the time that the application is submitted, place a Class I Legal Advertisement in a newspaper of general circulation in the area where the source is or will be located (See 45CSR§13-8.3 through 45CSR§13-8.5 and *Example Legal Advertisement* for details). Please submit the Affidavit of Publication as Attachment P immediately upon receipt.

33. Business Confidentiality Claims. Does this application include confidential information (per 45CSR31)?

[x] YES [ ] NO

> If YES, identify each segment of information on each page that is submitted as confidential and provide justification for each segment claimed confidential, including the criteria under 45CSR§31-4.1, and in accordance with the DAQ's "*Precautionary Notice – Claims of Confidentiality*" guidance found in the *General Instructions* as Attachment Q.

Section III. Certification of Information

34. Authority/Delegation of Authority. Only required when someone other than the responsible official signs the application. Check applicable Authority Form below:

- [ ] Authority of Corporation or Other Business Entity
- [ ] Authority of Partnership
- [ ] Authority of Governmental Agency
- [x] Authority of Limited Partnership

Submit completed and signed Authority Form as Attachment R.

All of the required forms and additional information can be found under the Permitting Section of DAQ's website, or requested by phone.

35A. Certification of Information. To certify this permit application, a Responsible Official (per 45CSR§13-2.22 and 45CSR§30-2.28) or Authorized Representative shall check the appropriate box and sign below.

Certification of Truth, Accuracy, and Completeness

I, the undersigned [x] Responsible Official / [ ] Authorized Representative, hereby certify that all information contained in this application and any supporting documents appended hereto, is true, accurate, and complete based on information and belief after reasonable inquiry I further agree to assume responsibility for the construction, modification and/or relocation and operation of the stationary source described herein in accordance with this application and any amendments thereto, as well as the Department of Environmental Protection, Division of Air Quality permit issued in accordance with this application, along with all applicable rules and regulations of the West Virginia Division of Air Quality and W.Va. Code § 22-5-1 et seq. (State Air Pollution Control Act). If the business or agency changes its Responsible Official or Authorized Representative, the Director of the Division of Air Quality will be notified in writing within 30 days of the official change.

Compliance Certification

Except for requirements identified in the Title V Application for which compliance is not achieved, I, the undersigned hereby certify that, based on information and belief formed after reasonable inquiry, all air contaminant sources identified in this application are in compliance with all applicable requirements.

SIGNATURE Bernard R. Brown (Please use blue ink) DATE: 11/30/2023 (Please use blue ink)

35B. Printed name of signee: Bernard Brown		35C. Title: Chief Operating Officer
35D. E-mail: bbrown@empireda.com	35E. Phone: 681-287-6080	35F. FAX:
36A. Printed name of contact person (if different from above):		36B. Title:
36C. E-mail:	36D. Phone:	36E. FAX:

PLEASE CHECK ALL APPLICABLE ATTACHMENTS INCLUDED WITH THIS PERMIT APPLICATION:

- [x] Attachment A: Business Certificate
- [x] Attachment B: Map(s)
- [x] Attachment C: Installation and Start Up Schedule
- [x] Attachment D: Regulatory Discussion
- [x] Attachment E: Plot Plan
- [x] Attachment F: Detailed Process Flow Diagram(s)
- [x] Attachment G: Process Description
- [x] Attachment H: Material Safety Data Sheets (MSDS)
- [x] Attachment I: Emission Units Table
- [x] Attachment J: Emission Points Data Summary Sheet
- [x] Attachment K: Fugitive Emissions Data Summary Sheet
- [x] Attachment L: Emissions Unit Data Sheet(s)
- [x] Attachment M: Air Pollution Control Device Sheet(s)
- [x] Attachment N: Supporting Emissions Calculations
- [x] Attachment O: Monitoring/Recordkeeping/Reporting/Testing Plans
- [x] Attachment P: Public Notice
- [x] Attachment Q: Business Confidential Claims
- [x] Attachment R: Authority Forms
- [ ] Attachment S: Title V Permit Revision Information
- [ ] Application Fee

Please mail an original and three (3) copies of the complete permit application with the signature(s) to the DAQ, Permitting Section, at the address listed on the first page of this application. Please DO NOT fax permit applications.

FOR AGENCY USE ONLY – IF THIS IS A TITLE V SOURCE:

- [ ] *Forward 1 copy of the application to the Title V Permitting Group and:*
- [ ] *For Title V Administrative Amendments:*
  - [ ] *NSR permit writer should notify Title V permit writer of draft permit,*
- [ ] *For Title V Minor Modifications:*
  - [ ] *Title V permit writer should send appropriate notification to EPA and affected states within 5 days of receipt,*
  - [ ] *NSR permit writer should notify Title V permit writer of draft permit.*
- [ ] *For Title V Significant Modifications processed in parallel with NSR Permit revision:*
  - [ ] *NSR permit writer should notify a Title V permit writer of draft permit,*
  - [ ] *Public notice should reference both 45CSR13 and Title V permits,*
  - [ ] *EPA has 45 day review period of a draft permit.*

All of the required forms and additional information can be found under the Permitting Section of DAQ's website, or requested by phone.

WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF AIR QUALITY
601 57th Street, SE
Charleston, WV 25304
Phone: (304) 926-0475
www.dep.wv.gov/daq

PERMIT DETERMINATION FORM (PDF)

FOR AGENCY USE ONLY: PLANT I.D. # ________ PDF # ________ PERMIT WRITER: ________

1. NAME OF APPLICANT (AS REGISTERED WITH THE WV SECRETARY OF STATE'S OFFICE): Empire Green Generation, LLC		
2. NAME OF FACILITY (IF DIFFERENT FROM ABOVE): Follansbee Operations		3. NORTH AMERICAN INDUSTRY CLASSIFICATION SYSTEM (NAICS) CODE: 562920
4A. MAILING ADDRESS: 1400 Main Street, Follansbee, WV 26037	4B. PHYSICAL ADDRESS: 601 Koppers Rd, Follansbee WV 26037	
5A. DIRECTIONS TO FACILITY (PLEASE PROVIDE MAP AS ATTACHMENT A): Turn off of WV-2 onto Veterans Drive (0.6 miles). Turn right onto Koppers Rd (0.2 miles). Facility on the right		
5B. NEAREST ROAD: WV-2	5C. NEAREST CITY OR TOWN: Follansbee, WV	5D. COUNTY: Brooke
5E. UTM NORTHING (KM): 40.336880	5F. UTM EASTING (KM): -80.605026	5G. UTM ZONE: 17T
6A. INDIVIDUAL TO CONTACT IF MORE INFORMATION IS REQUIRED: Bernard Brown		6B. TITLE: Chief Technology Officer
6C. TELEPHONE: 681-287-6803	6D. FAX:	6E. E-MAIL: bbrown@empireda.com
7A. DAQ PLANT I.D. NO. (FOR AN EXISTING FACILITY ONLY): 009 – 00141	7B. PLEASE LIST ALL CURRENT 45CSR13, 45CSR14, 45CSR19 AND/OR TITLE V (45CSR30) PERMIT NUMBERS ASSOCIATED WITH THIS PROCESS (FOR AN EXISTING FACILITY ONLY): R13-3555	
7C. IS THIS PDF BEING SUBMITTED AS THE RESULT OF AN ENFORCEMENT ACTION? IF YES, PLEASE LIST:		
8A. TYPE OF EMISSION SOURCE (CHECK ONE): [ ] NEW SOURCE [ ] ADMINISTRATIVE UPDATE [x] MODIFICATION [ ] OTHER (PLEASE EXPLAIN IN 11B)	8B. IF ADMINISTRATIVE UPDATE, DOES DAQ HAVE THE APPLICANT'S CONSENT TO UPDATE THE EXISTING PERMIT WITH THE INFORMATION CONTAINED HEREIN? [ ] YES [ ] NO	
9. IS DEMOLITION OR PHYSICAL RENOVATION AT AN EXISTING FACILITY INVOLVED? [ ] YES [x] NO		
10A. DATE OF ANTICIPATED INSTALLATION OR CHANGE: 1 / 15 / 2024	10B. DATE OF ANTICIPATED START-UP: 3 / 15 / 2024	
11A. PLEASE PROVIDE A DETAILED PROCESS FLOW DIAGRAM SHOWING EACH PROPOSED OR MODIFIED PROCESS EMISSION POINT AS ATTACHMENT B.		
11B. PLEASE PROVIDE A DETAILED PROCESS DESCRIPTION AS ATTACHMENT C.		
12. PLEASE PROVIDE MATERIAL SAFETY DATA SHEETS (MSDS) FOR ALL MATERIALS PROCESSED, USED OR PRODUCED AS ATTACHMENT D. FOR CHEMICAL PROCESSES, PLEASE PROVIDE A MSDS FOR EACH COMPOUND EMITTED TO AIR.		

POLLUTANT	HOURLY PTE (LB/HR)	YEARLY PTE (TON/YR) (HOURLY PTE MULTIPLIED BY 8760 HR/YR) DIVIDED BY 2000 LB/TON
PM	6.7	29.0
PM_{10}	3.20	14.0
VOCs	5.48	24.0
CO	22.60	99.0
NO_x	5.48	24.0
SO_2	6.90	29.0
Pb	NA	NA
HAPs (AGGREGATE AMOUNT)	0.45	2.0
HAPs (INDIVIDUALLY)	0.45	2.0
OTHER (INDIVIDUALLY)	0.47	0.75

* ATTACH ADDITIONAL PAGES AS NEEDED

13B. PLEASE PROVIDE ALL SUPPORTING CALCULATIONS AS ATTACHMENT C.
CALCULATE AN HOURLY AND YEARLY PTE OF EACH PROCESS EMISSION POINT (SHOWN IN YOUR DETAILED PROCESS FLOW DIAGRAM) FOR ALL AIR POLLUTANTS LISTED ABOVE INCLUDING INDIVIDUAL HAPS LISTED IN SECTION 112(B) OF THE 1990 CAAA, TOPS LISTED IN 45CSR27, AND OTHER AIR POLLUTANTS (E.G. POLLUTANTS LISTED IN TABLE 45-13A OF 45CSR13, GHG'S, ODS PER 45CSR7, ETC.).

14. CERTIFICATION OF DATA

I, Bernard Brown, (PRINT NAME) ATTEST THAT ALL THE INFORMATION CONTAINED IN THIS APPLICATION, OR APPENDED HERETO, ARE TRUE, ACCURATE, AND COMPLETE TO THE BEST OF MY KNOWLEDGE OR AFTER REASONABLE INQUIRY, AND THAT I AM A RESPONSIBLE OFFICIAL** (PRESIDENT, VICE PRESIDENT, SECRETARY OR TREASURER, GENERAL PARTNER OR SOLE PROPRIETOR OF THE APPLICANT).

SIGNATURE OF RESPONSIBLE OFFICIAL: Bernard E. Brown

TITLE: Chief Technology Officer — DATE: 11 / 30 / 2022

**THE DEFINITION OF THE PHRASE RESPONSIBLE OFFICIAL CAN BE FOUND AT 45CSR13, SECTION 2.23.

NOTE: PLEASE CHECK ENCLOSED ATTACHMENTS:

☑ ATTACHMENT A ☑ ATTACHMENT B ☐ ATTACHMENT C ☑ ATTACHMENT D ☐ ATTACHMENT E

RECORDS OF ALL DATA/INFO ARE REQUIRED TO BE KEPT FOR SIX (6) YEARS.
THE PERMIT DETERMINATION FORM WITH THE INSTRUCTIONS CAN BE FOUND ON DAQ'S PERMITTING SECTION WEB SITE: www.dep.wv.gov/daq

ATTACHMENT A

Business Certificate

City of Follansbee
CITY LICENSE

Follansbee, West Virginia

This is to certify that the undersigned, in pursuance of the authority vested in him by law has this day granted to:

Name of Establishment: **EMPIRE GREEN GENERATION LLC**

Address: **1400 MAIN ST**

FOLLANSBEE WV 26037-1218

Name of Owner: **FRANK ROSSO**

Address: **401 EAST LAS OLAS BLVD SUITE 1400**

FORT LAUDERDALE FL 33301-2218

a license to engage in, conduct or operate the business of, or devices for which license tax has been assessed and paid as shown in license schedule herein.

Date Issued: **28-Jul-2022**

Expiration Date: **30-Jun-2023**

WV Contractors #

PAID

07/28/2022

City of Follansbee

Any automatic device licensed herein is that which is not a gambling device under city ordinance or the laws of the State of West Virginia

LICENSE
No : 288

John G McIntosh
City Treasurer

DISPLAY IN A CONSPICUOUS PLACE

State of West Virginia

Certificate

I, Mac Warner, Secretary of State of the State of West Virginia, hereby certify that

EMPIRE GREEN GENERATION, LLC

was duly authorized under the laws of this state to transact business in West Virginia as a foreign limited liability company on December 09, 2021.

The company is filed as an at-will company, for an indefinite period.

I further certify that the company has not been revoked or administratively dissolved by the State of West Virginia nor has the West Virginia Secretary of State issued a Certificate of Cancellation or Termination to the company.

Accordingly, I hereby issue this Certificate of Authorization

CERTIFICATE OF AUTHORIZATION

Validation ID:SWV3R_YA3BM

Given under my hand and the Great Seal of the State of West Virginia on this day of

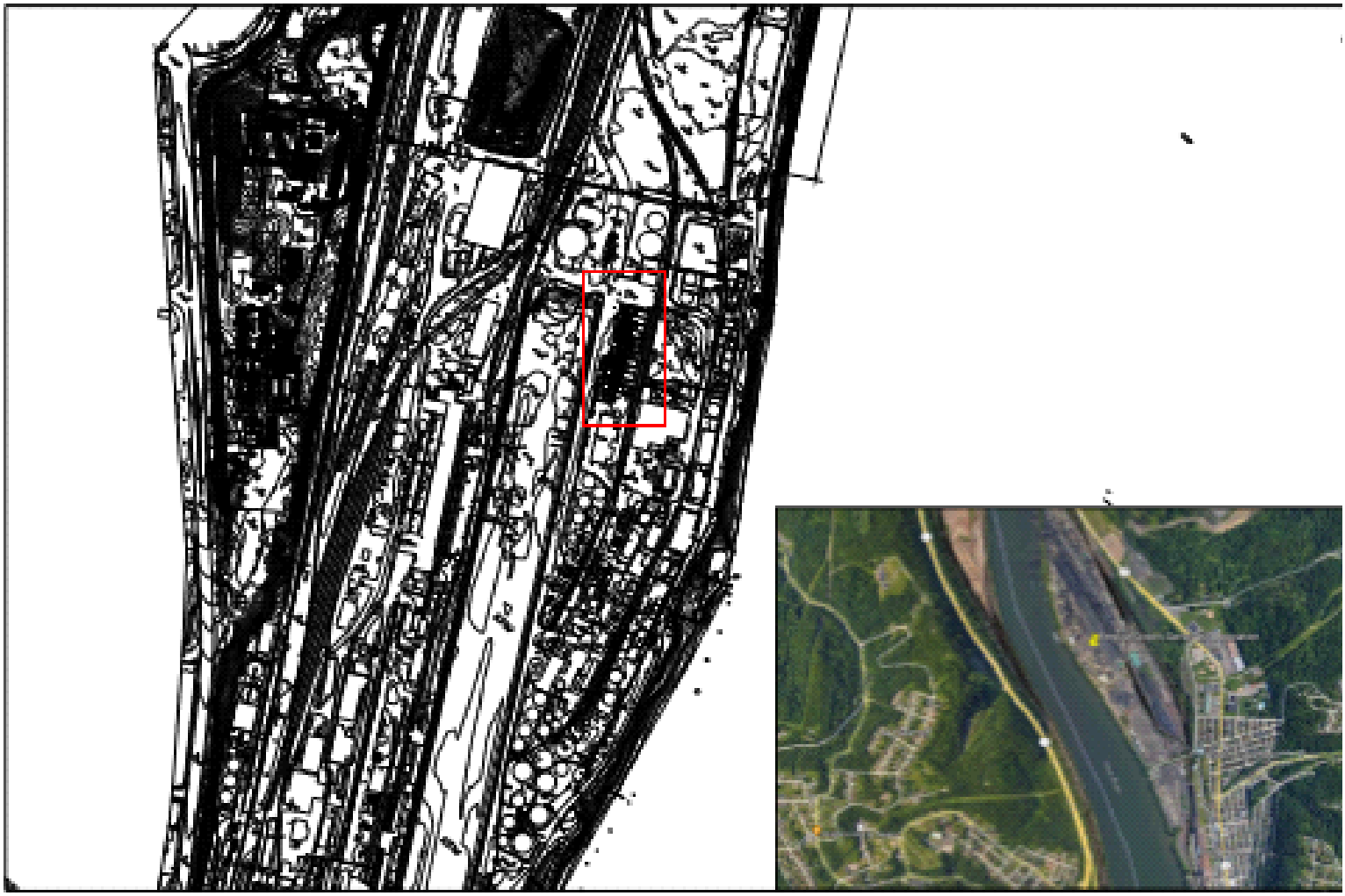
January 07, 2022

Mac Warner

Secretary of State

ATTACHMENT B

Maps



EMPIRE GREEN GENERATION, LLC
POLLANSBEE, WV
SITE MAP AND LAYOUT

ATTACHMENT C

Installation and Startup Schedule

ATTACHMENT C: INSTALLATION AND START UP SCHEDULE

Unit	Start of Installation	Approximate Start of Operations
RTO & 1000 (Thermal Oxidizer and Stack Exhaust)	October 2022	February 2024

ATTACHMENT D

Regulatory Discussion

1.1 West Virginia State Requirements

The Facility will be a minor source of emissions under the NSR Program as well as the Title V Operating Permit program under §45CSR30. However, the potential uncontrolled emissions for the Facility will exceed the permitting threshold of 6 pounds per hour (lb/hr) and/or 144 pounds per day (lb/day) in accordance with WVDEP §45CSR13-2.24. Accordingly, Empire Green Generation, LLC is submitting this application for a minor source permit to install and operate.

In addition to regulations, state regulations that pertain to this Facility are listed in Table 1-1. Titles shown in capital letters in the table are permits, notifications, and/or reports that will be needed for construction and operation of the Facility.

Federal authority is delegated to the State of West Virginia, and all permit applications will be submitted to West Virginia Department of Environmental Protection (WVDEP). The following list of air permits is applicable to the proposed facility:

Table 1-1 West Virginia DEP Applicable Regulations

Rule	Description
45CSR02	Control of visible and particulate emissions from stationary sources
45CSR06	Ambient Air Quality Standards
45CSR10	General emission limit provisions for sulfur dioxide
45CSR11	Prevention Of Air Pollution Emergency Episodes
45CSR13	Permits-to-Install New Sources and Permit-to-Install and Operate Program
45CSR17	Restrictions of emissions of fugitive dust
45CSR21	Control of emissions of VOCs from stationary sources

1.1.1 Permit Applicability

Air pollution control regulations have been established by the WVDEP for air emissions associated with stationary sources and fugitive emissions resulting from material transfer activities.

To determine permit applicability for the Facility's emission sources, the Potential-to-Emit (PTE) emissions have been presented in Attachment J and Permit Determination Form, the proposed Facility will be considered a minor source with potential uncontrolled PM emissions greater than 25 tons per year (tpy) and less than major source thresholds. Therefore, the Facility will need to obtain a permit to construct and operate. Applicable federal regulations present in Table 1-2 below.

Table 1-2 Federal Applicable Regulations

Rule	Description
40 CFR Part 60 Subpart JJJJ	Standards of Performance for Stationary Spark Ignition Internal Combustion Engines
40 CFR 60 Subpart A	General Provisions
40 CFR 60.18	General control device and work practice requirements

1.1.2 Criteria For Fuel

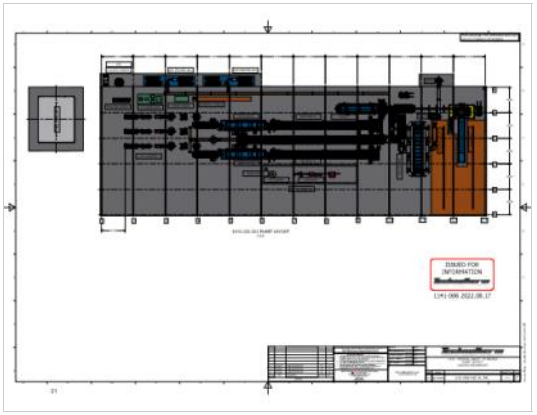
Processing the plastic feed stock is not viewed as a waste disposal through incineration, the plastics are being used as a fuel to create a syngas. The process for producing the syngas is through pyrolysis which is classified as an advanced recycling in West Virginia's House Bill 4048.

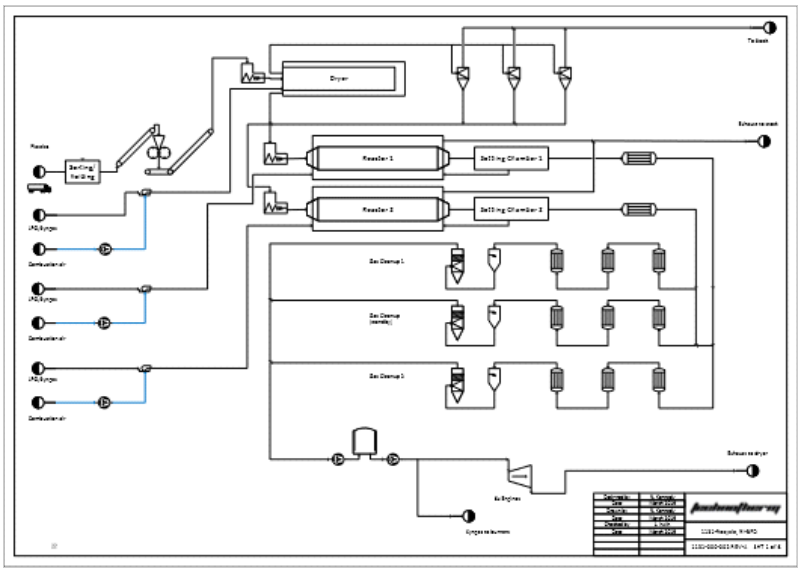
ATTACHMENT E

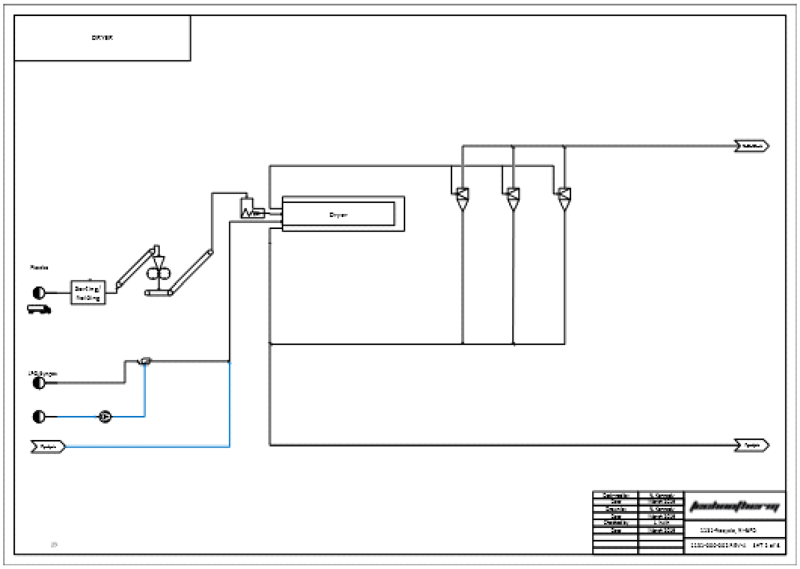
Plot Plan

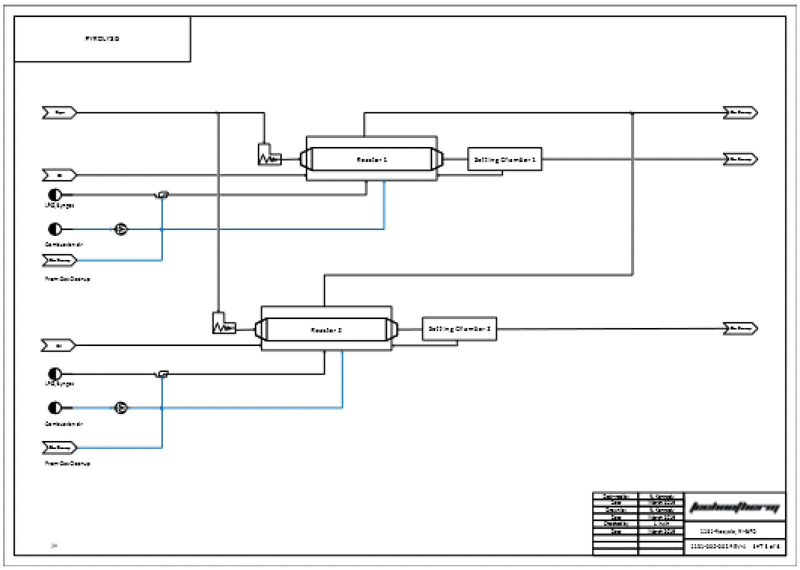
ATTACHMENT F

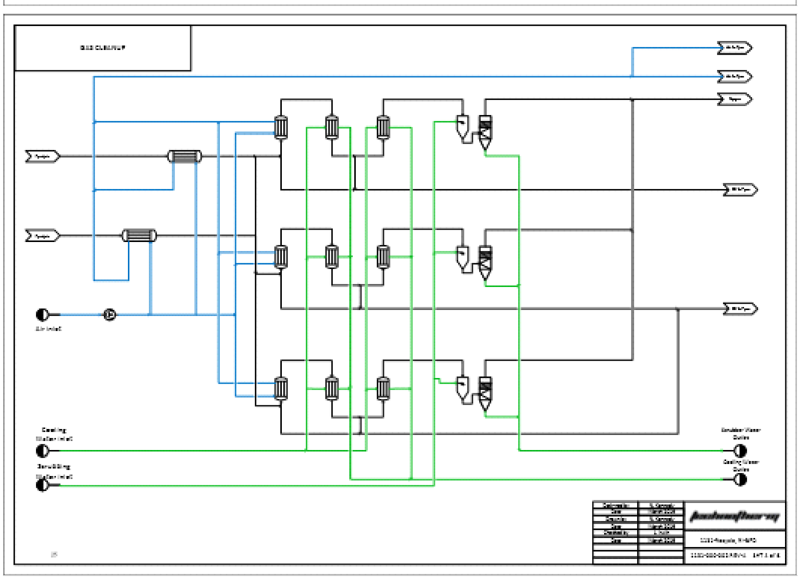
Process Flow Diagram

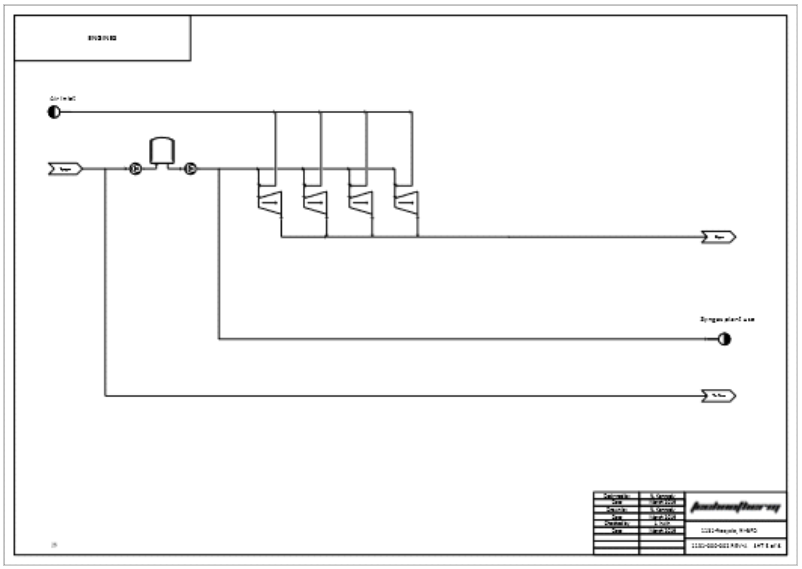


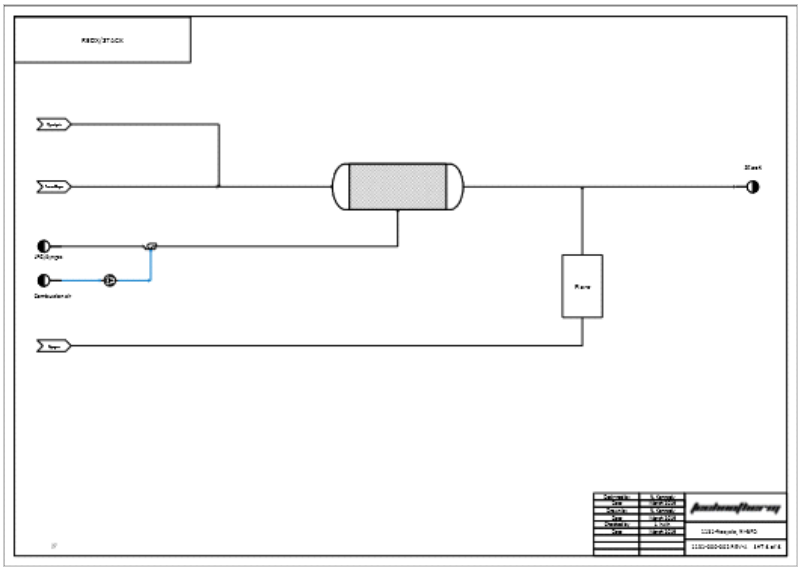



DRYER
Dryer


PYROLYSIS
Reactor 1
Settling Chamber 1
Reactor 2
Settling Chamber 2
Combustion Air
From Gas Cleanup


GAS CLEANUP
Air Inlet
Cooling Water Inlet
Scrubbing Water Inlet
Scrubber Water Outlet
Cooling Water Outlet





ATTACHMENT G

Process Description

REQUESTED REVISIONS

The following revisions from the original permit submittal are the following:

- All feedstock is now plastics, no medical waste will be processed through this system.
- Calorific value of the feed stock
- Plastics will be staged at a separate facility and brough on site as needed.
- Hydrochloric Acid (HCL) truck loading and associated scrubber system details added.

1. *PRE-PROCESSING HANDLING*

Feedstock will be sourced from recyclers, manufacturing, and plastic producers. Referring to Figure 1, Plastics will be received at an offsite location located in the state of Ohio. The plastics will be sorted by hand and sent to a shredder, the shredder is a diesel-powered generator which will be covered under an Ohio EPA General Air Permit 8.14. The plastics will be shredded to 1" to 4" these pieces will then be baled or placed into super sacks and loaded onto trucks for delivery to the facility as needed. The trucks into the site will be controlled by Empire Green Generation and the anticipated truck traffic is to be 4-6 trucks a day entering into the site via Route 2 from the north.

Figure 1. Flow Diagram for Pre-Processing Handling

2. *GENERAL PROCESS DESCRIPTION*

Overall process takes plastics, received by a transporting company, and thermally processes it in a pyrolysis system operating at 800°C - 900°C (1,472°F - 2,1652°F). Waste composition will consist of plastics with resin numbers one through seven. Organic matter and hydrocarbons from the plastics are thermally decomposed without oxygen forming a syngas that can directly be used as a fuel source for electrical generating engines. Oil and tar are produced where the oil is recycled through the pyrolysis system to make more syngas and the tar is used to heat a vitrification system in which solids from the process are vitrified and made inert. The electrical generator's exhausts from the engines are sent to a drying unit where the plastic is dried prior to be introduced into the pyrolysis system. All exhaust gasses are sent to a Thermal Oxidizer where they are conditioned for release to atmosphere via a stack at a temperature of 880°C (1,562°F).

3. *DETAILED PROCESS DESCRIPTION*

Referring to Figure 2 below, a detailed description of the process follows where Plastics (#100) is received, sent to Staging (#120) and then to the Macerator (#200). Macerator (#200) operating at negative pressure of -0.034 kilopascals (kPa) reduces the Plastics to less than or equal to 20 mm (0.78-inch). Plastics (#100) moves from the Macerator (#200) to the Dryer (#220) and is dried from the exhaust of the four (4) Engines (#600). Once the Plastics (#100) is dried, it moves to the Feed Silo (#240) through load lock valves. When the Pyrolysis (#300) system is ready to accept feed, load locking valves are actuated such that the feed in put into the Pre-Pyrolysis (#300) system. Coordinated valve actuation is used to keep oxygen level from air below 2.0% in the Pre-Pyrolysis (#300) and Pyrolysis (#350) system. Chlorides are driven off in the Pre- Pyrolysis (#300) and processed into hydrochloric acid to be sold. As plastics (#100) is being processed in the Pyrolysis (#350) system, organic matter and hydrocarbons are thermally decomposed forming syngas and moves to the Gas Cleanup (#400). The Gas Cleanup (#400) removes particulate matter and performs the bulk of neutralizing acid forming gases. Next, the gas passes to the Scrubber (#420) where any acid gasses are further removed from the syngas. The syngas then proceeds to the Gasometer (#500) which helps regulate the pressure in the Engine (#600). Syngas is combusted in the Engine (#600) and the exhaust is sent to Dryer (#220). Exhaust from the dryer is diverted through the Cyclone (#620) and then to the Feed Silo (#240). The Vitrifier (#800) exhaust flows to the Pyrolysis (#300) system, then makes a single pass through the outer chamber of the Pyrolyser (#300) system where additional heat is provided. Next the gases flow through the Dryer (#220). Gases from the Dryer (#220) outlet is sent to the Thermal Oxidizer (TO) (#900) through Cyclone (#620). Tar (#720) is mixed with Air (#820) and heats the Vitrifier (#800) sufficiently to make an inert solid product (#840) which is ready for disposal. Oil (#700) is continuously recycled through the Pyrolysis (#300) system. Off-gas from the Thermal Oxidizer (#900) are sent through the Stack (#1000), which includes and emergency flare, prior to being released into the atmosphere.

Figure 2. Block flow diagram for detailed process description.

SUB-SYSTEM OPERATION PHASE EQUIPMENT DETAIL

Waste Equipment & Systems
The following descriptions supplements the Process Flow Diagrams (PFDs) shown in Figure 1.

1. Delivery of Wastes
   The material will be offloaded from five (5) tractor-trailers per day and tipped onto the receiving conveyor with the use of bin tipping stations as shown in Figure 2.

Figure 2: Illustration of typical bin tipping station

The waste operator will record the weight of each load prior to tipping. Additionally, a weighbridge operator records the weight of the trucks as they enter and exit the plant.

The material will automatically feed the Macerator required and dictated by the plant control philosophy.

An air extraction system is built into the Macerator with an extraction fan pulling from the topside of the Macerator at a rate of 1.2 m³/sec. Macerator will be under negative pressure of -0.024 kPa at all times during operations.

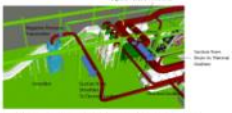


Figure 4: Negative Pressure from Macerator to Thermal Oxidiser.
Note all areas prior to thermal degradation are sealed and under negative pressure.

Further detail, qualifying waste in prepared sealed containers are delivered to the plant and placed on an input conveyor. After placing on the conveyor operator has no further involvement with the waste.

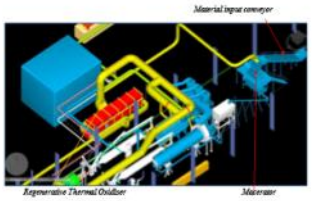


Figure 5.

2. Materials input conveyor to Macerator under negative pressure to Thermal Oxidiser.

   The shredder / macerator has a single opening that is sealed, allowing the waste to enter as presented through a single entry point under suction that is closed when waste is not presented for an extended period or during shut down mode.

   The entire facility is closed to the operating environment and operates under a negative pressure (-0.024 kPa), ensuring no escape of odors or pathogens.

   Transfer from the Macerator to the dryer and from the dryer to the thermal pre-cyclister is also sealed to the environment operating under a negative pressure.

Progression to the high temperature pyrolysis unit (Fig. 3) is again sealed.

The main item that is creating a negative pressure is an Induced Draft Fan. This fan is connected to the regenerative thermal oxidiser, from the thermal oxidiser to the Macerator, dryer and all material interfaces.

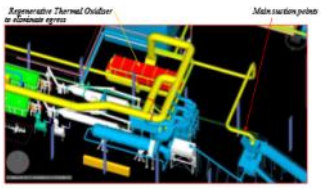


Figure 6. The Regenerative thermal oxidiser is maintained at 650°C.

2.1 Interlocks: The plant cannot be energized unless the ID fan is on and the Thermal oxidiser at temperature. There is no possibility of odors.

If the Thermal Oxidize goes below a predetermined temperature, the plant goes into shut down mode. In the event of a power failure the main control functions are connected via UPS. At this time a normally closed solenoid valve will have closed the only orifice on the plant which is where the waste is admitted.
In the unlikely event of an ID fan failure (never had one in 28 years) the plant will again default to shut down mode.

2.2 Maceration Negative Pressure

Maceration material (feed stock) is conveyed to the thermal dryer feed hopper. Figure 6 shows a typical Maceration system.

Figure 7. Picture of a typical Maceration/Shredder system.

3. Thermal Dryer

The drying of the feed stock is carried out in a direct heated, parallel flow, rotary kiln drum type dryer using a combination of engine exhaust and, if necessary during start-up or unusual operating conditions, syngas and, as a last resort, propane.

Feed stock is transported from the dryer feed hopper into the dryer by means of a screw conveyor. Upon entering the dryer inner retort, the moist feed stock comes into direct contact with the parallel stream of hot

flue gases.

Lifters and progression plates ensure intimate contact between the feed stock and flue gas therefore facilitating efficient drying, sterilization and movement of feed stock along the retort. Once both feed stock and flue gases reach the closed end of the dryer they are discharged from the inner concentric retort into the outer retort and return to the entry end of the dryer, discharging 10% moisture level feed stock into an expansion chamber. Coarse dry feed stock falls to the bottom of the chamber forming a heap on the belt conveyor located beneath.

The flue gas exhaust, contaminated with light particulate feed stock material, is also discharged from the expansion chamber and ducted to a bank of cyclones where separation occurs. Fine particulate falls to the bottom of each cyclone and is discharged via rotary valves into a common screw conveyor. The screw conveyor discharges the fine product onto the belt conveyor joining the dryer exit material and fine product. The conveyor transfers the combined dry feed stock streams onto a conveyor feeding an intermediate storage hopper that feeds both Pyrolysers.

The cooled flue gas stream from the cyclones is directed to the Thermal

Oxidiser. 7 and 8 shows photos of a typical dryer in operation.

Figure 8. Photo of a typical dryer in operation from first floor level.

Figure 9. Photo of a typical dryer in operation from ground floor level.

4. Pyrolyser & Vitrification Furnace

Overview

The Pyrolyser train consists of two identical Pyrolysers. Per unit, the source of indirect heat is primarily hot exhaust flue gas from a vitrification furnace located beneath the pyrolyse retort. These hot flue gasses exit the Pyrolyse Retorts and then progress to the medium grade heat applications (Thermal Dryer and during start up Syngas Cooler and Tar Condenser). Supplemental heating of the pyrolyse retort is being provided by firing a portion of the cleaned syngas. Natural gas / LPG is available for initial startup or any start-up where insufficient syngas is available. After passing through the dryers the gas is progressed to the Thermal Oxidiser.

Detailed Description

Feed stock is transferred from the dryer to a live bottom screw hopper, which feed an inlet hopper complete with horizontal material feed screw. Material is fed from a gas-tight, storage hopper into the horizontal, concentric shaped, rotary drum Pyrolyser Retort by a rotary screw.

As the material passes through the pyrolysis reton, it undergoes thermal degradation releasing volatile organic syngas compounds that areEscharged from the retort. The crude syngas off-takes are collected into a common manifold that transfers the syngas to the syngas cleaning system.

The heavier particles, mainly comprising of ash and fixed carbon, collect in a specially designed high temperature de-acceleration chamber where the particles are collected and returned to the vitrification furnace.

The Pyrolysers must be designed and arranged such that no propensity for harmonic vibrations shall exist under any load condition and shall be complete with all ancillary equipment for safe, reliable and efficient operation, and be of proven design capable of the required continuous, intermittent and transient operation and be suitable for its intended location. The design and materials of construction shall take fully into account the location.

Ash and carbonaceous residue produced by the Pyrolysers drops off the dust from the aforementioned de-acceleration chamber screw conveyors, together with the main residue collected from the base of the Pyrolyser into a Vitrifier, a refractory lined furnace fired by recovered tars (described below in the syngas cleaning equipment). The heat liberated by burning the tars and oils is sufficient to heat the ash from the Pyrolysis units above their eutectic temperature with excess, preheated air to burn off the tars. The other is completely combusted into CO2 and H2O.

Figure 10, 11 and 2 show photos of Pyrolysers in operation.

Figure 10. Photo A of typical high temperature pyrolysis unit.

Figure 11. Photo B of typical high temperature pyrolysis unit.

Figure 12. Photo of typical low temperature pyrolysis unit.

5. Syngas Cleanup

Particulate Matter (PM) Cleanup

Raw syngas is removed from the Pyrolysis Retorts, as described above, and passes through a de-acceleration chamber and then hot cyclones. The cyclones are arranged for parallel flow to ensure maximum PM removal efficiency during startup and shutdown as the flow varies. PM drops to specially designed hot screw conveyors and from there is directed to the vitrification furnaces described above.

Syngas Coolers

The partially cleaned, still hot, flue gas flows next through stainless steel tubular syngas coolers. The cooler is in essence a Heat Exchanger which indirectly transfers heat from syngas to the combustion air heaters.

Tar Condensers

The syngas from the coolers described above flows to a stainless-steel shell & tube Heat Exchanger/cooler that is cooled by an air blower system. Tars are condensed out and drop into heated troughs, the heat source of which is engine exhaust. Hot condensed tar is pumped to the vitrification furnaces described above. The common installed spare set of coolers uses engine exhaust flue gas to heat the heat exchangers and thereby cause the tars to drop into the heated trough below.

Oil Condensers

The syngas from the tar condensers described above flows to a shell & tube Heat Exchanger/cooler that are cooled by water cooling system. Condensed oils, which also contain condensed water, are collected and re pumped to the combustion furnace described previously. The common installed spare set of coolers uses engine exhaust flue gas to heat the heat exchangers and thereby cause the oils to drop into the heated trough below.

Venturi Scrubbers

From the oil condensers the syngas flows through a high pressure drop Venturi Scrubber to remove any remaining PM.

Figure 13 and 14 show photos of a typical gas cleanup system in operation.

Figure 13. Photo A of a typical gas cleanup system in operation

Figure 14. Photo B of a typical gas clean up system in operation

Gas Bladder (Syngas Storage tank)

The syngas storage tank provides surge capacity of cleaned syngas to level out flow and composition variations. It shall be a bladder contained within a demarcated area. The bladder will operate with an internal pressure of 20 to 40 inches water gauge.

Figure 15 shows a typical gas bladder in operation.

Figure 15. Picture of typical gas bladder

Stack

The hot gasses progress through the stack in to the atmosphere after passing through the Thermal Oxidizer (discussed in next section).

6. Thermal Oxidizer

After passing through a scrubber the flue gasses enter a Thermal Oxidizer comprising of a rectangular box shaped furnace. The internal dimensions are determined by the total volume that needs to be raised to 850 °C and maintained for 2 seconds.

Figure 16 shows a typical Thermal Oxidizer in operation. Please refer to the technical specification file for more details if required.

Figure 16 Photo of a typical Thermal Oxidizer in operation

7. Syngas Engines

Each syngas engine shall be a fully packaged unit complete with all associated components and auxiliaries. These engines are of robust design and have been proven on low and medium calorific value gas fuels.

The engine package will be complete to allow the engine to start, synchronize, operate continuously at base or part load and shut down.

The syngas engines shall be assembled in containers as indicated on the plant layout. The containerised engines shall conform to a sound pressure level of 80 dBA (2003 Noise Regulations 1st Action Level) as measured one meter from the enclosure at 1no meter above floor level.

Notwithstanding the syngas clean up equipment and systems described in the Syngas Clean up Section above, the syngas engine exhaust systems shall be designed and installed such that they meet emissions standards as of the Commencement Date.

The Engine cooling will be by means of external radiators, they shall be designed and constructed with sufficient margin and spare surface area for the maximum heat rejection duty under all operational conditions.

The radiators shall incorporate features to minimize corrosion and erosion on the air and waterside and suitable provisions for cleaning and core replacement.

The radiators and all of their component parts shall be of proven design and arranged so as to minimize maintenance work.

Figure 17 and Figure 18 illustrates the containerized engines in production.

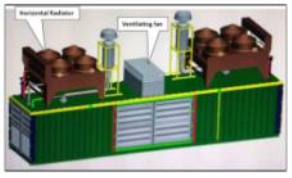


Figure 17: Illustration A of containerized engines in production

ATTACHMENT H

Material Data Safety Sheets (MSDSe)
Safety Data Sheets (SDSe)

DAKOTA GASIFICATION COMPANY

SAFETY DATA SHEET

Section 1: Identification

Product identifier

Product Name - Synthetic Natural Gas

Relevant identified uses of the substance or mixture and uses advised against

Recommended use • Fuel for combustion applications, raw material for chemical reactions

Details of the supplier of the safety data sheet

Manufacturer • Dakota Gasification
420 County Road 26
Beulah, ND 58523-8400
United States
www.dakotagas.com

Telephone (General) • 701-873-2100

Emergency Contact information

Email • DGCEmergency@bepc.com

Manufacturer • (701) 873-8600

CHEMTREC • 800-424-9300

Section 2: Hazard identification

United States (US)

According to OSHA 29 CFR 1910.1200 HCS

Classification of the substance or mixture

OSHA HCS 2012 • Flammable Gases 1 - H220
Compressed Gas - H280
Simple Asphyxiant

Label elements

OSHA HCS 2012

DANGER

Hazard statements • Extremely flammable gas - H220
Contains gas under pressure; may explode if heated - H280
May displace oxygen and cause rapid suffocation.

Precautionary statements

Prevention • Keep away from heat, sparks, open flames and/or hot surfaces. - No smoking. - P210

Response • Leaking gas fire: Do not extinguish, unless leak can be stopped safely. - P377
Eliminate all ignition sources if safe to do so. - P381

Storage/Disposal • Protect from sunlight. Store in a well-ventilated place. - P410+P403

Other hazards

OSHA HCS 2012 • Under United States Regulations (29 CFR 1910.1200 - Hazard Communication Standard), this product is considered hazardous.

Canada

According to WHMIS

Classification of the substance or mixture

WHMIS • Compressed Gas - A
Flammable Gases - B1

Label elements

WHMIS

• Compressed Gas - A
Flammable Gases - B1

Other hazards

WHMIS • This material is a simple asphyxiant. May displace or reduce oxygen available for breathing especially in confined spaces.
In Canada, the product mentioned above is considered hazardous under the Workplace Hazardous Materials Information System (WHMIS).

Section 3 - Composition/information on ingredients

Substances

• Material does not meet the criteria of a substance.

Mixtures

Composition

Chemical Name	Identifiers	%	LD50/LC50	Classification According to Regulation/Directive	Comments
Methane	CAS:74-82-8	98%	NDA	OSHA HCS 2012: Flam. Gas 1; Press. Gas - Comp. Gas; Asphyx.	NDA
Hydrogen	CAS:1333-74-0	1.1%	NDA	OSHA HCS 2012: Flam. Gas 1; Press. Gas - Comp. Gas; Asphyx.	NDA
Carbon dioxide	CAS:124-38-9	1.1%	Inhalation-Rat LC50 - 470000 ppm; 30 Minute(s)	OSHA HCS 2012: Press. Gas - Comp. Gas; Asphyx.	NDA

Section 4: First-Aid Measures

Description of first aid measures

Inhalation • IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Administer oxygen if breathing is difficult. Give artificial respiration if victim is not breathing. If signs/symptoms continue, get medical attention.

Skin • IF ON SKIN: Wash with plenty of soap and water. If skin irritation occurs: Get medical advice/attention. Wash contaminated clothing before reuse.

Eye • IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.

Ingestion • Ingestion is not anticipated to be a likely route of exposure to this product.

Most important symptoms and effects, both acute and delayed

• Refer to Section 11 - Toxicological Information.

Indication of any immediate medical attention and special treatment needed

Notes to Physician • All treatments should be based on observed signs and symptoms of distress in the patient. Consideration should be given to the possibility that overexposure to materials other than this product may have occurred.

Other information

• Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves. RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO GASES WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus must be worn. Victim(s) who experience any adverse effect after over-exposure to this gas mixture must be taken for medical attention. Rescuers should be taken for medical attention if necessary. Take a copy of the label and the MSDS to physician or other health professional with victim(s).

Section 5: Fire-Fighting Measures

Extinguishing media

Suitable Extinguishing Media • SMALL FIRES: Dry chemical or CO2.
LARGE FIRES: Water spray or fog.

Unsuitable Extinguishing Media • No data available

Special hazards arising from the substance or mixture

Unusual Fire and Explosion Hazards • EXTREMELY FLAMMABLE.
Will form explosive mixtures with air.
Vapors may travel to source of ignition and flash back.
Cylinders exposed to fire may vent and release flammable gas through pressure relief devices.
Containers may explode when heated.
Ruptured cylinders may rocket.

Burns with a pale, faintly luminous flame; air containing more than 14% methane burns without noise.

Hazardous Combustion Products
- No data available

Advice for firefighters
- Structural firefighters' protective clothing provides limited protection in fire situations ONLY; it is not effective in spill situations where direct contact with the substance is possible.
Wear positive pressure self-contained breathing apparatus (SCBA).
DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS LEAK CAN BE STOPPED.
Move containers from fire area if you can do it without risk.
FIRE: If tank, rail car or tank truck is involved in a fire, ISOLATE for 1600 meters (1 mile) in all directions; also, consider initial evacuation for 1600 meters (1 mile) in all directions.
FIRE INVOLVING TANKS: ALWAYS stay away from tanks engulfed in fire.
FIRE INVOLVING TANKS: Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
FIRE INVOLVING TANKS: Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
FIRE INVOLVING TANKS: Cool containers with flooding quantities of water until well after fire is out.
FIRE INVOLVING TANKS: Do not direct water at source of leak or safety devices; icing may occur.
FIRE INVOLVING TANKS: For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

Section 6 - Accidental Release Measures

Personal precautions, protective equipment and emergency procedures

Personal Precautions
- Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Do not walk through spilled material. Ventilate the area before entry.

Emergency Procedures
- ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). As an immediate precautionary measure, isolate spill or leak area for at least 100 meters (330 feet) in all directions. Stop leak if you can do it without risk. Keep unauthorized personnel away. Keep out of low areas. Stay upwind. LARGE SPILL: Consider initial downwind evacuation for at least 800 meters (1/2 mile) if uncontrolled leakage is encountered which cannot be stopped by shutting off the closest appropriate valve or main supply valve (without risk), implement a plan for evacuation and quickly contact the local fire department.

Environmental precautions
- Prevent spreading of vapors through sewers, ventilation systems and confined areas.

Methods and material for containment and cleaning up

Containment/Clean-up Measures
- All equipment used when handling the product must be grounded.
Stop leak if you can do it without risk.
If possible, turn leaking containers so that gas escapes rather than liquid.
Use water spray to reduce vapors; do not put water directly on leak, spill area or inside container.
Do not direct water at spill or source of leak.
Isolate area until gas has dispersed.

Section 7 - Handling and Storage

Precautions for safe handling

Handling
- Keep away from heat and ignition sources – No Smoking. Take precautionary measures against static charges. All equipment used when handling the product must be grounded. Use only non-sparking tools. Use only with adequate ventilation. Ventilate closed spaces before entering. Be aware of any signs of dizziness or fatigue, especially if work is done in a poorly ventilated area; exposures to fatal concentrations of this gas mixture could occur without any significant warning symptoms, due to olfactory fatigue or oxygen deficiency. Cylinders should be firmly secured to prevent falling or being knocked-over. Use explosion-proof – electrical, ventilating and/or lighting equipment. Do not attempt to repair, adjust, or in any other way modify cylinders. If there is a malfunction or another type of operational problem, contact nearest distributor immediately. Empty containers retain product residue and can be hazardous. Do not cut, weld, puncture or incinerate container.

Conditions for safe storage, including any incompatibilities

Storage
- Cylinders should be stored in dry, well-ventilated areas away from sources of heat, ignition and direct sunlight. Do not allow area where cylinders are stored to exceed 52C (125F). Cylinders must be protected from the environment, and preferably kept at room temperature approximately 21C (70F). Protect cylinders against physical damage. Cylinders should be firmly secured to prevent falling or being knocked-over. Store locked up.

Section 8 - Exposure Controls/Personal Protection

Control parameters

		Exposure Limits/Guidelines		
	Result	ACGIH	NIOSH	OSHA
Carbon dioxide (124-38-9)	TWA	5000 ppm TWA	5000 ppm TWA 9000 mg/m3 TWA	5000 ppm TWA 9000 mg/m3 TWA
	STEL	30000 ppm STEL	30000 ppm STEL, 54000 mg/m3 STEL	Not established
Methane (74-82-8)	TWA	1000 ppm TWA (listed under Aliphatic hydrocarbon gases - Alkane C1-4)	Not established	Not established

Exposure controls

Engineering Measures/Controls
- Good general ventilation should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. Use explosion-proof - electrical, ventilating and/or lighting equipment.

Personal Protective Equipment

Respiratory
- Follow the OSHA respirator regulations found in 29 CFR 1910.134. Use a NIOSH/MSHA approved respirator if exposure limits are exceeded or symptoms are experienced.

Eye/Face
- Wear safety glasses.

Skin/Body
- Wear leather gloves when handling cylinders.

Environmental Exposure Controls
- Follow best practice for site management and disposal of waste. Controls should be engineered to prevent release to the environment, including procedures to prevent spills, atmospheric release and release to waterways.

Key to abbreviations

ACGIH = American Conference of Governmental Industrial Hygiene
NIOSH = National Institute of Occupational Safety and Health
OSHA = Occupational Safety and Health Administration
STEL = Short Term Exposure Limits are based on 15-minute exposures
TWA = Time-Weighted Averages are based on 8-hour, 40-hours exposures

Section 9 - Physical and Chemical Properties

Information on Physical and Chemical Properties

Material Description			
Physical Form	Gas	Appearance/Description	Colorless gas with a mild sweet odor
Color	Colorless	Odor	Mild, sweet
Odor Threshold	200 ppm		
General Properties			
Boiling Point	-258.5(-217.3 F) -161.4 C)	Melting Point	-296.5 F(-182.5 C)
Decomposition Temperature	No data available	pH	Not relevant
Specific Gravity/Relative Density	0.422 Water=1 @ -160 C(-256 F) (liquid)	Bulk Density	No data available
Water Solubility	Slightly Soluble	Viscosity	No data available
Explosive Properties	No data available	Oxidizing Properties	No data available
Volatility			
Vapor Pressure	Very high	Vapor Density	0.416 lb/ft3 68.4in/l
Evaporation Rate	No data available	Volatiles (Vol.)	100 %
Flammability			
Flash Point	-306 F(-187 77'F) C)	LEL	5 %
UEL	15 %	Autoignition	999 F(537.2222 C)
Flammability (solid, gas)	Flammable Gas		
Environmental			
Octanol/Water Partition Coefficient	No data available		

Section 10: Stability and Reactivity

Reactivity
- No dangerous reaction known under conditions of normal use.

Chemical stability
- Stable.

Possibility of hazardous reactions
- Hazardous polymerization will not occur.

Conditions to avoid
- Incompatible materials. Avoid contact with heat and ignition sources. Excess heat.

Incompatible materials
- Reacts violently with powerful oxidizers (e.g. bromine pentafluoride, chlorine trifluoride, chlorine, fluorine, iodine heptafluoride, dioxygenyl tetrafluoroborate, dioxygen difluoride, trioxygen difluoride, liquid oxygen.

Hazardous decomposition products
- No data available

Section 11 - Toxicological Information

Information on toxicological effects

Component		
Methane (96%)	No Data	**Acute Toxicity:** Inhalation-Mouse LC50 - 326 g/m³ 2 Hour(s)
Carbon Dioxide (4.1%)	124-38-9	**Acute Toxicity:** Inhalation-Rat LC50 - 470000 ppm 30 Minute(s) Inhalation-Human TCLo - 7 pph **Behavioral:** Irritability. **Brain and Coverings:** Other degenerative changes. **Nutritional and Gross Metabolic Changes:** Hypothermia or temperature body temperature decrease. **Reproductive:** Inhalation-Rat TCLo - 6 ppm 24 Hour(s) 100 preg). **Reproductive Effects Specific Developmental Abnormalities Musculoskeletal system. Reproductive effects Specific Developmental Abnormalities Cardiovascular (circulatory) system. Reproductive Effects Specific Developmental Abnormalities Respiratory system**

GHS Properties	Classification
Acute toxicity	DSHA HCS 2012•Data lacking
Aspiration Hazard	DSHA HCS 2012•Data lacking
Carcinogenicity	DSHA HCS 2012•Data lacking
Germ Cell Mutagenicity	DSHA HCS 2012•Data lacking
Skin corrosion/irritation	DSHA HCS 2012•Data lacking
Skin sensitization	DSHA HCS 2012•Data lacking
STOT-RE	DSHA HCS 2012•Data lacking
STOT-SE	DSHA HCS 2012•Data lacking
Toxicity for Reproduction	DSHA HCS 2012•Data lacking
Respiratory sensitization	DSHA HCS 2012•Data lacking
Serious eye damage/irritation	DSHA HCS 2012•Data lacking

Potential Health Effects

Inhalation

Acute (immediate)
- This material is a simple asphyxiant. May displace or reduce oxygen available for breathing especially in confined spaces. If this material is released in a small, poorly ventilated area (i.e. an enclosed or confined space), an oxygen-deficient environment may occur. Individuals breathing such an atmosphere may experience symptoms which include headaches, ringing in ears, dizziness, drowsiness, unconsciousness, nausea, vomiting, and depression of all the senses. Under some circumstances of over-exposure, death may occur. The following effects associated with decreased levels of oxygen: increase in breathing and pulse rate, emotional upset, abnormal fatigue, nausea, vomiting, collapse, loss of consciousness, convulsive movements, respiratory collapse and death.

Chronic (delayed):
- No data available

Skin

Acute (immediate)
- Under normal conditions of use, no health effects are expected.

Chronic (delayed):
- No data available

Eye

Acute (immediate)
- Under normal conditions of use, no health effects are expected.

Chronic (delayed):
- No data available

Ingestion

Acute (immediate)
- Under normal conditions of use, no health effects are expected.

Chronic (delayed):
- No data available

Key to abbreviations
LC = Lethal Concentration
TD = Toxic Dose or Dosage

Section 12 - Ecological Information

Toxicity
- Material data lacking.

Persistence and degradability
- Material data lacking.

Bioaccumulative potential
- Material data lacking.

Mobility in Soil
- Material data lacking.

Results of PBT and vPvB assessment
- PBT and vPvB assessment has not been conducted for this material.

Other adverse effects
- No studies have been found.

Section 13 - Disposal Considerations

Waste treatment methods

Product waste
- Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

Packaging waste
- Dispose of content and/or container in accordance with local, regional, national, and/or international regulations.

Section 14 - Transport information

	UN number	UN proper shipping name	Transport hazard class(es)	Packing group	Environmental hazards
DOT	UN1964	Compressed gas, flammable, n.o.s. (Methane and Hydrogen)	2.1	NDA	NDA
TDG	UN1964	COMPRESSED GAS, FLAMMABLE, N.O.S.(Methane and Hydrogen)	2.1	NDA	Potential Marine Pollutant
MTC/IMDG	UN1964	Compressed gas, flammable, n.o.s. (Methane and Hydrogen)	2.1	NDA	NDA

Special precautions for user
- Cylinders should be transported in a secure position, in a well-ventilated vehicle. The transportation of compressed gas cylinders in automobiles or in closed-body vehicles

can present serious safety hazards. If transporting these cylinders in vehicles, ensure these cylinders are not exposed to extremely high temperatures (as may occur in an enclosed vehicle on a hot day). Additionally, the vehicle should be well-ventilated during transportation.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code
- No data available

Section 15 - Regulatory Information

Safety, health and environmental regulations/legislation specific for the substance or mixture

SARA Hazard Classifications
- Acute, Fire, Pressure/Sudden Release of)

Inventory						
Component	CAS	Canada DSL	Canada NDSL	EU EINECS	EU ELINCS	Korea KECL
Carbon dioxide	124-38-9	Yes	No	Yes	No	Yes
Hydrogen	1333-74-0	Yes	No	Yes	No	Yes
Methane	74-82-8	Yes	No	Yes	No	Yes

Canada

Labor

Canada - WHMIS - Classifications of Substances

•Hydrogen	1333-74-0	A, B1
•Carbon dioxide	124-38-9	A, Uncontrolled product according to WHMIS classification criteria (solid)
•Methane	74-82-8	A, B1

Canada - WHMIS - Ingredient Disclosure List

•Hydrogen	1333-74-0	Not Listed
•Carbon dioxide	124-38-9	1%
•Methane	74-82-8	Not Listed

Environment

Canada - CEPA - Priority Substances List

•Hydrogen	1333-74-0	Not Listed
•Carbon dioxide	124-38-9	Not Listed
•Methane	74-82-8	Not Listed

United States

Labor

U.S. - OSHA - Process Safety Management - Highly Hazardous Chemicals

•Hydrogen	1333-74-0	Not Listed
•Carbon dioxide	124-38-9	Not Listed
•Methane	74-82-8	Not Listed

U.S. - OSHA - Specifically Regulated Chemicals

•Hydrogen	1333-74-0	Not Listed
•Carbon dioxide	124-38-9	Not Listed
•Methane	74-82-8	Not Listed

Environment

U.S. - CAA (Clean Air Act) - HAP Hazardous Air Pollutants

•Hydrogen	1333-74-0	Not Listed
•Carbon dioxide	124-38-9	Not Listed

•Methane	74-82-8	Not Listed
U.S. - CERCLA/SARA - Hazardous Substances and their Reportable Quantities		
•Hydrogen	1333-74-0	Not Listed
•Carbon dioxide	124-38-9	Not Listed
•Methane	74-82-8	Not Listed
U.S. - CERCLA/SARA - Radionuclides and Their Reportable Quantities		
•Hydrogen	1333-74-0	Not Listed
•Carbon dioxide	124-38-9	Not Listed
•Methane	74-82-8	Not Listed
U.S. - CERCLA/SARA - Section 302 Extremely Hazardous Substances EPCRA RQs		
•Hydrogen	1333-74-0	Not Listed
•Carbon dioxide	124-38-9	Not Listed
•Methane	74-82-8	Not Listed
U.S. - CERCLA/SARA - Section 302 Extremely Hazardous Substances TPQs		
•Hydrogen	1333-74-0	Not Listed
•Carbon dioxide	124-38-9	Not Listed
•Methane	74-82-8	Not Listed
U.S. - CERCLA/SARA - Section 313 - Emission Reporting		
•Hydrogen	1333-74-0	Not Listed
•Carbon dioxide	124-38-9	Not Listed
•Methane	74-82-8	Not Listed
U.S. - CERCLA/SARA - Section 313 - PBT Chemical Listing		
•Hydrogen	1333-74-0	Not Listed
•Carbon dioxide	124-38-9	Not Listed
•Methane	74-82-8	Not Listed
Inventory - United States - Section 8(b) Inventory (TSCA) - PMN Number to EPA Accession Number Link		
•Hydrogen	1333-74-0	Not Listed
•Carbon dioxide	124-38-9	Not Listed
•Methane	74-82-8	Not Listed

United States - California

Environment		
U.S. - California - Proposition 65 - Carcinogens List		
•Hydrogen	1333-74-0	Not Listed
•Carbon dioxide	124-38-9	Not Listed
•Methane	74-82-8	Not Listed
U.S. - California - Proposition 65 - Developmental Toxicity		
•Hydrogen	1333-74-0	Not Listed
•Carbon dioxide	124-38-9	Not Listed
•Methane	74-82-8	Not Listed
U.S. - California - Proposition 65 - Maximum Allowable Dose Levels (MADL)		
•Hydrogen	1333-74-0	Not Listed
•Carbon dioxide	124-38-9	Not Listed
•Methane	74-82-8	Not Listed
U.S. - California - Proposition 65 - No Significant Risk Levels (NSRL)		
•Hydrogen	1333-74-0	Not Listed
•Carbon dioxide	124-38-9	Not Listed
•Methane	74-82-8	Not Listed
U.S. - California - Proposition 65 - Reproductive Toxicity - Female		
•Hydrogen	1333-74-0	Not Listed
•Carbon dioxide	124-38-9	Not Listed
•Methane	74-82-8	Not Listed
U.S. - California - Proposition 65 - Reproductive Toxicity - Male		
•Hydrogen	1333-74-0	Not Listed
•Carbon dioxide	124-38-9	Not Listed
•Methane	74-82-8	Not Listed

Section 16 - Other information

Last Revision Date • 02/October/2018
Preparation Date • 01/October/2014

Key to abbreviations
NDA=No data available

Disclaimer/Statement of Liability • The information contained in this Safety Data Sheet (SDS) is believed to be correct since it was obtained from sources we believe are reliable. However no representation, guarantees or warranties of any kind are made as to its accuracy, suitability for particular applications, hazards connected with the use of the material, or the results to be obtained from the use thereof. User assumes all risks and liability of any use, processing or handling of any material, variations in methods, conditions and equipment used to store, handle, or process the material and hazards connected with the use of the material are solely the responsibility of the user and remain at his sole discretion. Compliance with all applicable federal, state, and local laws and regulations remains the responsibility of the user, and the user has the responsibility to provide a safe work place to examine all aspects of its operation and to determine if or where precautions, in addition to those described herein, are required.

MATHESON
Gas Professionals

Safety Data Sheet

Material Name: Propane – UN1075 Specific SDS ID: 002480010

Section 1 - PRODUCT AND COMPANY IDENTIFICATION

Material Name
Propane – UN1075 Specific
Synonyms
INDUSTRIAL PROPANE; MTG MSDS 'St; N-PROPANE; DIMETHYLMETHANE; PROPYL HYDRIDE; R-290; PROPYLHYDRIDE; LIQUEFIED PETROLEUM GAS; LPG; >96% NATURAL GRADE; >99.9% PURE GRADE; UN 1978 ; CSD)
Chemical Family
Hydrocarbons, aliphatic
Product Description
Classification determined in accordance with Compressed Gas Association standards
Product Use
Industrial and Specialty Gas Applications.
Restrictions on Use
None known.
Details of the supplier of the safety data sheet
MATHESON TRI-GAS, INC
959 Lake Carolyn Parkway
Suite 1500
Irving, TX 75039
General Information: 1-800-416-2505
Emergency: 1-800-424-9300 (CHEMTREC)
Outside the US: 703-527-3887 (Call Collect)

Section 2 - HAZARDS IDENTIFICATION

Classification in accordance with paragraph (d) of 29 CFR 1910.1200.
Flammable Gases - Category 1
Gases Under Pressure - Liquefied gas
Simple Asphyxiant
GHS Label Elements
Symbol(s)

Signal Word
Danger
Hazard Statement(s)
Extremely flammable gas.
Contains gas under pressure; may explode if heated.
May displace oxygen and cause rapid suffocation.
Precautionary Statement(s)
Prevention
Keep away from heat/sparks/open flame/hot surfaces - No smoking.
Response

Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
Eliminate all ignition sources if safe to do so.
Storage
Protect from sunlight. Store in a well-ventilated place.
Disposal
Dispose of contents/container in accordance with local/regional/national/international regulations.
Other Hazards
May cause frostbite upon sudden release of liquefied gas.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

CAS	Component Name	Percent
74-98-6	Propane	>96

Section 4 - FIRST AID MEASURES

Inhalation
If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. Get immediate medical attention.
Skin
If frostbite or freezing occur, immediately flush with plenty of lukewarm water (105-115°F; 41-46°C). DO NOT USE HOT WATER. If warm water is not available, gently wrap affected parts in blankets. Get immediate medical attention.
Eyes
Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Then get immediate medical attention.
Ingestion
If swallowed, get medical attention.
Most Important Symptoms/Effects
Acute
frostbite, suffocation
Delayed
No information on significant adverse effects.
Indication of any immediate medical attention and special treatment needed
For inhalation, consider oxygen. Treat symptomatically and supportively.

Section 5 - FIRE FIGHTING MEASURES

Extinguishing Media
Suitable Extinguishing Media
regular dry chemical, carbon dioxide, Large fires: water spray or fog
Unsuitable Extinguishing Media
Do not direct water at source of leak or safety devices; icing may occur.
Special Hazards Arising from the Chemical
Severe fire hazard. Severe explosion hazard. Gas/air mixtures are explosive. The vapor is heavier than air. Vapors or gases may ignite at distant ignition sources and flash back. Electrostatic discharges may be generated by flow or agitation resulting in ignition or explosion.
Hazardous Combustion Products
Oxides of carbon
Fire Fighting Measures

Move container from fire area if it can be done without risk. Cool containers with water spray until well after the fire is out. Apply water from a protected location or from a safe distance. Stay away from the ends of tanks. For fires in cargo or storage area: Cool containers with water from unmanned hose holder or monitor nozzles until well after fire is out. If this is impossible then take the following precautions: Keep unnecessary people away, isolate hazard area and deny entry. Let the fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tanks due to fire. For tank, rail car or tank truck: Evacuation radius: 1600 meters (1 mile). Stop leak if possible without personal risk. Let burn unless leak can be stopped immediately. For smaller tanks or cylinders, extinguish and isolate from other flammables.
Special Protective Equipment and Precautions for Firefighters
Wear full protective fire fighting gear including self-contained breathing apparatus (SCBA) for protection against possible exposure.

Section 6 - ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures
Wear personal protective clothing and equipment. See Section 8.
Methods and Materials for Containment and Cleaning Up
Avoid heat, flames, sparks and other sources of ignition. All equipment used when handling the product must be grounded. Remove sources of ignition. Do not touch or walk through spilled material. Stop leak if possible without personal risk. If possible, turn leaking containers so that gas escapes rather than liquid. Use water spray to reduce vapors or divert vapor cloud drift. Avoid allowing water runoff to contact spilled material. Do not direct water at spill or source of leak. Keep unnecessary people away, isolate hazard area and deny entry. Ventilate closed spaces before entering.
Environmental Precautions
Avoid release to the environment.

Section 7 - HANDLING AND STORAGE

Precautions for Safe Handling
Keep away from heat, sparks, open flames, and hot surfaces. - No smoking. Avoid breathing dust/fume/gas/mist/vapors/spray. Use only outdoors or in a well-ventilated area. Wash hands thoroughly after handling. Close valve after each use and when empty. Never put cylinders into unventilated areas of passenger vehicles. Do not open valve until connected to equipment prepared for use.
Conditions for Safe Storage, Including any Incompatibilities
Protect from sunlight. Store in a well-ventilated place.
Store and handle in accordance with all current regulations and standards. Keep container tightly closed. Grounding and bonding required. Keep separated from incompatible substances.
Incompatible Materials
combustible materials, oxidizing materials

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

Component Exposure Limits

Propane	74-98-6
ACGIH:	(See Appendix F: Minimal Oxygen Content, asphixiate hazard.)
NIOSH:	1000 ppm TWA; 1800 mg/m3 TWA
	2100 ppm IDLH (10% LEL)
OSHA (US):	1000 ppm TWA; 1800 mg/m3 TWA

Mexico:	1000 ppm TWA [VLE-PPT]

ACGIH - Threshold Limit Values - Biological Exposure Indices (BEI)
There are no biological limit values for any of this product's components.
Engineering Controls
Ventilation equipment should be explosion-resistant if explosive concentrations of material are present. Provide local exhaust ventilation system. Ensure compliance with applicable exposure limits. Use a back flow preventive device in the piping.
Individual Protection Measures, such as Personal Protective Equipment
Eye/face protection
For the gas: Eye protection not required, but recommended. For the liquid: Wear splash resistant safety goggles. Contact lenses should not be worn. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.
Skin Protection
For the gas: Protective clothing is not required. For the liquid: Wear appropriate protective, cold insulating clothing.
Respiratory Protection
The following respirators and maximum use concentrations are drawn from NIOSH and/or OSHA. 2000 ppm: Any supplied-air respirator. Any self-contained breathing apparatus with a full facepiece. Emergency or planned entry into unknown concentrations or IDLH conditions: - Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode. Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode. Escape: - Any appropriate escape-type, self-contained breathing apparatus.
Glove Recommendations
Wear insulated gloves.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

Appearance	colorless gas	**Physical State**	gas
Odor	gasoline odor	**Color**	colorless
Odor Threshold	5000 - 20000 ppm	**pH**	Not available
Melting Point	-189 °C (-308 °F)	**Boiling Point**	-49 °C (-40 °F)
Boiling Point Range	Not available	**Freezing point**	Not available
Evaporation Rate	Not available	**Flammability (solid, gas)**	Flammable gas
Autoignition Temperature	450 °C (842 °F)	**Flash Point**	-105 °C (-157 °F)
Lower Explosive Limit	2.1 %	**Decomposition temperature**	Not available
Upper Explosive Limit	9.5 %	**Vapor Pressure**	4398 mmHg @ 21.1 °C
Vapor Density (air=1)	1.55	**Specific Gravity (water=1)**	0.5033 at -45 °C

Water Solubility	Very slightly soluble	Partition coefficient: n-octanol/water	Not available
Viscosity	Not available	Kinematic viscosity	Not available
Solubility (Other)	Not available	Density	Not available
Log KOW	2.36	Physical Form	Liquefied gas
Molecular Formula	C-H3-C-H2-C-H3	Molecular Weight	44.11
Critical Temperature	96.74 °C		

Solvent Solubility
Soluble
absolute alcohol, ether, chloroform, benzene, turpentine

Section 10 - STABILITY AND REACTIVITY

Reactivity
No reactivity hazard is expected.
Chemical Stability
Stable at normal temperatures and pressure
Possibility of Hazardous Reactions
Will not polymerize.
Conditions to Avoid
Avoid heat, flames, sparks and other sources of ignition. Minimize contact with material. Containers may rupture or explode if exposed to heat.
Incompatible Materials
combustible materials, oxidizing materials.
Hazardous decomposition products
Oxides of carbon

Section 11 - TOXICOLOGICAL INFORMATION

Information on Likely Routes of Exposure
Inhalation
nausea, suffocation, vomiting, irregular heartbeat, headache, drowsiness, dizziness, disorientation, mood swings, loss of coordination, convulsions, unconsciousness, coma
Skin Contact
Blisters, frostbite
Eye Contact
frostbite, blurred vision
Ingestion
ingestion of a gas is unlikely
Acute and Chronic Toxicity
Component Analysis - LD50/LC50
The components of this material have been reviewed in various sources and the following selected endpoints are published:
Propane (74-98-6)
Inhalation LC50 Rat >800000 ppm 15 min

Product Toxicity Data
Acute Toxicity Estimate

Inhalation - Gas	> 20000 ppm

Immediate Effects
frostbite, suffocation
Delayed Effects
No information on significant adverse effects.
Irritation/Corrosivity Data
No data available.
Respiratory Sensitization
No data available.
Dermal Sensitization
No data available.
Component Carcinogenicity
None of this product's components are listed by ACGIH, IARC, NTP, DFG or OSHA.
Germ Cell Mutagenicity
No data available.
Teratogenic Data
No data available.
Reproductive Toxicity
No data available.
Specific Target Organ Toxicity - Single Exposure
No target organs identified.
Specific Target Organ Toxicity - Repeated Exposure
No target organs identified.
Aspiration hazard
Not applicable.
Medical Conditions Aggravated by Exposure
None known.
Additional Data
Stimulants such as epinephrine may induce ventricular fibrillation.

Section 12 - ECOLOGICAL INFORMATION

Component Analysis - Aquatic Toxicity
No LOLC ecotoxicity data are available for this product's components.
Persistence and Degradability
This material is expected to biodegrade.
Bioaccumulative Potential
Bioconcentration potential in aquatic organisms is low based on a BCF value of 15.
Mobility
Expected to have moderate mobility in soil.
Other Toxicity
No additional information is available.

Section 13 - DISPOSAL CONSIDERATIONS

Disposal Methods
Dispose in accordance with all applicable regulations.
Component Waste Numbers

The U.S. EPA has not published waste numbers for this product's components.

Section 14 - TRANSPORT INFORMATION

US DOT Information:
Shipping Name: PETROLEUM GASES, LIQUEFIED
Hazard Class: 2.1
UN/NA #: UN1075
Required Label(s): 2.1

IMDG Information:
Shipping Name: PETROLEUM GASES, LIQUEFIED
Hazard Class: 2.1
UN#: UN1075
Required Label(s): 2.1
International Bulk Chemical Code
This material does not contain any chemicals required by the IBC Code to be identified as dangerous chemicals in bulk.

Section 15 - REGULATORY INFORMATION

U.S. Federal Regulations
None of this product's components are listed under SARA Sections 302/304 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65), CERCLA (40 CFR 302.4), TSCA 12(b), or require an OSHA process safety plan.
SARA Section 311/312 (40 CFR 370 Subparts B and C) reporting categories
Flammable, Gas Under Pressure, Simple Asphyxiant
U.S. State Regulations
The following components appear on one or more of the following state hazardous substances lists:

Component	CAS	CA	MA	MN	NJ	PA
Propane	74-98-6	No	Yes	Yes	Yes	Yes

California Safe Drinking Water and Toxic Enforcement Act (Proposition 65)
Not listed under California Proposition 65
Component Analysis - Inventory
Propane (74-98-6)

US	CA	AU	CN	EU	JP - ENCS	JP - ISHL	KR KECI - Annex 1	KR KECI - Annex 2
Yes	DSL	Yes	Yes	EINECS	Yes	Yes	Yes	No

KR - REACH CCA	MX	NZ	PH	TH-TECI	TW - CN	VN (Draft)
No	Yes	Yes	Yes	Yes	Yes	Yes

Section 16 - OTHER INFORMATION

NFPA Ratings
Health: 2 Fire: 4 Instability: 0
Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe
Preparation Date
New SDS: 10/09/2014

MATHESON
The Gas Professionals

Safety Data Sheet

Material Name: Propane – UN1075 Specific **SDS ID: 00249010**

Key / Legend

ACGIH - American Conference of Governmental Industrial Hygienists; ADR - European Road Transport; AU - Australia; BOD - Biochemical Oxygen Demand; C - Celsius; CA - Canada; CA/MA/MN/NJ/PA - California/Massachusetts/Minnesota/New Jersey/Pennsylvania*; CAS - Chemical Abstracts Service; CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act; CFR - Code of Federal Regulations (US); CLP - Classification, Labelling, and Packaging; CN - China; CPR - Controlled Products Regulations; DFG - Deutsche Forschungsgemeinschaft; DOT - Department of Transportation; DSD - Dangerous Substance Directive; DSL - Domestic Substances List; EC – European Commission; EEC - European Economic Community; EIN - European Inventory of (Existing Commercial Chemical Substances); EINECS - European Inventory of Existing Commercial Chemical Substances; ENCS - Japan Existing and New Chemical Substance Inventory; EPA - Environmental Protection Agency; EU - European Union; F - Fahrenheit; F - Background (for Venezuela Biological Exposure Indices); IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; ICAO - International Civil Aviation Organization; IDL - Ingredient Disclosure List; IDLH - Immediately Dangerous to Life and Health; IMDG - International Maritime Dangerous Goods; ISHL - Japan Industrial Safety and Health Law; IUCLID - International Uniform Chemical Information Database; JP - Japan; Kow - Octanol/water partition coefficient; KR KECI Annex 1 - Korea Existing Chemicals Inventory (KECI) / Korea Existing Chemicals List (KECL); KR KECI Annex 2 - Korea Existing Chemicals Inventory (KECI) / Korea Existing Chemicals List (KECL); KR - Korea; LD50/LC50 - Lethal Dose/ Lethal Concentration; KR REACH CCA - Korea Registration and Evaluation of Chemical Substances Chemical Control Act; LEL - Lower Explosive Limit; LLV - Level Limit Value; LOLI - List Of LIsts™ - ChemADVISOR's Regulatory Database; MAK - Maximum Concentration Value in the Workplace; MEL - Maximum Exposure Limits; MX – Mexico; Ne - Non-specific; NFPA - National Fire Protection Agency; NIOSH - National Institute for Occupational Safety and Health; NJTSR - New Jersey Trade Secret Registry; Nq - Non-quantitative; NSL – Non-Domestic Substance List (Canada); NTP - National Toxicology Program; NZ - New Zealand; OSHA - Occupational Safety and Health Administration; PEL- Permissible Exposure Limit; PH - Philippines; RCRA - Resource Conservation and Recovery Act; REACH- Registration, Evaluation, Authorisation, and restriction of Chemicals; RID - European Rail Transport; SARA - Superfund Amendments and Reauthorization Act; Sc - Semi-quantitative; STEL - Short-term Exposure Limit; TCCA – Korea Toxic Chemicals Control Act; TDG - Transportation of Dangerous Goods; TH-TECI - Thailand - TIIA Existing Chemicals Inventory (TECI); TLV - Threshold Limit Value; TSCA - Toxic Substances Control Act; TW – Taiwan; TWA – Time Weighted Average; UEL - Upper Explosive Limit; UN/NA - United Nations /North American; US - United States; VLE - Exposure Limit Value (Mexico); VN (Draft) - Vietnam (Draft); WHMIS - Workplace Hazardous Materials Information System (Canada).

Other Information

Disclaimer:

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Hydrochloric Acid,ACS

SECTION 1 : Identification of the substance/mixture and of the supplier

Product name : **Hydrochloric Acid,ACS**

Manufacturer/Supplier Trade name:

Manufacturer/Supplier Article number: **S25358**

Recommended uses of the product and uses restrictions on use:

Manufacturer Details:

AquaPhoenix Scientific
9 Barnhart Drive, Hanover, PA 17331

Supplier Details:

Fisher Science Education
15 Jet View Drive, Rochester, NY 14624

Emergency telephone number:

Fisher Science Education - Emergency Telephone No.: 800-535-5053

SECTION 2 : Hazards identification

Classification of the substance or mixture:

Corrosive
Serious eye damage, category 1
Corrosive to metals, category 1
Skin corrosion, category 1B

Irritant
Specific target organ toxicity following single exposure, category 3

Corr. Metals 1
Corr. Skin 1B
Eye Damage 1
STOT. SE 3

Signal word: Danger

Hazard statements:
May be corrosive to metals
Causes severe skin burns and eye damage
May cause respiratory irritation

Precautionary statements
If medical advice is needed, have product container or label at hand
Keep out of reach of children
Read label before use
Use only outdoors or in a well-ventilated area
Wear protective gloves/protective clothing/eye protection/face protection
Keep only in original container
Do not get in eyes, on skin, or on clothing
Wash skin thoroughly after handling
IF SWALLOWED: Rinse mouth. Do NOT induce vomiting

Hydrochloric Acid,ACS

IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing
Immediately call a POISON CENTER or doctor/physician
Specific treatment (see supplemental first aid instructions on this label)
Wash contaminated clothing before reuse
Absorb spillage to prevent material damage
Store in a well-ventilated place. Keep container tightly closed
Store locked up
Store in corrosive resistant stainless steel container with a resistant inner liner
Dispose of contents and container to an approved waste disposal plant

Other Non-GHS Classification:

WHMIS

D1A

E

NFPA/HMIS

NFPA SCALE (0-4)

HMIS RATINGS (0-4)

SECTION 3 : Composition/information on ingredients

Ingredients:		
CAS 7647-01-0	Hydrochloric Acid, ACS	30-50 %
CAS 7732-18-5	Water	50-70 %
		Percentages are by weight

SECTION 4 : First aid measures

Description of first aid measures

After inhalation: Move exposed individual to fresh air. Loosen clothing as necessary and position individual in a comfortable position. Seek medical attention if irritation or coughing persists.

After skin contact: Wash affected area with soap and water. Immediately remove contaminated clothing and shoes. Rinse thoroughly with plenty of water for at least 15 minutes. Immediately seek medical attention.

After eye contact: Protect unexposed eye. Flush thoroughly with plenty of water for at least 15

Safety Data Sheet
according to 29CFR1910/1200 and GHS Rev. 3

Hydrochloric Acid,ACS

minutes.Remove contact lenses while rinsing.Continue rinsing eyes during transport to hospital.

After swallowing: Rinse mouth thoroughly. Do not induce vomiting. Have exposed individual drink sips of water. Immediately seek medical attention.

Most important symptoms and effects, both acute and delayed:

Inhalation may cause irritation to nose and upper respiratory tract, ulceration, coughing, chest tightness and shortness of breath. Higher concentrations cause tachypnoea, pulmonary oedema and suffocation. Ingestion may cause corrosion of lips, mouth, oesophagus and stomach, dysphagia and vomiting.Pain, eye ulceration, conjunctival irritation, cataracts and glaucoma may occur following eye exposure.Erythema and skin irritation, as well as chemical burns to skin and mucous membranes may arise following skin exposure.,Potential sequelae following ingestion of hydrochloric acid include perforation, scarring of the oesophagus or stomach and stricture formation causing dysphagia or gastric outlet obstruction. In some cases RADS may develop. Respiratory symptoms may take up to 36 hours to develop.Symptoms of burning sensation, cough, wheezing, laryngitis, shortness of breath, spasm, inflammation, edema of the larynx, spasm, inflammation and edema of the bronchi, pneumonitis, pulmonary edema. Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin.

Indication of any immediate medical attention and special treatment needed:

Provide SDS to Physician.Physician should treat symptomatically.

SECTION 5 : Firefighting measures

Extinguishing media

Suitable extinguishing agents: Use water, dry chemical, chemical foam, carbon dioxide, or alcohol-resistant foam.

For safety reasons unsuitable extinguishing agents:

Special hazards arising from the substance or mixture:

Combustion products may include carbon oxides or other toxic vapors.If in contact with metals toxic fumes may be released.

Advice for firefighters:

Protective equipment: Wear protective eyeware, gloves, and clothing. Refer to Section 8. Wear respiratory protection.

Additional information (precautions): Thermal decomposition can produce poisoning chlorine. Hydrochloric acid reacts also with many organic materials with liberation of heat.Avoid inhaling gases, fumes, dust, mist, vapor, and aerosols. Avoid contact with skin, eyes, and clothing.

SECTION 6 : Accidental release measures

Personal precautions, protective equipment and emergency procedures:

Ensure adequate ventilation. Ensure that air-handling systems are operational.

Environmental precautions:

Should not be released into environment. Prevent from reaching drains, sewer, or waterway.

Methods and material for containment and cleaning up:

Always obey local regulations. If necessary use trained response staff or contractor. Evacuate personnel to safe areas. Containerize for disposal. Refer to Section 13. Keep in suitable closed containers for disposal. Soak up with inert absorbent material and dispose of as hazardous waste. Cover spill with soda ash or calcium carbonate. Mix and add water to form slurry.Wear protective eyeware, gloves, and clothing. Refer to Section 8.

Reference to other sections:

SECTION 7 : Handling and storage

Safety Data Sheet
according to 29CFR1910/1200 and GHS Rev. 3

Hydrochloric Acid,ACS

Precautions for safe handling:

Prevent formation of aerosols. Never use hot water and never add water to the acid.Do not allow contact between hydrochloric acid, metal and organics.Follow good hygiene procedures when handling chemical materials. Refer to Section 8. Prevent contact with skin, eyes, and clothing. Follow proper disposal methods. Refer to Section 13. Do not eat, drink, smoke, or use personal products when handling chemical substances. Use only in well-ventilated areas.Avoid splashes or spray in enclosed areas.

Conditions for safe storage, including any incompatibilities:

Store in a cool location. Keep away from food and beverages. Protect from freezing and physical damage. Store away from incompatible materials. Provide ventilation for containers. Keep container tightly sealed.Containers for hydrochloric acid must be made from corrosion resistant materials: glass, polyethylene, polypropylene, polyvinylchloride, carbon steel lined with rubber or ebonite.

SECTION 8 : Exposure controls/personal protection

Control Parameters:	7647-01-0, Hydrochloric Acid, ACGIH: 2 ppm Ceiling 7647-01-0, Hydrochloric Acid, NIOSH: 5 ppm Ceiling; 7 mg/m3 Ceiling
Appropriate Engineering controls:	Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor and mists below the applicable workplace exposure limits (Occupational Exposure Limits-OELs) indicated above. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of handling.
Respiratory protection:	Not required under normal conditions of use. Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. When necessary use NIOSH approved breathing equipment.
Protection of skin:	Select glove material impermeable and resistant to the substance. Select glove material based on rates of diffusion and degradation. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Use proper glove removal technique without touching outer surface. Avoid skin contact with used gloves. Wear protective clothing.
Eye protection:	Faceshield (8-inch minimum).Tightly fitting safety goggles.
General hygienic measures:	Perform routine housekeeping. Wash hands before breaks and immediately after handling the product. Avoid contact with skin, eyes, and clothing. Before reusing wash contaminated clothing.

SECTION 9 : Physical and chemical properties

Appearance (physical state,color):	Clear, colorless liquid.	**Explosion limit lower:** **Explosion limit upper:**	Non Explosive Non Explosive
Odor:	Pungent odor	**Vapor pressure:**	5.7mmHg @ 0C
Odor threshold:	0.3 - 14.8 mg/m3	**Vapor density:**	1.27 (Air=1)
pH-value:	< 1	**Relative density:**	1.0 - 1.2

Safety Data Sheet
according to 29CFR1910/1200 and GHS Rev. 3

Hydrochloric Acid,ACS

Melting/Freezing point:	-74 C	**Solubilities:**	Miscible
Boiling point/Boiling range:	81.5 - 110 C	**Partition coefficient (n-octanol/water):**	Not Determined
Flash point (closed cup):	Not Applicable	**Auto/Self-ignition temperature:**	Not Determined
Evaporation rate:	>1.00	**Decomposition temperature:**	Not Determined
Flammability (solid,gaseous):	non combustible	**Viscosity:**	a. Kinematic:Not Determined b. Dynamic: Not Determined
Density: Not Determined **Hydrochloric Acid:**MW 36.46			

SECTION 10 : Stability and reactivity

Reactivity: Reacts violently with bases and is corrosive.
Chemical stability: No decomposition if used and stored according to specifications.
Possible hazardous reactions: Attacks many metals in the presence of water forming flammable explosive gas (hydrogen).Reacts violently with oxidants forming toxic gas (chlorine).
Conditions to avoid: Incompatible materials.
Incompatible materials: Bases. Amines. Alkali metals. Metals. permanganates (potassium permanganate). Fluorine. Metal acetylides. Hexalithium disilicide.
Hazardous decomposition products: Hydrogen chloride gas.Carbon oxides.

SECTION 11 : Toxicological information

Acute Toxicity		
Inhalation:	7647-01-0	LC50 Rat 3124 ppm/hour
Oral:	7647-01-0	LD50 Rat 238 - 277 mg/kg
Dermal:	7647-01-0	LD50 Rabbit >5010 mg/kg
Chronic Toxicity: No additional information.		
Corrosion Irritation:		
Dermal:	7647-01-0	Skin - rabbit Result: Causes burns.
Ocular:	7647-01-0	Eyes - rabbit Result: Corrosive to eyes
Sensitization:		No additional information.
Single Target Organ (STOT):		7647-01-0: The substance or mixture is classified as specific target organ toxicant, single exposure, category 3 with respiratory tract irritation.
Numerical Measures:		No additional information.
Carcinogenicity:		No additional information.
Mutagenicity:		No additional information.

Reproductive Toxicity.	No additional information.

SECTION 12 : Ecological information

Ecotoxicity
7647-01-0: Toxic by in fish LC50 - Gambusia affinis (Mosquito fish) - 282 mg/l - 96 h (Hydrochloric acid)
Persistence and degradability:
Bioaccumulative potential
Mobility in soil:
Other adverse effects:

SECTION 13 : Disposal considerations

Waste disposal recommendations:
Do not allow product to reach sewage system or open water.It is the responsibility of the waste generator to properly characterize all waste materials according to applicable regulatory entities (US 40CFR262.11). Contact a licensed professional waste disposal service to dispose of this material. Dispose of empty containers as unused product. Product or containers must not be disposed together with household garbage. Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations. Ensure complete and accurate classification.

SECTION 14 : Transport information

UN-Number
1789
UN proper shipping name
HYDROCHLORIC ACID
Transport hazard class(es)
Class:
8 Corrosive substances
Packing group: II
Environmental hazard
Transport in bulk:
Special precautions for user:

SECTION 15 : Regulatory information

United States (USA)
SARA Section 311/312 (Specific toxic chemical listings):
Acute
SARA Section 313 (Specific toxic chemical listings)
7647-01-0 Hydrochloric Acid
RCRA (Hazardous waste code):
None of the ingredients is listed
TSCA (Toxic Substances Control Act)
All ingredients are listed.

CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act):
7647-01-0 Hydrochloric Acid 5000 lbs

Proposition 65 (California):
Chemicals known to cause cancer:
None of the ingredients is listed
Chemicals known to cause reproductive toxicity for females:
None of the ingredients is listed
Chemicals known to cause reproductive toxicity for males:
None of the ingredients is listed
Chemicals known to cause developmental toxicity:
None of the ingredients is listed

Canada
Canadian Domestic Substances List (DSL):
All ingredients are listed.
Canadian NPRI Ingredient Disclosure list (limit 0.1%):
None of the ingredients is listed
Canadian NPRI Ingredient Disclosure list (limit 1%):
7647-01-0 Hydrochloric Acid

SECTION 16 : Other information

This product has been classified in accordance with hazard criteria of the Controlled Products Regulations and the SDS contains all the information required by the Controlled Products Regulations.Note:. The responsibility to provide a safe workplace remains with the user.The user should consider the health hazards and safety information contained herein as a guide and should take those precautions required in an individual operation to instruct employees and develop work practice procedures for a safe work environment.The information contained herein is, to the best of our knowledge and belief, accurate.However, since the conditions of handling and use are beyond our control, we make no guarantee of results, and assume no liability for damages incurred by the use of this material. It is the responsibility of the user to comply with all applicable laws and regulations applicable to this material.
GHS Full Text Phrases:

Abbreviations and acronyms:
IMDG: International Maritime Code for Dangerous Goods
PNEC: Predicted No-Effect Concentration (REACH)
CFR: Code of Federal Regulations (USA)
SARA: Superfund Amendments and Reauthorization Act (USA)
RCRA: Resource Conservation and Recovery Act (USA)
TSCA: Toxic Substances Controlled Act (USA)
NPRI: National Pollutant Release Inventory (Canada)
DOT: US Department of Transportation
IATA: International Air Transport Association
GHS: Globally Harmonized System of Classification and Labelling of Chemicals
ACGIH: American Conference of Governmental Industrial Hygienists
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)

HMIS: Hazardous Materials Identification System (USA)
WHMIS: Workplace Hazardous Materials Information System (Canada)
DNEL: Derived No-Effect Level(REACH)

Effective date : 01/08/2035
Last updated : 05/26/2035

ATTACHMENT I

Emission Units Table

55

Attachment I
Emission Units Table
(includes all emission units and air pollution control devices
that will be part of this permit application review, regardless of permitting status)

Emission Unit ID*	Emission Point ID*	Emission Unit Description	Year Installed / Modified	Design Capacity	Type[1] and Date of Change	Control Device*
900	1000	Thermal Oxidizer (Ex-Situ)	2024	2.7 MMBTU/hr	New	1C
1000	1000	Emergency Flare (Stack)	2024	13,247 lbs/hr	New	2C
200	1000	Macerator/Shredder	2024	3,542 TPD/hr	New	N/A
300	1000	Dryer	2024	7,700 lb/hr	New	1C/2C
500	500	Pyrolysis	2024	*2 tpd	New	1C/2C
400	1000	Gas Cleanup System	2024		New	1C/2C
600	1000	Engines	2024	520 kW	New	1C/2C

* For Emission Units or Sources use the following numbering system: 1S, 2S, 3S... or other appropriate designation.
*For Emission Points use the following numbering system: 1E, 2E, 3E... or other appropriate designation.
[1] New, Modification, Removal
* For Control Devices use the following numbering system: 1C, 2C, 3C... or other appropriate designation.

56

Page _____ of _____

Emission Units Table
03/2007

ATTACHMENT J

Emission Points Data Summary Sheet

57

Attachment J
EMISSION POINTS DATA SUMMARY SHEET

Table 1: Emissions Data															
Emission Point ID No. (Must match Emission Units Table & Plot Plan)	Emission Point Type[1]	Emission Unit Vented Through This Point (Must match Emission Units Table & Plot Plan)		Air Pollution Control Device (Must match Emission Units Table & Plot Plan)		Vent Time for Emission Unit (chemical processes only)		All Regulated Pollutants - Chemical Name/CAS[3] (Speciate VOCs & HAPS)	Maximum Potential Uncontrolled Emissions[4]		Maximum Potential Controlled Emissions[5]		Emission Form or Phase (At exit conditions, Solid, Liquid or Gas/Vapor)	Est. Method Used[6]	Emission Concentration[7] (ppmv or mg/m³)
		ID No.	Source	ID No.	Device Type	Short Term[2]	Max (hr/yr)		lb/hr	ton/yr	lb/hr	ton/yr			
1000	Thermal Oxidizer (RTO) /Flare Stack		RTO (300) Flare (1000) Shredder (300) Dryer (...) Pyrolysis (300) Gas Cleaning System (...) Engines (...)	1000	Stack (RTO /Flare)		8,760	NOx CO SO2 PM10 PM2.5 VOC/Volatile [illegible] HAP	[illegible]	[illegible]	[illegible]	[illegible]	gas	EE	[illegible] ppmv

The EMISSION POINTS DATA SUMMARY SHEET provides a summation of emissions by emission unit. Note that uncaptured process emission unit emissions are not typically considered to be fugitive and must be accounted for on the appropriate EMISSIONS UNIT DATA SHEET and on the EMISSION POINTS DATA SUMMARY SHEET. Please note that total emissions from the source are equal to all vented emissions, all fugitive emissions, plus all other emissions (e.g. uncaptured emissions). Please complete the FUGITIVE EMISSIONS DATA SUMMARY SHEET for fugitive emission activities.

[1] Please add descriptors such as upward vertical stack, downward vertical stack, horizontal stack, relief vent, rain cap, etc.

[2] Indicate by "C" if venting is continuous. Otherwise, specify the average short-term venting rate with units, for intermittent venting (ie., 15 min/hr). Indicate as many rates as needed to clarify frequency of venting (e.g., 5 min/day, 2 days/wk).

[3] List all regulated air pollutants. Speciate VOCs, including all HAPs. Follow chemical name with Chemical Abstracts Service (CAS) number. LIST Acids, CO, CS_2, VOCs, H_2S, Inorganics, Lead, Organics, O_3, NO, NO_2, SO_2, SO_3, all applicable Greenhouse Gases (including CO_2 and methane), etc. DO NOT LIST H_2, H_2O, N_2, O_2, and Noble Gases.

[4] Give maximum potential emission rate with no control equipment operating. If emissions occur for less than 1 hr, then record emissions per batch in minutes (e.g. 5 lb VOC/20 minute batch).

[5] Give maximum potential emission rate with proposed control equipment operating. If emissions occur for less than 1 hr, then record emissions per batch in minutes (e.g. 5 lb VOC/20 minute batch).

[6] Indicate method used to determine emission rate as follows: MB = material balance; ST = stack test (give date of test); EE = engineering estimate; O = other (specify).

[7] Provide for all pollutant emissions. Typically, the units of parts per million by volume (ppmv) are used. If the emission is a mineral acid (sulfuric, nitric, hydrochloric or phosphoric) use units of milligram per dry cubic meter (mg/m³) at standard conditions (68 °F and 29.92 inches Hg) (see 45CSR7). If the pollutant is SO_2, use units of ppmv (See 45CSR10).

Attachment J
EMISSION POINTS DATA SUMMARY SHEET

Table 2: Release Parameter Data								
Emission Point ID No. (Must match Emission Units Table)	Inner Diameter (ft.)	Exit Gas			Emission Point Elevation (ft)		UTM Coordinates (km)	
		Temp. (°F)	Volumetric Flow[1] (acfm) at operating conditions	Velocity (fps)	Ground Level (Height above mean sea level)	Stack Height[2] (Release height of emissions above ground level)	Northing	Easting
1000	[illegible]	1,[illegible]	11,[illegible]	TBD	TBD	TBD	TBD	TBD

[1] Give at operating conditions. Include inerts.
[2] Release height of emissions above ground level.

ATTACHMENT K

Fugitive Emissions Data Summary Sheet

Attachment K
FUGITIVE EMISSIONS DATA SUMMARY SHEET

The FUGITIVE EMISSIONS SUMMARY SHEET provides a summation of fugitive emissions. Fugitive emissions are those emissions which could not reasonably pass through a stack, chimney, vent or other functionally equivalent opening. Note that uncaptured process emissions are not typically considered to be fugitive, and must be accounted for on the appropriate EMISSIONS UNIT DATA SHEET and on the EMISSION POINTS DATA SUMMARY SHEET.

Please note that total emissions from the source are equal to all vented emissions, all fugitive emissions, plus all other emissions (e.g. uncaptured emissions).

APPLICATION FORMS CHECKLIST - FUGITIVE EMISSIONS
1.) Will there be haul road activities? ☒ Yes ☐ No ☐ If YES, then complete the HAUL ROAD EMISSIONS UNIT DATA SHEET.
2.) Will there be Storage Piles? ☐ Yes ☒ No ☐ If YES, complete Table 1 of the NONMETALLIC MINERALS PROCESSING EMISSIONS UNIT DATA SHEET.
3.) Will there be Liquid Loading/Unloading Operations? ☒ Yes ☐ No ☐ If YES, complete the BULK LIQUID TRANSFER OPERATIONS EMISSIONS UNIT DATA SHEET.
4.) Will there be emissions of air pollutants from Wastewater Treatment Evaporation? ☐ Yes ☒ No ☐ If YES, complete the GENERAL EMISSIONS UNIT DATA SHEET.
5.) Will there be Equipment Leaks (e.g. leaks from pumps, compressors, in-line process valves, pressure relief devices, open-ended valves, sampling connections, flanges, agitators, cooling towers, etc.)? ☒ Yes No ☐ If YES, complete the LEAK SOURCE DATA SHEET section of the CHEMICAL PROCESSES EMISSIONS UNIT DATA SHEET.
6.) Will there be General Clean-up VOC Operations? ☐ Yes ☒ No ☐ If YES, complete the GENERAL EMISSIONS UNIT DATA SHEET.
7.) Will there be any other activities that generate fugitive emissions? ☒ Yes ☐ No ☐ If YES, complete the GENERAL EMISSIONS UNIT DATA SHEET or the most appropriate form.
If you answered "NO" to all of the items above, it is not necessary to complete the following table, "Fugitive Emissions Summary."

FUGITIVE EMISSIONS SUMMARY	All Regulated Pollutants' Chemical Name/CAS [1]	Maximum Potential Uncontrolled Emissions [2]		Maximum Potential Controlled Emissions [3]		Est. Method Used [4]
		lb/hr	ton/yr	lb/hr	ton/yr	
Haul Road/Road Dust Emissions Paved Haul Roads						
Unpaved Haul Roads						
Storage Pile Emissions						
Loading/Unloading Operations						
Wastewater Treatment Evaporation & Operations						
Equipment Leaks	Synthetic Natural Gas/74-82-8 Propane/74-98-6		50.41			
General Clean-up VOC Emissions						
Other						

[1] List all regulated air pollutants. Speciate VOCs, including all HAPs. Follow chemical name with Chemical Abstracts Service (CAS) number. List Acids, CO, CS$_2$, VOCs, H$_2$S, Inorganics, Lead, Organics, O$_3$, NO, NO$_2$, SO$_2$, SO$_3$, all applicable Greenhouse Gases (including CO$_2$ and methane), etc. DO NOT LIST H$_2$, H$_2$O, N$_2$, O$_2$, and Noble Gases.
[2] Give rate with no control equipment operating. If emissions occur for less than 1 hr, then record emissions per batch in minutes (e.g. 5 lb VOC/20 minute batch).
[3] Give rate with proposed control equipment operating. If emissions occur for less than 1 hr, then record emissions per batch in minutes (e.g. 5 lb VOC/20 minute batch).
[4] Indicate method used to determine emission rate as follows: MB = materials balance; ST = stack test (give date of test); EE = engineering estimate; O = other (explain).

ATTACHMENT L

Emission Units Data Sheet

Attachment L
EMISSIONS UNIT DATA SHEET
CHEMICAL PROCESS

For chemical processes please fill out this sheet and all supplementary forms (see below) that apply. Please check all supplementary forms that have been completed.

- ☐ *Emergency Vent Summary Sheet*
- ☐ *Leak Sources Data Sheet*
- ☐ *Toxicology Data Sheet*
- ☒ *Reactor Data Sheet*
- ☐ *Distillation Column Data Sheet*

1. Chemical process area name and equipment ID number (as shown in *Equipment List Form*)

2. Standard Industrial Classification Codes (SICs) for process(es)

3. List raw materials and ☐ attach MSDSs

4. List Products and Maximum Production and ☐ attach MSDSs

Description and CAS Number	Maximum Hourly (lb/hr)	Maximum Annual (ton/year)

5. Complete the *Emergency Vent Summary Sheet* for all emergency relief devices.

6. Complete the *Leak Source Data Sheet* and describe below or attach to application the leak detection or maintenance programs to minimize fugitive emissions. Include detection instruments, calibration gases or methods, planned inspection frequency, and record-keeping, and similar pertinent information. If subject to a rule requirement (e.g. 40CFR60, Subpart VV), please list those here.

7. Clearly describe below or attach to application Accident Procedures to be followed in the event of an accidental spill or release.

8A. Complete the **Toxicology Data Sheet** or attach to application a toxicology report (an up-to-date material safety data sheets (MSDS) may be used) outlining the currently known acute and chronic health effects of each compound or chemical entity emitted to the air. If these compounds have already been listed in Item 3, then a duplicate MSDS sheet is not required. Include data such as the OSHA time weighted average (TWA) or carcinogenicity, teratogenicity, irritation, and other known or suspected effects should be addressed. Indicate where these are unknown, and provide references.

8B. Describe any health effects testing or epidemiological studies on these compounds that are being or may be conducted by the company or required under TSCA, RCRA or other federal regulations. Discuss the persistence in the environment of any emission (e.g. pesticides, etc.).

9. **Waste Products** - Waste products status. (If source is subject to RCRA or 45CSR25, please contact the Hazardous Waste Section of WVDEP, DAQ at (304) 926-3647.)

9A. Types and amounts of wastes to be disposed.

9B. Method of disposal and location of waste disposal facilities.
Carrier: Phone:

9C. Check here if approved USEPA/State Hazardous Waste Landfill will be used ☐

10. Maximum and Projected Typical Operating Schedule for process or project as a whole (circle appropriate units.)

circle units:	(hr/day) (hr/batch)	(days), (batches/day), (batches/week)	(days/yr), (weeks/year)
10A. Maximum			
10B. Typical			

11. Complete a **Reactor Data Sheet** for each reactor in this chemical process.

12. Complete a **Distillation Column Data Sheet** for each distillation column in this chemical process.

13. **Proposed Monitoring, Recordkeeping, Reporting, and Testing**
Please propose monitoring, recordkeeping, and reporting in order to demonstrate compliance with the proposed operating parameters. Please propose testing in order to demonstrate compliance with the proposed emissions limits.

MONITORING	RECORDKEEPING
REPORTING	TESTING

MONITORING. Please list and describe the process parameters and ranges that are proposed to be monitored in order to demonstrate compliance with the operation of this process equipment/operations or air pollution control device.

RECORDKEEPING. Please describe the proposed recordkeeping that will accompany the monitoring.

REPORTING. Please describe the proposed frequency of reporting of the recordkeeping.

TESTING. Please describe any proposed emissions testing for this process equipment or air pollution control device.

14. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty.

INFORMATION REQUIRED FOR CHEMICAL PROCESSES

The notes listed below for chemical processes are intended to help the applicant submit a complete application to the DAQ; these notes are not intended to be all inclusive. The requirements for a complete application for a permit issued under 45CSR13 are designed to provided enough information for a permit reviewer to begin a technical review. Additional information beyond that identified may be required to complete the technical review of any individual application.

Process Description

Please keep these points in mind when completing your process description as part of this permit application.

1. Provide a general process overview. The brief, but complete, process description should include chemical or registered trademark names of chemical products, intermediates, and/or raw materials to be produced or consumed, and the ultimate use(s) of the product(s). A list of the various chemical compounds is helpful.
2. Describe each process step. Include the process chemistry and stoichiometrically balanced reaction equation or material mass balance on all components.
3. Describe the methods and equipment used to receive, store, handle, and charge raw materials.
4. Describe the methods and equipment used to handle, store, or package final products and intermediates.
5. Provide process flow diagrams or equipment layout drawings which clearly show the process flow relationships among all pieces of process and control equipment. Identify all air emission discharge points. Discuss instrumentation and controls for the process.
6. Discuss the possibilities of process upsets, the duration and frequency of upsets, and consequences (including air emissions) of these upsets. Include a description of rupture discs, pressure relief valves, and secondary containment systems.
7. Discuss any fugitive emissions and the methods used to minimize them.
8. Include the following plans for the process if available:
   a. preventative maintenance and malfunction abatement plan (recommended for all control equipment).
   b. continuous emissions (in-stack) monitoring plan
   c. ambient monitoring plan
   d. emergency response plan

Regulatory Discussion

The following state and federal air pollution control regulations may be applicable to your chemical process. You should review these regulations carefully to determine if they apply to your process. Please summarize the results of your review in your permit application along with any other regulations you believe are applicable.

- The 45 Legislative Rule Division of Environmental Protection, Office of Air Quality contains West Virginia's air pollution control regulations, including the following promulgated rules which may require emissions reductions or control technologies for your chemical process.
  a. 45CSR27 - Best Available Technology (BAT) for Toxic Air Pollutants (TAPs)
  b. 45CSR21 - VOC emissions controls for ozone maintenance in Hancock, Cabell, Putnam, Wayne, and Wood counties.
  c. 45CSR13 (Table 45-13A) - plantwide emission thresholds for permitting for certain pollutants.
- Federal Guidelines for case-by-case MACT determinations under section 112(g) of the 1990 CAAA for individual and total HAPs greater than 10 and 25 tons per year, respectively.
- There are also subparts of the federal Standards of Performance for New Stationary Sources (NSPS), 40CFR60, and the National Emission Standards for Hazardous Air Pollutants (NESHAPs) at 40CFR61 and 40CFR63, which apply to various chemical and nonchemical processes. These subparts are too numerous to list here, but these areas of the federal regulations should be consulted carefully to determine applicability to your process.

Emissions Summary and Calculations

Please keep these points in mind when submitting your emissions calculations as part of this permit application.

1. For each pollutant, provide the basis for the emissions estimate and for all emission reduction(s) or control efficiency(ies) claimed.
2. For all batch processes provide the following:
   a. Emissions of each pollutant in pound(s) per batch, from each process step
   b. Annual emissions based on number of batches requested per year
   c. The total time for each process step and the duration of the emissions during the process step
   d. Total batch time, total emissions per batch (or per day), and annual emissions based on the number of batches requested per year.

EMERGENCY VENT SUMMARY SHEET

List below all emergency relief devices, rupture discs, safety relief valves, and similar openings that will vent only under abnormal conditions.

Emission Point ID[1]	Equipment to Relief Vent (type, ID if available)[2]	Relief Vents (type) & Set Pressure (psig)	Name of Chemical(s) or Pollutants Controlled	Worst Case Emission per Release Event (lbs)

All routine vents (non-emergency) should be listed on the **Emission Points Data Summary Sheet.**

[1] Indicate the emission point, if any, to which source equipment normally vents. Do not assign emission point ID numbers to each emergency relief vent or device.

[2] List all emergency relief devices next to the piece of equipment from which they control releases.

LEAK SOURCE DATA SHEET

Source Category	Pollutant	Number of Source Components[1]	Number of Components Monitored by Frequency[2]	Average Time to Repair (days)[3]	Estimated Annual Emission Rate (lb/yr)[4]
Pumps[5]	light liquid VOC[6,7]				
	heavy liquid VOC[7]				
	Non-VOC[8]				
Valves[11]	Gas VOC				
	Light Liquid VOC				
	Heavy Liquid VOC				
	Non-VOC				
Safety Relief Valves[9]	Gas VOC				
	Non VOC				
Open-ended Lines[12]	VOC				
	Non-VOC				
Sampling Connections[13]	VOC				
	Non-VOC				
Compressors	VOC				
	Non-VOC				
Flanges	VOC				
	Non-VOC				
Other	VOC				
	Non-VOC				

[1-13] See notes on the following page.

Notes for Leak Source Data Sheet

1. For VOC sources include components on streams and equipment that contain greater than 10% w/w VOC, including feed streams, reaction/separation facilities, and product/by-product delivery lines. Do not include certain leakless equipment as defined below by category.

2. By monitoring frequency, give the number of sources routinely monitored for leaks, using a portable detection device that measures concentration in ppm. Do not include monitoring by visual or soap-bubble leak detection methods. "M/Q/SM/A/SA/W/O" means the time period between inspections as follows:

   Monthly/Quarterly, with Monthly follow-up of repaired leakers/Quarterly/Semi-annual/Annually/Other (specify time period)

   If source category is not monitored, a single zero in the space will suffice. For example, if 50 gas-service valves are monitored quarterly, with monthly follow-up of those repaired, 75 are monitored semi-annually, and 50 are checked bimonthly (alternate months), with non checked at any other frequency, you would put in the category "**valves, gas service**," 0/50/0/75/0/50 (bimonthly).

3. Give the average number of days, after a leak is discovered, that an attempt will be made to repair the leak.

4. Note the method used: MB - material balance, EE - engineering estimate, EPA - emission factors established by EPA (cite document used), O - other method, such as in-house emission factor (specify).

5. Do not include in the equipment count sealless pumps (canned motor or diaphragm) or those with enclosed venting to a control device. (Emissions from vented equipment should be included in the estimates given in the Emission Points Data Sheet.)

6. Volatile organic compounds (VOC) means the term as defined in 40 CFR ::51.100 (s).

7. A light liquid is defined as a fluid with vapor pressure equal to or greater than 0.04 psi (0.3 Kpa) at 20°C. For mixtures, if 20% w/w or more of the stream is composed of fluids with vapor pressures greater than 0.04 psi (0.3 Kpa) at 20 °C, then the fluid is defined as a light liquid.

8. A heavy liquid is defined as a fluid with a vapor pressure less than 0.04 psi (0.3 Kpa) at 20°C. For mixtures, if less than 20% w/w of the stream is composed of fluids with vapor pressures greater than 0.04 psi (0.3 Kpa) at 20 °C, then the fluid is defined as a heavy liquid.

9. LIST CO, H_2S, mineral acids, NO, NO_2, SO_2, etc. DO NOT LIST CO_2, H_2, H_2O, N_2, O_2, and Noble Gases.

10. Include all process valves whether in-line or on an open-ended line such as sample, drain and purge valves. Do not include safety-relief valves, or leakless valves such as check, diaphragm, and bellows seal valves.

11. Do not include a safety-relief valve if there is a rupture disk in place upstream of the valve, or if the valve vents to a control device.

12. Open-ended lines include purge, drain and vent lines. Do not include sampling connections, or lines sealed by plugs, caps, blinds or second valves.

13. Do not include closed-purge sampling connections.

TOXICOLOGY DATA SHEET[1]

Descriptor Name/CAS Number	OSHA Limits[2] TWA	OSHA Limits[2] CL	Acute[3] TC_{Lo} – Atrified LC_{Lo} – Animal LC_{Lo} – Animal	Chronic[4]	Irritation[5]	References

[1] Indicate by "ND" where no data exists, in company's knowledge.
[2] Time Weighted Average, Ceiling Limit, or other, with units.
[3] If inhalation data is not available, provide other data as available.
[4] Relying on animal or human studies, indicate if any data suggests: C = carcinogenicity, M = mutagenicity, T = teratogenicity, O = oncogenicity.
[5] Indicate if there are dermal or eye irritation effects and whether they are considered to be low, moderate, or severe.

REACTOR DATA SHEET

Provide the following information for each piece of equipment that is a potential or actual source of emissions as shown on the ***Equipment List Form*** and other parts of application.

Identification Number (as shown on ***Equipment List Form***): 169

1. Name and type of equipment (e.g. CSTR, plug flow, batch, etc.)
   Pyrolysers

2. Type of operation: ☒ Batch ☒ Continuous ☐ Semi-batch

3. Projected Actual Equipment Operating Schedule (complete appropriate lines):
   24 hrs/day 7 days/week 52 weeks/year
   hrs/batch batches/day, weeks day,weeks/yr
   (Circle one) (Circle one)

4. Feed Data: Flow In = Varies as Batch gal/hr, or gal/batch

Material Name & CAS No.	Phase[a]	Specific Gravity	Vapor Pressure[b]	Charge Rate Normal	Max	Units	Fill Time (min/batch, run)[c]
Varies	S	TBD	N/A	Varies	70	tpd	Varies

   a. S = Solid, L = Liquid, G = gas or vapor
   b. At feed conditions
   c. Total time that equipment is filling per batch or run (start-up), for tank or vessel-type equipment.

5. Provide all **chemical reactions** that will be involved (if applicable), including the residence time and any side reactions that may occur as well as gases that may be generated during these reactions. Indicate if the reaction(s) are exothermic or endothermic.

6. Maximum Temperature		7A. Maximum Pressure 7B. Max. Set Pressure for venting			
900	°C	-0.15	mmHg	-0.15	mmHg
1,365	°F	N/A	psig	N/A	psig

8. Output Data: Flow Out = gal/hr or gal/batch

Material Name and CAS No.	Phase	Specific Gravity	Vapor Pressure	Hourly or Batch Output Rate			
				Normal	Maximum	Units	
Varies per feed	SOL	TBD	TBD	TBD	TBD		

9. Complete the following emission data for equipment connected to a header exhaust system, giving emissions levels before entering header system (i.e. before control equipment).

☐ Check here if not applicable

Emission Point ID (exhaust point of header system): 1000

Material Name and CAS No.	Maximum Potential Emission Rate (lb/hr)	Method **
TBD		

** MB - material balance; EE - Engineering Estimate; TM - Test Measurement (submit test data); O - other (Explain)

10. Provide the following information pertaining to each condenser that may be attached to this reactor. Attach additional pages as necessary if more than one condenser is used for this reactor. Complete the Condenser Air Pollution Control Device Sheet if necessary.

☒ Check here if not applicable

10A. Cooling material

10B. Minimum and Maximum flowrate of cooling material (gal/hr)

10C. Inlet temperature of cooling material (°F)

10D. Outlet temperature of cooling material (°F)

10E. Pressure drop of gas to be condensed from inlet to outlet (psig)

10F. Inlet temperature of gas stream (°F)

10G. Outlet temperature of gas stream (°F)

10H. Number of passes

10I. Cooling surface area

11. Provide the following pertaining to auxiliary equipment that burns fuel (heaters, dryers, etc.):

☐ Check here if not applicable

11A. Type of fuel and maximum fuel burn rate, per hour:

Natural Gas for startup at 122.4m for 4hrs, syngas to continue process once start-up has been completed.

11B. Provide maximum percent sulfur (S), ash content of fuel, and the energy content using appropriate units:

% S | % Ash | BTU/lb, std. ft³/day, gal (circle one)

11C. Theoretical combustion air requirement in SCFD per unit of fuel (circle appropriate unit) @ 70°F and 14.7 PSIA

SCFD/lb, SCFD, gal (circle one)

11D. Percent excess air: %

11E. Type, amount, and BTU rating of burners and all other firing equipment that are planned to be used.

11F. Total maximum design heat input ×10⁶ BTU/hr.

12. **Proposed Monitoring, Recordkeeping, Reporting, and Testing**

Please propose monitoring, recordkeeping, and reporting in order to demonstrate compliance with the proposed operating parameters. Please propose testing in order to demonstrate compliance with the proposed emissions limits.

MONITORING	RECORDKEEPING
Weekly and monthly inspections according to manufacturer specifications.	All Weekly and Monthly inspections along with any malfunctions.
REPORTING	**TESTING**
Any malfunctions.	Per request

MONITORING. PLEASE LIST AND DESCRIBE THE PROCESS PARAMETERS AND RANGES THAT ARE PROPOSED TO BE MONITORED IN ORDER TO DEMONSTRATE COMPLIANCE WITH THE OPERATION OF THIS PROCESS EQUIPMENT OR PLANT AND/OR AIR POLLUTION CONTROL DEVICE.

RECORDKEEPING. PLEASE DESCRIBE THE PROPOSED RECORDKEEPING THAT WILL ACCOMPANY THE MONITORING.

REPORTING. PLEASE DESCRIBE THE PROPOSED FREQUENCY OF REPORTING OF THE RECORDKEEPING.

TESTING. PLEASE DESCRIBE ANY PROPOSED EMISSIONS TESTING FOR THIS PROCESS EQUIPMENT OR AIR POLLUTION CONTROL DEVICE.

13. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty.

N/A

NOTE: An **AIR POLLUTION CONTROL DEVICE SHEET** must be completed for any air pollution device(s) (except emergency relief devices) used to control emissions from this reactor.

DISTILLATION COLUMN DATA SHEET

Identification Number (as assigned on **Equipment List Form**):

1. Name and type of equipment

8. Projected actual equipment operating schedule (complete appropriate lines):

hrs/day | days/week | weeks/year

hrs/batch | batches/day, batch es/week (circle one) | days/yr, weeks/yr (circle one)

2. Number of stages (plates), excluding condenser

3. Number of feed plates and stage location

4. Specify details of any reheating, recycling, or stage conditioning along with the stage locations

5. Specify reflux ratio, R (where R is defined as the ratio of the reflux to the overhead product, given symbolically as R=L/D, where L = liquid down column, D = distillation product)

6. Specify the fraction of feed which is vaporized, f (where f is the molal fraction of the feed that leaves the feed plate continuously as vapor).

7A. Type of condenser used: ☐ total ☐ partial ☐ multiple ☐ other

7B. For each condenser provide process operating details including all inlet and outlet temperatures, pressures, and compositions.

8. Feed Characteristics
   A. Molar composition
   B. Individual vapor pressure of each component
   C. Total feed stage pressure
   D. Total feed stage temperature
   E. Total mass flow rate of each stream into the system

9. Overhead Product
   A. Molar composition of components
   B. Vapor pressure of components
   C. Total mass flow rate of all streams leaving the system as overhead products

10. Bottom Product
   A. Molar composition of all components
   B. Total mass flow rate of all streams leaving the system as bottom products

11. General Information
   A. Distillation column diameter
   B. Distillation column height
   C. Type of plates
   D. Plate spacing
   E. Murphree plate efficiency
   F. Any other information necessary of describe the operation of this distillation column.

12. **Proposed Monitoring, Recordkeeping, Reporting, and Testing**
Please propose monitoring, recordkeeping, and reporting in order to demonstrate compliance with the proposed operating parameters. Please propose testing in order to demonstrate compliance with the proposed emissions limits.

MONITORING	RECORDKEEPING
REPORTING	**TESTING**

MONITORING. PLEASE LIST AND DESCRIBE THE PROCESS PARAMETERS AND RANGES THAT ARE PROPOSED TO BE MONITORED IN ORDER TO DEMONSTRATE COMPLIANCE WITH THE OPERATION OF THIS PROCESS EQUIPMENT OR/AND ITS/ OR AIR POLLUTION CONTROL DEVICE.

RECORDKEEPING. PLEASE DESCRIBE THE PROPOSED RECORDKEEPING THAT WILL ACCOMPANY THE MONITORING.

REPORTING. PLEASE DESCRIBE THE PROPOSED FREQUENCY OF REPORTING OF THE RECORDKEEPING.

TESTING. PLEASE DESCRIBE ANY PROPOSED EMISSIONS TESTING FOR THIS PROCESS EQUIPMENT OR AIR POLLUTION CONTROL DEVICE.

13. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty

NOTE: An **AIR POLLUTION CONTROL DEVICE SHEET** must be completed for any air pollution device(s) (except emergency relief devices) used to control emissions from this distillation column.

Supertherm (Pty) Ltd t/a TECHNOTHERM
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Email: info@technotherm.co.za | Tel: 010 045 3003
VAT 4600258843 | Reg No. 2010/009941/07
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TECHNICAL FILE
(Area-010)

Phase Pyroliser for Power Plant

PYROLISER PLANT
(Area 010)

Equipment – MEDRECYCLER – 010

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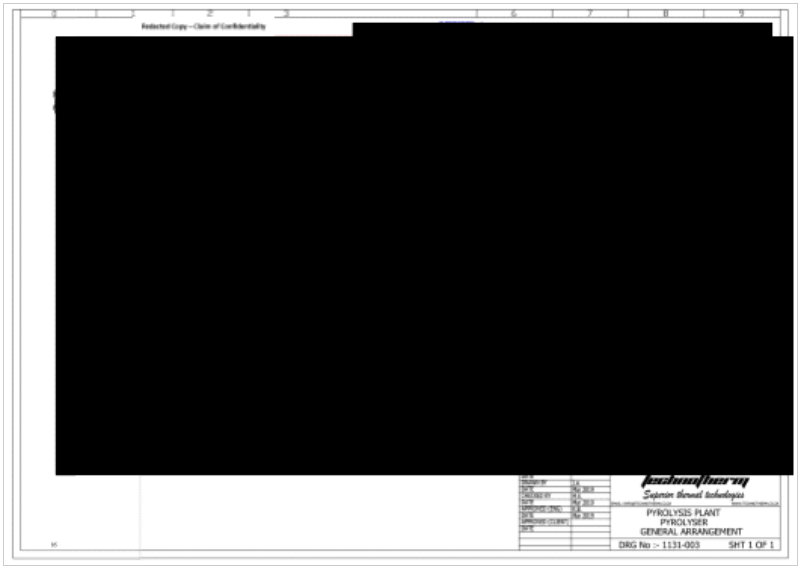


Attachment L

Emission Unit Data Sheet

(INCINERATOR)

Control Device ID No. (must match List Forms): 900

Equipment Information

1. Manufacturer: Technotherm	2. Model No. Regenerative Thermal Oxidiser
3. On a separate sheet sketch or draw the proposed incinerator showing the location and dimensions (inside and exit) of (1) the primary combustion chamber, (2) the secondary combustion chamber, (3) the flame port, (4) auxiliary burners, and (5) dampers **with special emphasis on dimensions of the flame port and secondary combustion chambers (inside). Also,** sketch in the minimum distance the gas travels through the secondary combustion chamber.	
4. Rated capacity of the incinerator for the type of waste to be burned: Maximum: 110,000 lb/hr Typical: ~72,970 lb/hr Annual: ~297,766 tons/yr	
5. By what means is waste charged? ☐ Batch ☒ Continuous ☐ Periodically	
6. Type: ☐ Multiple Chamber ☒ Single Chamber ☐ Other, specify:	
7. Projected operating schedule: 24 hr/day 365 day/yr	

Primary Combustion Chamber

8. Volume: ft³	9. Effective grate area: ft²
10. Maximum temperature: 1562 °F	11. Burning rate: lb/ft²/hr
12. Heat release in primary chamber: BTU/hr/ft³	13. Total heat release in incinerator: BTU/hr/ft²

Secondary Combustion Chamber

14. Volume: N/A ft³	15. Cross sectional area: ft²
16. Volume of gas through secondary combustion chamber: ACFM @ °F	17. Gas velocity through secondary combustion chamber: ft/sec
18. Minimum gas temperature: °F	19. Minimum retention time of gas: sec
20. Minimum distance of gas travel through secondary combustion chamber: ft	21. Location of air admission:

Flame Port

22. Flame port area: ft² 23. Velocity through flame port: ft/sec

Dampers

24. Type: Pneumatically operated, profiled blade louver	25. Number: 4
26. Diameter: inches	27. Capacity: ACFM @ °F

Page 5 of 5

Revision 05/2007

Combustion Air

26. Type of draft: ☐ Natural ☒ Forced ☐ Induced ☐ Sliding damper ☐ Barometric damper Windshielding? ☐ Yes ☐ No	29. If draft is forced or induced, describe ID fans or blowers: Number: 1 for HP rating: ~89 HP Rated flow: 3,236 ft³/min Rated speed: RPM Fan rated draft: in. H₂O Volume: @ °F
30. Theoretical air/refuse ratio: lb air/lb refuse	
31. Percent of total air applied as: overfire air: underfire air:	

Auxiliary Burners

32. Proposed type and fuel: NG

33. Primary Burner	34. Secondary Burner
Capacity: 3.79 MMBTU/hr Number: 2 Manufacture: Techniterm Model: TBD Estimated capacity: BTU/hr Fuel: NG How controlled? Air Is there a temperature indicator? ☒ Yes ☐ No How temperature recorded? thermocouple/transmit	Capacity: N/A MMBTU/hr Number: Manufacture: Model: Estimated capacity: BTU/hr Fuel: How controlled? Is there a temperature indicator? ☐ Yes ☐ No

Miscellaneous Devices and Controls

35. Automatic loading device. ☒ Yes ☐ No If yes, describe. Gas flow	36. Self closing doors. ☐ Yes ☐ No
37. Sparks arrestor ☒ Yes ☐ No	38. Flame failure protection equipment ☐ Yes ☐ No
39. Method of creating turbulence for combustion gases. Describe. Air	40. Method of cleaning secondary or settling chamber. Describe. N/A
41. Other interlocking devices or controls. If yes, describe. ☒ Yes ☐ No Maintenance and fire protection	

Installation

42. Indoor Installation: ☐ Yes ☒ No If yes, describe method of supplying combustion air.	43. Outdoor Installation: ☒ Yes ☐ No

Stack or Vent Data

44. Inside diameter or dimensions: 2.16 ft	45. Gas exit temperature: 100 °F
46. Height: 41.33 ft	47. Stack serves: ☐ This equipment only ☒ Other equipment also (submit type and rating of all other equipment exhausted through this stack or vent)
48. Gas flow rate: 15,239 ft³/min	
49. Estimated percent of moisture: %	

Waste

50. Source of waste: ☐ Hospital ☐ Restaurant ☐ Store ☒ Industry ☐ Apartment ☐ Crematory ☐ Warehouse ☐ Public Institution ☒ Other, specify:

51. Describe fully, in detail, the composition of waste feed to the incinerator.
The waste feed will vary and is a combination of all of the emissions from the process equipment and engines.

52. Expected BTU/lb as fired: BTU/lb	53. Daily amount: lb
54. Does incinerator have a charge hopper ☐ Yes ☒ No	55. What is the volume of the charge hopper? ft³
56. Does the charge hopper have automatic control? ☐ Yes ☐ No	57. Is the waste charged to the incinerator weighed? ☐ Yes ☒ No
58. Is the secondary chamber preheated prior to charging waste? ☐ Yes ☐ No	59. At what secondary temperature does waste charging begin? °F
60. Is the ash waste quenched? ☐ Yes ☐ No	61. Is all the waste burned generated on site? ☒ Yes ☐ No
62. For hospital waste, is the ash inspected for recognizable combustible components? ☐ Yes ☐ No	
63. For hospital waste, are recognizable combustible components of the ash returned? ☐ Yes ☐ No	
64. Is any waste received from outside the local government boundary? ☐ Yes ☐ No	
65. Are hazardous or special waste burned? ☐ Yes ☒ No If yes, please describe:	66. Are potential infectious waste burned? ☐ Yes ☒ No

67. How will the waste material from process and control equipment be disposed of?
Through the stack. Gas

68. Method of charging waste solids: ☐ Manual ☐ Manual charge hopper ☐ Automatic charge hopper ☐ Other, specify: N/A	69. Method of feeding liquids: ☐ Lab pack ☐ Injection as a primary burner fuel ☐ Injection as a secondary burner fuel ☐ Other, specify: N/A
70. Rated steam flow - heat recovery boiler: lbs/hr	71. Rated pressure - recovery boiler: PSIG

Emissions Stream

72. Emission rates: Emission Rates Vary by Feed

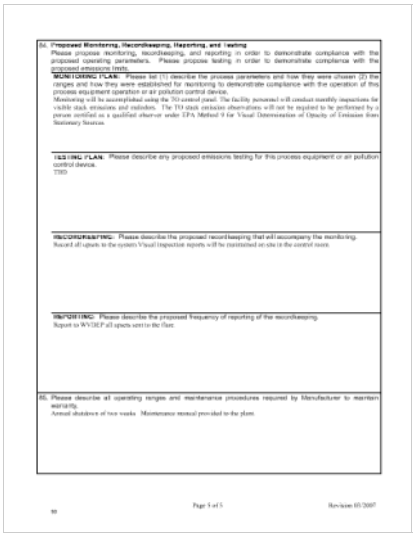
Pollutant	Pounds per Hour lb/hr	grams/ACF	lbf >	PSIA	tons per Year tons/yr	Parts per Million ppm
CO						
Hydrocarbons						
NO_x						
Pb						
PM_{10}						
SO_2						
VOCs						
Other (specify)						

73. If an *Air Pollution Control Device* is not submitted, the emission rates should be the same as those reported here *'Maximum Potential and Maximum Actual Emissions' on the Emission Points Data Summary Sheet.*

74. Emissions rates should be substantiated by submitting *stack test data* and/or *calculations.*

Fuel Usage Data

75. Estimated annual fuel cost: $	
76. Firing rate: Maximum: mmBTU/hr Typical: mmBTU/hr Design: mmBTU/hr	77. Fuel type: ☒ Natural Gas ☐ Coal ☐ Fuel Oil, No. ☐ Other, specify:
78. Typical heating content of fuel:	79. Typical fuel sulfur content: wt. %
80. Typical fuel ash content: wt. %	81. Annual fuel usage:
82. Please complete an *Air Pollution Control Device Sheet(s)* for the control(s) used on this Emission Unit, if applicable.	
83. Have you included the *air pollution rates* on the Emissions Points Data Summary Sheet?	



84. **Proposed Monitoring, Recordkeeping, Reporting, and Testing**
Please propose monitoring, recordkeeping, and reporting in order to demonstrate compliance with the proposed operating parameters. Please propose testing in order to demonstrate compliance with the proposed emissions limits.

MONITORING PLAN: Please list (1) describe the process parameters and how they were chosen (2) the ranges and how they were established for monitoring to demonstrate compliance with the operation of this process equipment operation or air pollution control device.
Monitoring will be accomplished using the TO control panel. The facility personnel will conduct monthly inspections for visible stack emissions and exhibits. The TO stack emission observations will not be required to be performed by a person certified as a qualified observer under EPA Method 9 for Visual Determination of Opacity of Emission from Stationary Sources.

TESTING PLAN: Please describe any proposed emissions testing for this process equipment or air pollution control device.
TBD

RECORDKEEPING: Please describe the proposed recordkeeping that will accompany the monitoring.
Record all upsets to the system Visual inspection reports will be maintained on site in the control room

REPORTING: Please describe the proposed frequency of reporting of the recordkeeping.
Report to WVDEP all upsets sent to the flare

85. Please describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty.
Annual shutdown of two weeks Maintenance manual provided to the plant

Page 5 of 5 Revision 05/2007

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TECHNICAL FILE
(Area-950)

Regenerative Thermal Oxidiser for Power Plant

REGENERATIVE THERMAL OXIDISER (Re-Ox)
(Area 950)

Equipment – MEDRECYCLER – 950

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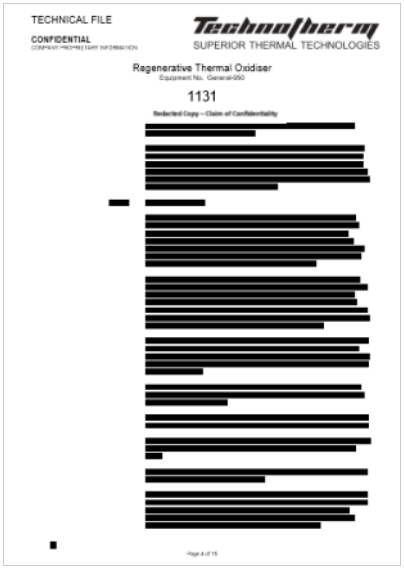
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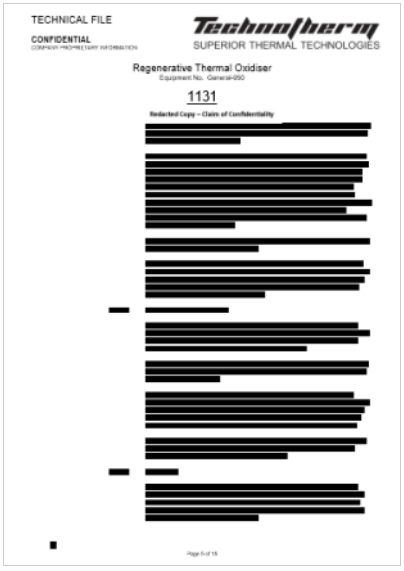
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Equipment No. General-950

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Equipment No. General-950

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Haul Road Fugitivee

Attachment L

Emission Unit Data Sheet

(INDIRECT HEAT EXCHANGER)

Control Device ID No. (must match List Forms) 490

Equipment Information

1. Manufacturer: Technotherm	2. Model No. Serial No.
3. Number of units: Gas desorberion chamber with Cyclones, Desuperheat Heat Exchanger, Tar Condensers, Oil Condensing Scrubbers, Wet Alkali-based Gas Scrubbers, API-CPI Settling tanks (per scrubber), Centrifuge	4. Use: Gas Clean-Up System
5. Rated Boiler Horsepower: N/A hp	6. Boiler Serial No.:
7. Date constructed:	8. Date of last modification and explain:
9. Maximum design heat input per unit: N/A x10⁶ BTU/hr	10. Peak heat input per unit: x10⁶ BTU/hr
11. Steam produced at maximum design output: N/A LB/hr psig	12. Projected Operating Schedule: Hours/Day 24 Days/Week 7 Weeks/Year 52
13. Type of firing equipment to be used: ☐ Pulverized coal ☐ Spreader stoker ☐ Oil burners ☐ Natural Gas Burner ☐ Others, specify	14. Proposed type of burners and orientation: ☐ Vertical ☐ Front Wall ☐ Opposed ☐ Tangential ☐ Others, specify
15. Type of draft: ☐ Forced ☐ Induced	16. Percent of ash retained in furnace: %
17. Will flyash be reinjected? ☐ Yes ☐ No	18. Percent of carbon in flyash. %

Stack or Vent Data

19. Inside diameter or dimensions: ft.	20. Gas exit temperature: 342 °F
21. Height: ft.	22. Stack serves: ☐ This equipment only ☐ Other equipment also (submit type and rating of all other equipment exhausted through this stack or vent)
23. Gas flow rate: ft³/min	
24. Estimated percent of moisture: %	

Fuel Requirements

25. Type	Fuel Oil No.	Natural Gas	Gas (other, specify)	Coal, Type:	Other:
Quantity (at Design Output)	gph@60°F	ft³/hr	ft³/hr	TPH	
Annually	$\times 10^3$ gal	$\times 10^6$ ft³/hr	$\times 10^6$ ft³/hr	tons	
Sulfur	Maximum: wt. % Average: wt. %	gr/100 ft³	gr/100 ft³	Maximum: wt. %	
Ash (%)				Maximum	
BTU Content	BTU/Gal. Low/Gas @60°F	BTU/ft³	BTU/ft³	BTU/lb	
Source					
Supplier					
Halogens (Yes/No)					
Lead and Identify Metals					

26. Gas burner mode of control: ☐ Manual ☐ Automatic full modulation ☐ Automatic low/off ☐ Automatic on-off

27. Gas burner manufacture:

28. Oil burner manufacture:

29. If fuel oil is used, how is it atomized? ☐ Oil Pressure ☐ Compressed Air ☐ Steam Pressure ☐ Rotary Cup ☐ Other, specify

30. Fuel oil preheated: ☐ Yes ☐ No

31. If yes, indicate temperature: °F

32. Specify the calculated theoretical air requirements for combustion of the fuel or mixture of fuels described above actual cubic feet (ACF) per unit of fuel.
@ °F PSIA % moisture

33. Emission rate at rated capacity: lb/hr

34. Percent excess air actually required for combustion of the fuel described: %

Coal Characteristics

35. Seams:

36. Proximate analysis (Dry basis): % of Fixed Carbon: % of Sulfur:
% of Moisture: % of Volatile Matter:
% of Ash:

Emissions Stream

37. What quantities of pollutants will be emitted from the boiler before controls?

Pollutant	Pounds per Hour lb/hr	grain/ACF	@ °F	PSIA
CO				
Hydrocarbons				
NO_x				
Pb				
PM_{10}				
SO_2				
VOCs				
Other (specify)				

38. What quantities of pollutants will be emitted from the boiler after controls?

Pollutant	Pounds per Hour lb/hr	grain/ACF	@ °F	PSIA
CO				
Hydrocarbons				
NO_x				
Pb				
PM_{10}				
SO_2				
VOCs				
Other (specify)				

39. How will waste material from the process and control equipment be disposed of?
Stack 1000, Landfill

40. Have you completed an ***Air Pollution Control Device Sheet(s)*** for the control(s) used on this Emission Unit, Y

41. Have you included the ***air pollution rates*** on the Emissions Points Data Summary Sheet? Y

42. **Proposed Monitoring, Recordkeeping, Reporting, and Testing**
Please propose monitoring, recordkeeping, and reporting in order to demonstrate compliance with the proposed operating parameters. Please propose testing in order to demonstrate compliance with the proposed emissions limits.

MONITORING PLAN: Please list (1) describe the process parameters and how they were chosen (2) the ranges and how they were established for monitoring to demonstrate compliance with the operation of this process equipment operation or air pollution control device.
Weekly and monthly inspections according to manufacturer specifications. Instrumentation to assist in preventing issues.

TESTING PLAN: Please describe any proposed emissions testing for this process equipment or air pollution control device.
Per request.

RECORDKEEPING: Please describe the proposed recordkeeping that will accompany the monitoring.
Any Malfunctions

REPORTING: Please describe the proposed frequency of reporting of the recordkeeping.
All Weekly and Monthly inspections along with any malfunctions

43. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty.
The gas clean-up system will be monitored via instrumentation for any errors or Markups requiring maintenance. Itemizing regular maintenance procedures to be provided by manufacturer.

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Woodhill Office Park - 53 Philip Engelbrecht Street,
Ground Floor, Block A, Moreleta, 1448
Email: info@technotherm.co.za | Tel: 012 940 2400
VAT: 4680256643 | Reg No: 2015/009561/07
All hours number: 0027 78 311 8358

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Synthesis Gas Cleaning System

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Synthesis Gas Cleaning System

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Attachment L
EMISSIONS UNIT DATA SHEET
GENERAL

To be used for affected sources other than asphalt plants, foundries, incinerators, indirect heat exchangers, and quarries.
Identification Number (as assigned on *Equipment List Form*): 120

1. Name or type and model of proposed affected source:

Dryer
Technotherm

2. On a separate sheet(s), furnish a sketch(es) of this affected source. If a modification is to be made to this source, clearly indicated the change(s). Provide a narrative description of all features of the affected source which may affect the production of air pollutants.

3. Name(s) and maximum amount of proposed process material(s) charged per hour:

7,332.6 lb/hr

4. Name(s) and maximum amount of proposed material(s) produced per hour:

7,700 lb/hr dryer maximum

5. Give chemical reactions, if applicable, that will be involved in the generation of air pollutants:

N/A

* The identification number which appears here must correspond to the air pollution control device identification number appearing on the *List Form*.

6. Combustion Data (if applicable):
(a) Type and amount in appropriate units of fuel(s) to be burned:

76 cfm of natural gas for 4 hrs during start-up then will use syngas

(b) Chemical analysis of proposed fuel(s), excluding coal, including maximum percent sulfur and ash:

Natural gas
Syngas will vary in composition

(c) Theoretical combustion air requirement (ACF~~unit of fuel~~):

29643 @ 60 °F and 14.7 psia.

(d) Percent excess air:

(e) Type and BTU/hr of burners and all other firing equipment planned to be used:

1 burner

(f) If coal is proposed as a source of fuel, identify supplier and seams and give sizing of the coal as it will be fired:

N/A

(g) Proposed maximum design heat input: 4.39 × 10^6 BTU/hr.

7. Projected operating schedule:

Hours/Day	24	Days/Week	7	Weeks/Year	52

8. Projected amount of pollutants that would be emitted from this affected source if no control devices were used:

@ N/A °F and psia

a.	NO_2	N/A	lb/hr	N/A	grains/ACF
b.	SO_2	N/A	lb/hr	N/A	grains/ACF
c.	CO	N/A	lb/hr	N/A	grains/ACF
d.	PM_{10}	N/A	lb/hr	N/A	grains/ACF
e.	Hydrocarbons	N/A	lb/hr	N/A	grains/ACF
f.	VOCs	N/A	lb/hr	N/A	grains/ACF
g.	PS	N/A	lb/hr	N/A	grains/ACF
h.	Specify other(s)				
			lb/hr		grains/ACF
			lb/hr		grains/ACF
			lb/hr		grains/ACF
			lb/hr		grains/ACF

NOTE: (1) An Air Pollution Control Device Sheet must be completed for any air pollution device(s) used to control emissions from this affected source.
(2) Complete the Emission Points Data Sheet.

9. Proposed Monitoring, Recordkeeping, Reporting, and Testing
Please propose monitoring, recordkeeping, and reporting in order to demonstrate compliance with the proposed operating parameters. Please propose testing in order to demonstrate compliance with the proposed emissions limits.

MONITORING	RECORDKEEPING
Weekly and monthly inspections according to manufacturer specifications.	All Weekly and Monthly inspections along with any malfunctions
REPORTING	**TESTING**
Any malfunctions.	Upon request.

MONITORING. PLEASE LIST AND DESCRIBE THE PROCESS PARAMETERS AND RANGES THAT ARE PROPOSED TO BE MONITORED IN ORDER TO DEMONSTRATE COMPLIANCE WITH THE OPERATION OF THIS PROCESS EQUIPMENT OPERATION/AIR POLLUTION CONTROL DEVICE.
RECORDKEEPING. PLEASE DESCRIBE THE PROPOSED RECORDKEEPING THAT WILL ACCOMPANY THE MONITORING.
REPORTING. PLEASE DESCRIBE THE PROPOSED FREQUENCY OF REPORTING OF THE RECORDKEEPING.
TESTING. PLEASE DESCRIBE ANY PROPOSED EMISSIONS TESTING FOR THIS PROCESS EQUIPMENT/AIR POLLUTION CONTROL DEVICE.

10. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty
Routine maintenance (lubrication) do not require shut down. Major maintenance issues to involve a shut-down.

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TECHNICAL FILE
(Area-030)

Dryer for Power Plant

DRYER PLANT
(Area 030)

Equipment – MEDRECYCLER – 030

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Equipment No. General-030

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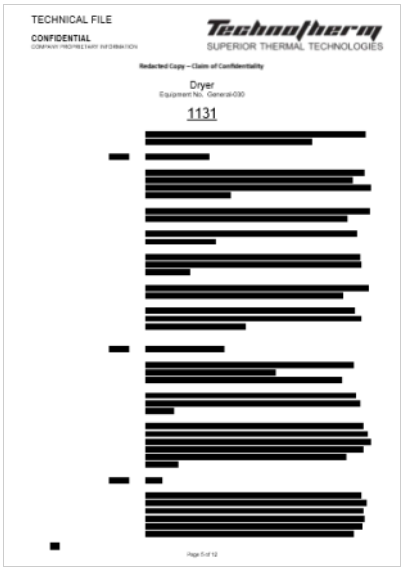
Page 4 of 12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Dryer

Equipment No. General-030

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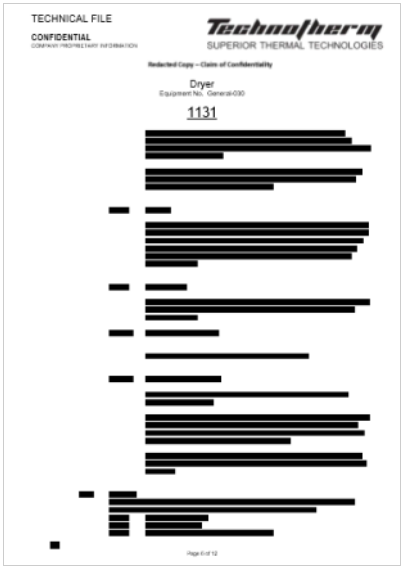
Page 5 of 12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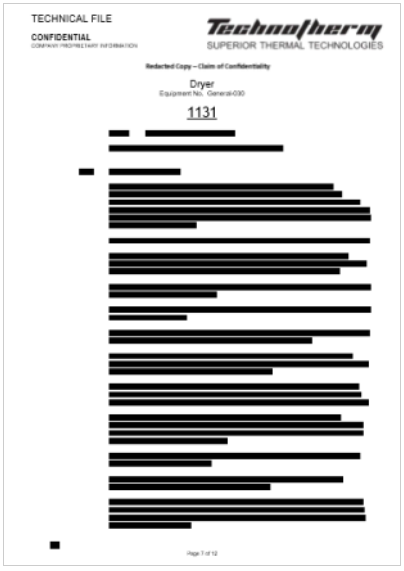
Page 6 of 12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Page 7 of 12

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CONFIDENTIAL

COMPANY PROPRIETARY INFORMATION

Technotherm

SUPERIOR THERMAL TECHNOLOGIES

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Dryer

Equipment No. General-030

1131

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Page 6 of 12

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Technotherm

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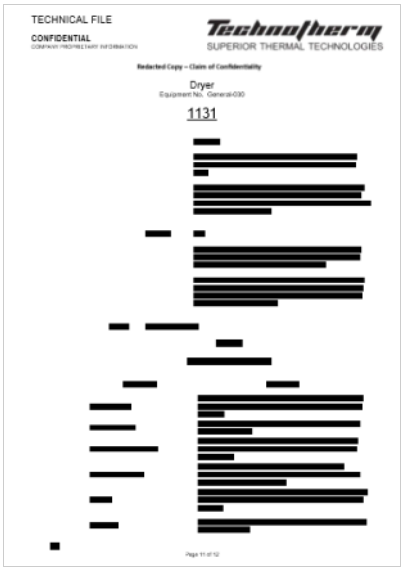
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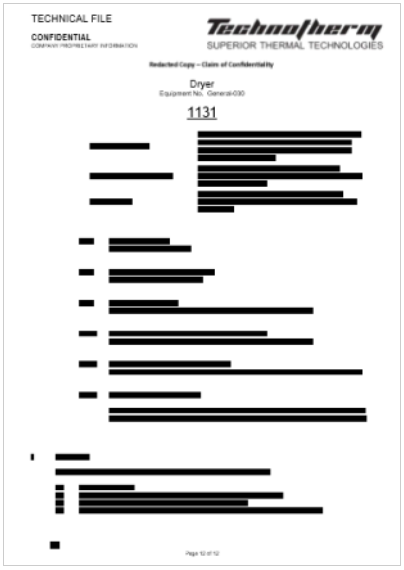
CONFIDENTIAL
COMPANY PROPRIETARY INFORMATION
Technotherm
SUPERIOR THERMAL TECHNOLOGIES
Redacted Copy – Claim of Confidentiality
Dryer
Equipment No. General-030
1131
Page 11 of 12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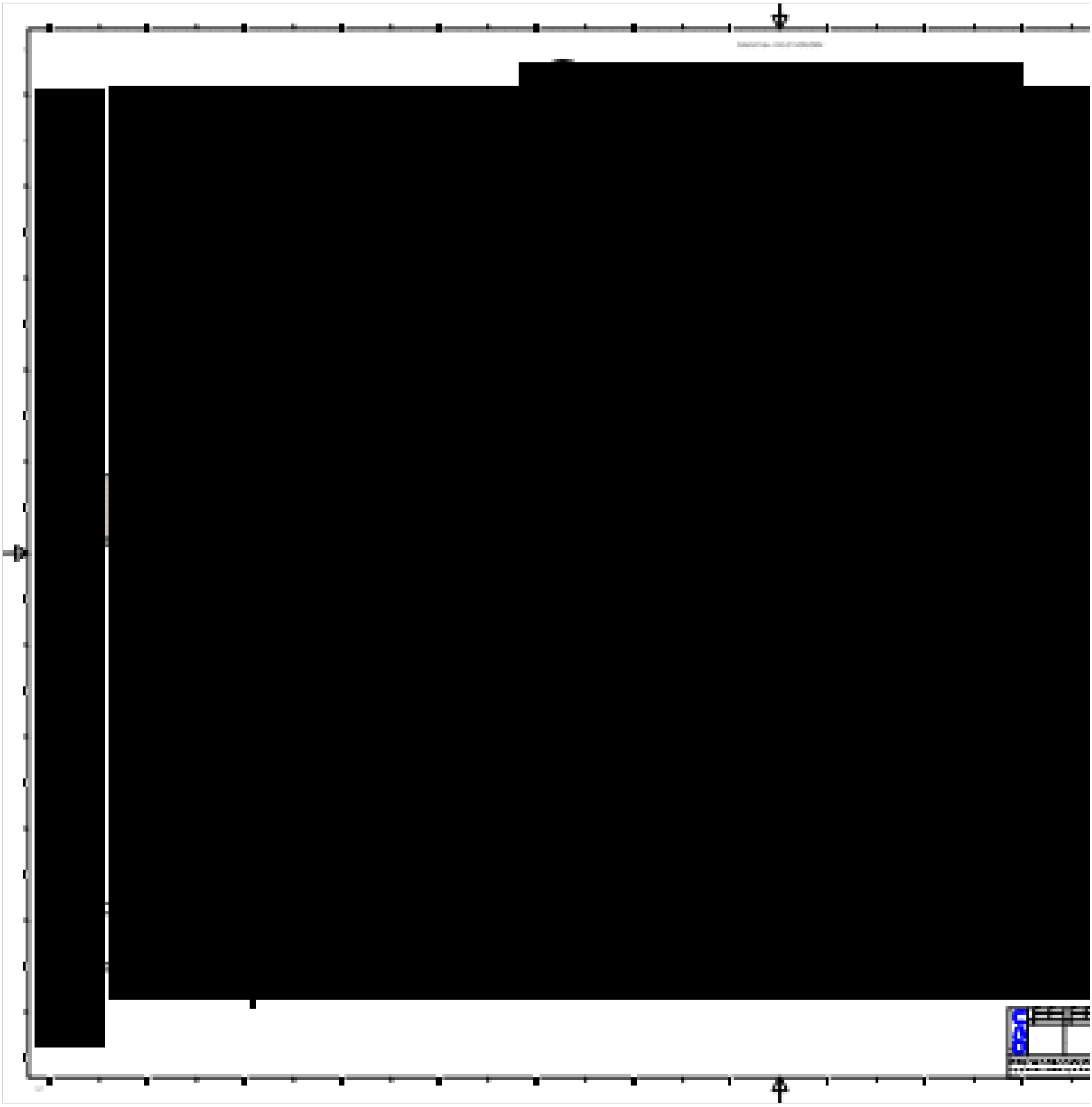
Technotherm
SUPERIOR THERMAL TECHNOLOGIES
Redacted Copy – Claim of Confidentiality
Dryer
Equipment No. General-030
1131
Page 12 of 12



Attachment L
EMISSIONS UNIT DATA SHEET
GENERAL

To be used for affected sources other than asphalt plants, foundries, incinerators, indirect heat exchangers, and quarries.
Identification Number (as assigned on *Equipment List Form*): 200

1. Name or type and model of proposed affected source:

Macerator/Shredder
Medical Waste Shredder by Technoform

2. On a separate sheet(s), furnish a sketch(es) of this affected source. If a modification is to be made to this source, clearly indicated the change(s). Provide a narrative description of all features of the affected source which may affect the production of air pollutants.

3. Name(s) and maximum amount of proposed process material(s) charged per hour:

2,542.7 lb/hr

4. Name(s) and maximum amount of proposed material(s) produced per hour:

2,542.7 lb/hr

5. Give chemical reactions, if applicable, that will be involved in the generation of air pollutants:

N/A

* The identification number which appears here must correspond to the air pollution control device identification number appearing on the *List Form*.

6. Combustion Data (if applicable):
(a) Type and amount in appropriate units of fuel(s) to be burned:

N/A

(b) Chemical analysis of proposed fuel(s), excluding coal, including maximum percent sulfur and ash:

N/A

(c) Theoretical combustion air requirement (ACF/unit of fuel):

N/A @ °F and psia.

(d) Percent excess air: N/A

(e) Type and BTU/hr of burners and all other firing equipment planned to be used:

N/A

(f) If coal is proposed as a source of fuel, identify supplier and seams and give sizing of the coal as it will be fired:

N/A

(g) Proposed maximum design heat input: N/A × 10^6 BTU/hr.

7. Projected operating schedule:

Hours/Day	24	Days/Week	7	Weeks/Year	52

8. Projected amount of pollutants that would be emitted from this affected source if no control devices were used:

@ N/A °F and psia

a.	NO_x	N/A	lb/hr	N/A	grains/ACF
b.	SO_2	N/A	lb/hr	N/A	grains/ACF
c.	CO	N/A	lb/hr	N/A	grains/ACF
d.	PM_{10}	N/A	lb/hr	N/A	grains/ACF
e.	Hydrocarbons	N/A	lb/hr	N/A	grains/ACF
f.	VOCs	N/A	lb/hr	N/A	grains/ACF
g.	Pb	N/A	lb/hr	N/A	grains/ACF
h.	Specify other(s)				
			lb/hr		grains/ACF
			lb/hr		grains/ACF
			lb/hr		grains/ACF
			lb/hr		grains/ACF

NOTE: (1) An Air Pollution Control Device Sheet must be completed for any air pollution device(s) used to control emissions from this affected source.
(2) Complete the Emission Points Data Sheet.

9. Proposed Monitoring, Recordkeeping, Reporting, and Testing
Please propose monitoring, recordkeeping, and reporting in order to demonstrate compliance with the proposed operating parameters. Please propose testing in order to demonstrate compliance with the proposed emissions limits.

MONITORING	RECORDKEEPING
Weekly and monthly inspections according to manufacturer specifications.	All Weekly and Monthly inspections along with any malfunctions
REPORTING	**TESTING**
Any malfunctions.	No air emissions associated with equipment

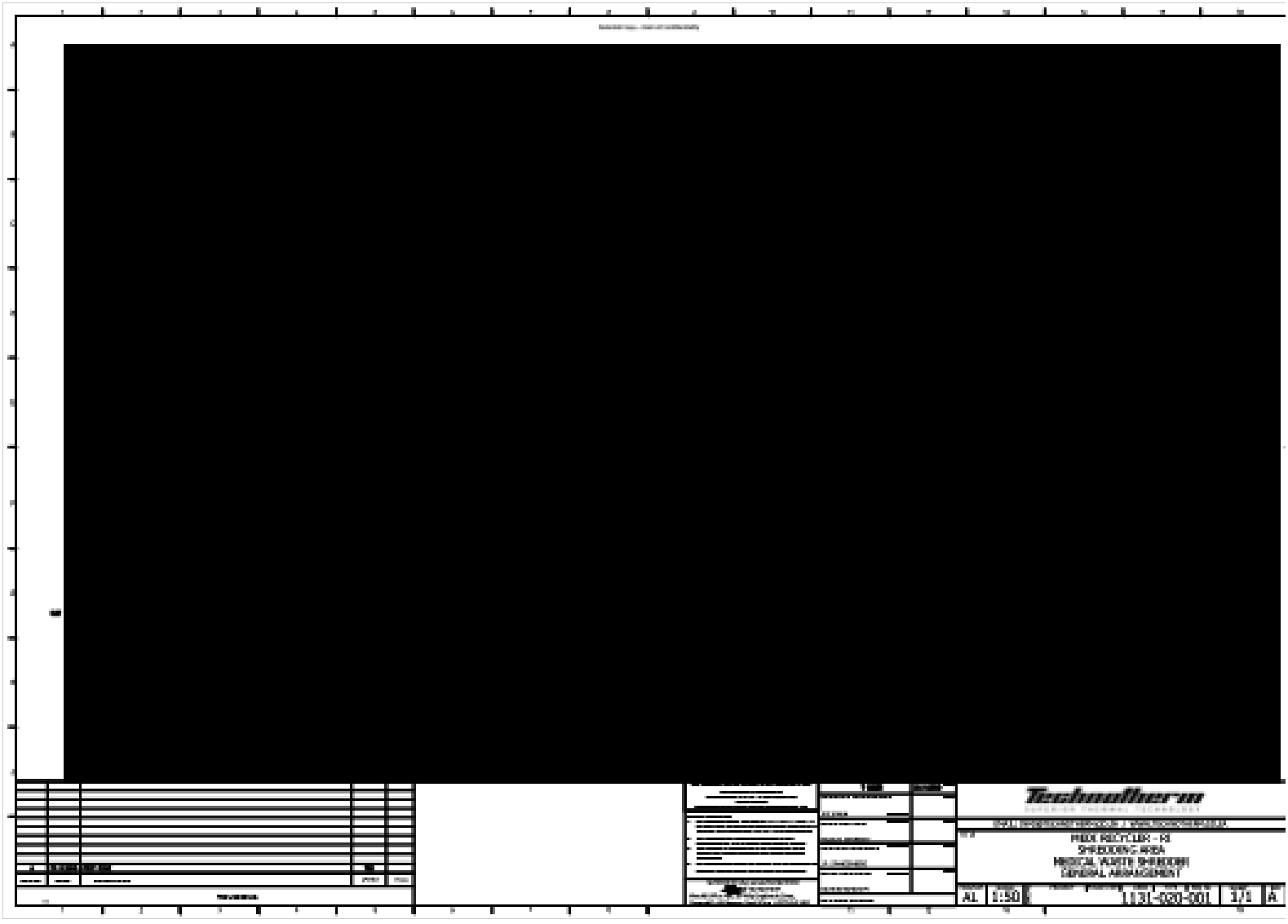
MONITORING. PLEASE LIST AND DESCRIBE THE PROCESS PARAMETERS AND RANGES THAT ARE PROPOSED TO BE MONITORED IN ORDER TO DEMONSTRATE COMPLIANCE WITH THE OPERATION OF THIS PROCESS EQUIPMENT OPERATION/AIR POLLUTION CONTROL DEVICE.

RECORDKEEPING. PLEASE DESCRIBE THE PROPOSED RECORDKEEPING THAT WILL ACCOMPANY THE MONITORING.

REPORTING. PLEASE DESCRIBE THE PROPOSED FREQUENCY OF REPORTING OF THE RECORDKEEPING.

TESTING. PLEASE DESCRIBE ANY PROPOSED EMISSIONS TESTING FOR THIS PROCESS EQUIPMENT/AIR POLLUTION CONTROL DEVICE.

10. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty.
Operations to take place at -0.0035psia



Attachment L
EMISSIONS UNIT DATA SHEET
BULK LIQUID TRANSFER OPERATIONS

Furnish the following information for each new or modified bulk liquid transfer area or loading rack, as shown on the *Equipment List Form* and other parts of this application. This form is to be used for bulk liquid transfer operations such as to and from drums, marine vessels, rail tank cars, and tank trucks.

Identification Number (as assigned on *Equipment List Form*):
1. Loading Area Name:
2. Type of cargo vessels accommodated at this rack or transfer point (check as many as apply): ☐ Drums ☐ Marine Vessels ☐ Rail Tank Cars ☒ Tank Trucks

3. Loading Rack or Transfer Point Data:	
Number of pumps	
Number of liquids loaded	2
Maximum number of marine vessels, tank trucks, tank cars, and/or drums loading at one time	1

4. Does ballasting of marine vessels occur at this loading area? ☐ Yes ☐ No ☒ Does not apply
5. Describe cleaning location, compounds and procedure for cargo vessels using this transfer point:
6. Are cargo vessels pressure tested for leaks at this or any other location? ☐ Yes ☒ No If YES, describe:
7. Projected Maximum Operating Schedule (for rack or transfer point as a whole):

Maximum	Jan. - Mar.	Apr. - June	July - Sept	Oct. - Dec.
hours/day				
days/week				
weeks/quarter				

8. Bulk Liquid Data *(add pages as necessary)*:

Pump ID No.							
Liquid Name		HCL					
Max. daily throughput (1000 gal/day)		5k					
Max. annual throughput (1000 gal/yr)		1300					
Loading Method [1]		sub					
Max. Fill Rate (gal/min)		1000					
Average Fill Time (min/loading)		500					
Max. Bulk Liquid Temperature (°F)		75					
True Vapor Pressure [2]							
Cargo Vessel Condition [3]							
Control Equipment or Method [4]							
Minimum control efficiency (%)							
Maximum Emission Rate	Loading (lb/hr)						
	Annual (lb/yr)						
Estimation Method [5]							

[1] BF = Bottom Fill SP = Splash Fill SUB = Submerged Fill

[2] At maximum bulk liquid temperature

[3] B = Ballasted Vessel, C = Cleaned, U = Uncleaned (dedicated service), O = other (describe)

[4] List as many as apply (complete and submit appropriate *Air Pollution Control Device Sheet*): CA = Carbon Adsorption CDA = Cyclone (Adsorption) CO = Condensation DO = Dual Organic Scrubber (Absorption) ECA = Electrostatic Precipitator-Adsorption FL = Flare LOA = Lean Oil Adsorption RO = Refrigeration-Absorption SC = Scrubber (Absorption) SCA = Compression-Refrigeration-Absorption TO = Thermal Oxidation or Incineration CRC = Compression-Refrigeration-Condensation VB = Dedicated Vapor Balance (closed system) O = other (describe)

[5] EPA = EPA Emission Factor as stated in AP-42
MB = Material Balance

TM = Test Measurement based upon test data submittal
O = other (describe)

9. **Proposed Monitoring, Recordkeeping, Reporting, and Testing**
Please propose monitoring, recordkeeping, and reporting in order to demonstrate compliance with the proposed operating parameters. Please propose testing in order to demonstrate compliance with the proposed emissions limits.

MONITORING	RECORDKEEPING
REPORTING	TESTING

MONITORING. PLEASE LIST AND DESCRIBE THE PROCESS PARAMETERS AND RANGES THAT ARE PROPOSED TO BE MONITORED IN ORDER TO DEMONSTRATE COMPLIANCE WITH THE OPERATION OF THIS PROCESS EQUIPMENT/OPERATION/AIR POLLUTION CONTROL DEVICE.

RECORDKEEPING. PLEASE DESCRIBE THE PROPOSED RECORDKEEPING THAT WILL ACCOMPANY THE MONITORING.

REPORTING. PLEASE DESCRIBE THE PROPOSED FREQUENCY OF REPORTING OF THE RECORDKEEPING.

TESTING. PLEASE DESCRIBE ANY PROPOSED EMISSIONS TESTING FOR THIS PROCESS EQUIPMENT/AIR POLLUTION CONTROL DEVICE.

10. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty.

ATTACHMENT M

Air Pollution Control Device Sheet

tnd

Attachment L

FUGITIVE EMISSIONS FROM UNPAVED HAULROADS

UNPAVED HAULROADS (including all equipment traffic involved in process, haul trucks, endloaders, etc.)

		PM	PM-10
k =	Particle size multiplier	0.80	0.36
s =	Silt content of road surface material (%)		
p =	Number of days per year with precipitation >0.01 in.		

Item Number	Description	Number of Wheels	Mean Vehicle Weight (tons)	Mean Vehicle Speed (mph)	Miles per Trip	Maximum Trips per Hour	Maximum Trips per Year	Control Device ID Number	Control Efficiency (%)
1									
2									
3									
4									
5									
6									
7									
8									

Source: AP-42 Fifth Edition – 13.2.2 Unpaved Roads

E = k × 5.9 × (s ÷ 12) × (S ÷ 30) × (W ÷ 3)$^{0.7}$ × (w ÷ 4)$^{0.5}$ × ((365 – p) ÷ 365) = lb/Vehicle Mile Traveled (VMT)

Where:

		PM	PM-10
k =	Particle size multiplier	0.80	0.36
s =	Silt content of road surface material (%)		
S =	Mean vehicle speed (mph)		
W =	Mean vehicle weight (tons)		
w =	Mean number of wheels per vehicle		
p =	Number of days per year with precipitation >0.01 in.		

For lb/hr: [lb = VMT] × [VMT = trip] × (Trips ÷ Hour) = lb/hr

For TPY: [lb = VMT] × [VMT = trip] × (Trips ÷ Hour) × (Ton ÷ 2000 lb) = Tons/year

SUMMARY OF UNPAVED HAULROAD EMISSIONS

Item No.	PM				PM-10			
	Uncontrolled		Controlled		Uncontrolled		Controlled	
	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY	lb/hr	TPY
1								
2								
3								
4								
5								
6								
7								
8								
TOTALS								

tn1

FUGITIVE EMISSIONS FROM PAVED HAULROADS

INDUSTRIAL PAVED HAULROADS (including all equipment traffic involved in process, haul trucks, endloaders, etc.)

i =	Industrial augmentation factor (dimensionless)	
n =	Number of traffic lanes	
s =	Surface material silt content (%)	
L =	Surface dust loading (lb/mile)	

Item Number	Description	Mean Vehicle Weight (tons)	Miles per Trip	Maximum Trips per Hour	Maximum Trips per Year	Control Device ID Number	Control Efficiency (%)
1							
2							
3							
4							
5							
6							
7							
8							

Source: AP-42 Fifth Edition – 13.2.6 Industrial Paved Roads

E = 0.077 × i × (4 ÷ n) × (s ÷ 10) × (L ÷ 1000) × (W ÷ 3)$^{0.7}$ = lb/Vehicle Mile Traveled (VMT)

Where:

i =	Industrial augmentation factor (dimensionless)	
n =	Number of traffic lanes	
s =	Surface material silt content (%)	
L =	Surface dust loading (lb/mile)	
W =	Average vehicle weight (tons)	

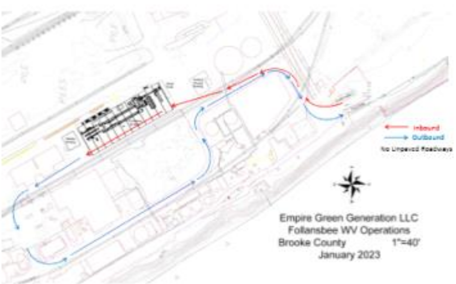
For lb/hr: [lb = VMT] × [VMT = trip] × (Trips ÷ Hour) = lb/hr

For TPY: [lb = VMT] × [VMT = trip] × (Trips ÷ Hour) × (Ton ÷ 2000 lb) = Tons/year

SUMMARY OF PAVED HAULROAD EMISSIONS

Item No.	Uncontrolled		Controlled	
	lb/hr	TPY	lb/hr	TPY
1				
2				
3				
4				
5				
6				
7				
8				
TOTALS				

tn2



Attachment M
Air Pollution Control Device Sheet
(FLARE SYSTEM)

Control Device ID No. (must match Emission Units Table): 1000

Equipment Information

1. Manufacturer: Technotherm
   Model No. To Be Determined

2. Method: ☐ Elevated flare ☒ Ground flare ☐ Other
   Describe
   Stack/Emergency Flare

3. Provide diagram(s) of unit describing capture system with duct arrangement and size of duct, air volume, capacity, horsepower of movers. If applicable, state hood face velocity and hood collection efficiency.

4. Method of system used:
   ☐ Steam-assisted ☒ Air-assisted ☐ Pressure-assisted ☐ Non-assisted

5. Maximum capacity of flare:
   15,239 scf/min
   scf/hr

6. Dimensions of stack:
   Diameter 2.36 ft.
   Height 49.21 ft.

7. Estimated combustion efficiency:
   (Waste gas destruction efficiency)
   Estimated: >98 %
   Minimum guaranteed: >98 %

8. Fuel used in burners:
   ☒ Natural Gas
   ☐ Fuel Oil, Number
   ☐ Other, Specify: Syn Gas

9. Number of burners: 1
   Rating: 12,247 BTU/hr

10. Will preheat be used? ☐ Yes ☒ No

11. Describe method of controlling flame:

12. Flare height: 49.21 ft

13. Flare tip inside diameter: 2.36 ft

14. Natural gas flow rate to flare pilot flame per pilot light:
    0.20 scf/min
    12.0 scf/hr

15. Number of pilot lights: 1
    Total 12,247 BTU/hr

16. Will automatic re-ignition be used?
    ☒ Yes ☐ No

17. If automatic re-ignition will be used, describe the method:
    An electrical ignition assembly will be used to ignite the gases and including ignitor rods and an electrical control assembly to provide a spark. The assembly will be employed to light the pilot. A pilot flame thermocouple and a stack flame thermocouple will monitor the system and provide the spark for re-ignition when necessary.

18. Is pilot flame equipped with a monitor? ☒ Yes ☐ No
    If yes, what type? ☒ Thermocouple ☐ Infra-Red
    ☐ Ultra Violet ☐ Camera with monitoring control room
    ☐ Other, Describe:

19. Hours of unit operation per year: 24 hours per day; 7 days per week

Page 1 of 3 Revision 03/15/2007

Steam Injection

20. Will steam injection be used? ☐ Yes ☒ No

21. Steam pressure PSIG
    Minimum Expected:
    Design Maximum:

22. Total Steam flow rate: LB/hr

23. Temperature: °F

24. Velocity ft/sec

25. Number of jet streams

26. Diameter of steam jets: in

27. Design basis for steam injected:
    LB steam/LB hydrocarbon

28. How will steam flow be controlled if steam injection is used?

Characteristics of the Waste Gas Stream to be Burned

29.

Name	Quantity Grains of H_2S/100 ft³	Quantity (LB/hr, ft³/hr, etc)	Source of Material
Hydrocarbons	TBD		
Cynaide Compounds	TBD		
Ammonia	TBD		
CO	TBD		
Hydrogen	TBD		
NOx / SOx	TBD		

30. Estimate total combustible to flare: 66,000 acfm ~~LB/hr~~ or ACF/hr
    (Maximum mass flow rate of waste gas) scfm

31. Estimated total flow rate to flare including materials to be burned, carrier gases, auxiliary fuel, etc.:
    5,100 LB/hr or ~~ACF/hr~~

32. Give composition of carrier gases:
    TBD Syngas

33. Temperature of emission stream:
    1,562 °F max
    Heating value of emission stream:
    TBD BTU/ft³
    Mean molecular weight of emission stream:
    MW = TBD lb/lb-mole

34. Identify and describe all auxiliary fuels to be burned.
    Not Applicable BTU/scf
    BTU/scf
    BTU/scf
    BTU/scf
    BTU/scf

35. Temperature of flare gas: 932 °F

36. Flare gas flow rate: 11,000 acf/min

37. Flare gas heat content: TBD BTU/ft³

38. Flare gas exit velocity: TBD scf/min

39. Maximum rate during emergency for one major piece of equipment or process unit: N/A scf/min

40. Maximum rate during emergency for one major piece of equipment or process unit: N/A BTU/min

41. Describe any air pollution control device inlet and outlet gas conditioning processes (e.g., gas cooling, gas reheating, gas humidification):
    Not Applicable

42. Describe the collection material disposal system:
    Not Applicable

43. Have you included ***Flare Control Device*** in the Emissions Points Data Summary Sheet? Yes

Page 2 of 3 Revision 03/15/2007

41. Proposed Monitoring, Recordkeeping, Reporting, and Testing
Please propose monitoring, recordkeeping, and reporting in order to demonstrate compliance with the proposed operating parameters. Please propose testing in order to demonstrate compliance with the proposed emissions limits.

MONITORING:	RECORDKEEPING:
Monitoring will be accomplished using the control panel. The facility personnel will conduct monthly inspections for visible stack emissions and odorless. The stack emission observations will not be required to be performed by a person certified as a qualified observer under EPA Method 9 for Visual Determination of Opacity of Emission from Stationary Sources.	Record all upsets to the system.Visual inspection reports will be maintained on site in the control room.
REPORTING:	TESTING:
Report to WVDEP all upsets sent to the flare.	TBD

MONITORING: Please list and describe the process parameters and ranges that are proposed to be monitored in order to demonstrate compliance with the operation of this process equipment or air control device.
RECORDKEEPING: Please describe the proposed recordkeeping that will accompany the monitoring.
REPORTING: Please describe any proposed emissions testing for this process equipment on air pollution control device.
TESTING: Please describe any proposed emissions testing for this process equipment on air pollution control device.

45. Manufacturer's Guaranteed Capture Efficiency for each air pollutant.
<98%

46. Manufacturer's Guaranteed Control Efficiency for each air pollutant.
<98%

47. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty.
See attached document

krom schroder

Ionisationszündbrenner
Ionization pilot burner
Brûleur pilote à ionisation
ZAI

krom schroder

Ionisationszündbrenner ZAI

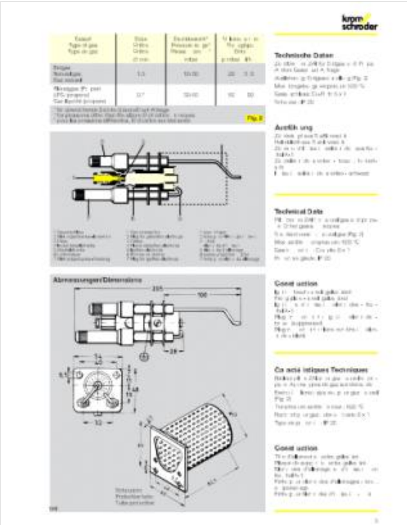
Anwendung

Ionization pilot burner ZAI

Application

Brûleur pilote à ionisation ZAI

Application



2019/03/19

Specification sheet

Equipment type: Stack

Equipment name: Stack

Project: 1131-MedRecycler

Design velocity (m/s)	20
Design exhaust flow (m^3/hr)	25890
Material of construction	mild steel, painted
Inner diameter (mm)	720
Total height above ground (mm)	15000
Height from ground to air inlet (mm)	2000
Distance insulated from air inlet (mm)	2000
Outer diameter insulated zone (mm)	1020
Rain hood	none

914,286.721 cfhr
15,238.29 cf/min

Disclaimer: values are subject to change.

161

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www.technotherm.co.za
www.technothermsa.com

1141 – General Operations and Maintenance

Company: Empire Diversified Energy
Address: 600 Veterans Drive
Follansbee WV
USA

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Contents

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Introduction

Project Overview

The Project as a commercial Plant using advanced conversion technology in the nature of a waste acceptance facility using plastics with moisture content of 39% from which a clean syngas is produced and subsequently combusted in reciprocating engine generator sets to produce electricity for export.

The Project comprises of a macerator, rotary thermal dryer, 2 sets of pyrolysers , 3 sets of syngas clean-up equipment, a hydrochloric acid recovery system, gas bladder (syngas accumulator), reciprocating engine generators, thermal oxidiser, a stack and flare.
The Facility is a 3 tph swallowing capacity plastics to renewable energy power plant producing baseload electricity for export to the grid. The Project is operated on a continuous basis and is designed with sufficient plant redundancy to negate any single point total plant failures.

Waste heat is recovered from the exhaust of the engines and the Pyrolyser to dry the plastics once shredded. Site available natural gas provides start-up and standby thermal energy. The plant design and configuration is comprised of equipment that results in low life cycle costs, high operational efficiency and operational flexibility consistent with the results of the design reviews, RAM and HAZOP studies conducted during the project execution.

Supplier

Company Name	TECHNOTHERM
Physical Address	86 Rand Vaal Road Rand Vaal, Gauteng South Africa
Telephone	+27 (0)10 045 3603
Facsimile	+27 (0)86 586 5921
Website	www.technotherm.co.za

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Plant and Equipment

This instruction manual relates to a WASTE TO ENERGY PLANT Scheme.
The design is for 900ºC maximum process temperature.
It essentially comprises of a

- Shredder
- Dryer
- Pyrolysers
- Hydrochloric acid recovery system
- Gas clean-up system
- Gas temporary storage
- Engines
- Regenerative thermal oxidiser
- Stack and flare

Operating Philosophy

Overall process takes plastics, received by a transporting company, and thermally processes it in a pyrolysis system operating at 800ºC - 900ºC (1,472ºF - 2,162ºF). Organic matter from the plastics is evaporated forming a syngas that can directly be used as a fuel source for electrical generating engines. Oil and tar are produced where the oil is recycled through the pyrolysis system to make more syngas, and the tar is used to heat a vitrification system where solids from the process are vitrified and made inert. Exhaust from the engines are sent to a drying unit, where the plastics is dried prior to being introduced into the pyrolysis system. All gasses are sent to a Thermal Oxidizer operating at 850ºC (1,562ºF), after which they are conditioned for release to atmosphere via a stack.

Shredder Section

Plastics received at the facility will be in sealed containers about 2 feet square and they are not opened. Each box has an inventory, so Empire Green Generation knows what is in the box prior to being fed into the Pyrolysis System. Plastics in boxes are not stored on site but are processed as they arrive after cataloging the wastes.

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Sealed containers will be fed into the Macerator. In the Macerator, operating under negative pressure, the plastics in sealed containers will be reduced to 25 mm or less.

Drying Section

The drying of the feedstock is carried out in a direct heated, parallel flow, rotary twin drum type dryer using a combination of engine exhaust and, if necessary during start-up or unusual operating conditions, syngas and, as a last resort, natural gas.

Feedstock is transported from the dryer feed hopper into the dryer by means of a screw conveyor. Upon entering the dryer inner retort, the moist feedstock comes into direct contact with the parallel stream of hot flue gases.

Lifters and progression plates ensure intimate contact between the feedstock and flue gas therefore facilitating efficient drying and movement of feedstock along the retort.

Once both feedstock and flue gases reach the closed end of the dryer they are discharged from the inner concentric retort into the outer retort and return to the entry end of the dryer, discharging 10% moisture level feedstock into an expansion chamber. Coarse dry feedstock falls to the bottom of the chamber forming a heap on the conveyor located beneath.

The flue gas exhaust, contaminated with light particulate feedstock material, is also discharged from the expansion chamber and ducted to a bank of cyclones where separation occurs. Fine particulate falls to the bottom of each cyclone and is discharged via rotary valves into a common screw conveyor. The screw conveyor discharges the fine product onto the conveyor joining the dryer exit material and fine product. This conveyor transfers the combined dry feedstock streams onto a conveyor feeding an intermediate storage hopper that feeds both pyrolysers.

HCl Recovery System

This system is fed with dried feedstock from a thermal dryer via a live bottom screw hopper. Material is fed from a gas-tight, storage hopper into the horizontal pre-pyrolyser retort by a rotary screw. The feedstock passes through a pre-pyrolyser chamber where it is

heated in an inert environment to allow gradual release of Chlorine. The gas is removed and condensed to form hydrochloric acid where after it is bottled.

Pyrolyser

The pyroliyser train is fed dried and partially reconstructed feedstock from the HCl recovery system as described in the previous section. The pyrolysis train consists of two identical pyrolysers. Per unit, the source of indirect heat is primarily hot exhaust flue gas from a furnace located beneath the pyrolysis retort. These hot flue gasses exit the pyrolysis retorts and then progress to the medium grade heat applications (Thermal dryer and during start up syngas cooler and tar condenser). Supplemental heating of the pyrolysis retort is being provided by firing a portion of the cleaned syngas. Natural gas is available for initial start-up or any start-up where insufficient syngas is available. After passing through the dryers the flue gas is progressed to the thermal oxidiser.

As the material passes through the pyrolysis retort, it undergoes thermal degradation releasing volatile organic syngas compounds that is discharged from the retort. The crude syngas off-takes are collected into a common manifold that transfers the syngas to the syngas cleaning system.

The heavier particles, mainly comprising of ash and fixed carbon, collect in a specially designed high temperature de-acceleration chamber where the particles are collected and returned to the furnace for energy recovery.

Ash and carbonaceous residue produced by the pyrolysers drops off the dust from the aforementioned de-acceleration chamber screw conveyers, together with the main residue collected from the base of the pyroliyser into a refractory lined furnace fired by recovered tars (described below in the syngas cleaning equipment). The heat liberated by burning the tars and oils is sufficient to heat the ash from the pyrolysis units above their eutectic temperature with excess, preheated air to burn off the tars. The char is completely combusted into CO_2 and H_2O.

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Syngas Clean-up

Particulate Matter Clean-up

Raw syngas is removed from the pyrolysis retorts, as described above, and passes through a de-acceleration chamber and then hot cyclones. The cyclones are arranged for parallel flow to ensure maximum PM removal efficiency during start-up and shutdown as the flow varies. PM drops to specially designed hot screw conveyors and from there is directed to the vitrification furnaces described above.

Syngas Coolers

The partially cleaned, still hot, flue gas flows next through stainless steel tubular syngas coolers. The cooler is in essence a heat exchanger which indirectly transfers heat from syngas to the combustion air heaters.

Tar Condensers

The syngas from the coolers described above flows to a stainless-steel shell & tube heat exchanger/cooler that is cooled by an air blower system. Tars are condensed out and drop into heated troughs, the heat source of which is engine exhaust. Hot condensed tar is pumped to the vitrification furnaces described above. The common installed spare set of coolers uses engine exhaust flue gas to heat the heat exchangers and thereby cause the tars to drop into the heated trough below.

Oil Scrubbers

The syngas from the tar condensers described above flows to a scrubber with interconnected oil and water separator.

Dosing Scrubbers

From the oil scrubber the syngas flows through a high pressure drop venturi scrubber which is kept at a set pH to neutralise the gas before progressing to temporary storage.

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Gas Bladder (Syngas Storage Tank)

The syngas storage tank provides surge capacity of cleaned syngas to level out flow and composition variations. The bladder is contained within a demarcated area. The bladder will operate with an internal pressure of 30 to 40 millibar gauge.

Thermal Oxidiser

All flue gasses enter a thermal oxidiser comprising of a rectangular box shaped furnace. The internal dimensions are determined by the total volume that needs to be raised to 830°C and maintained for 2 seconds.

Stack and Flare

The stack and flare comprises of the following:

1. Induced Draft Fan
2. Flare Stack (combined with plant stack) and
3. Plant Stack (3 m above nearest building x 720 mm dia.)

The treated hot gasses progress through the stack and disperses into the atmosphere after passing through the thermal oxidiser.

Gas Engines

Each syngas engine is a fully packaged unit complete with all associated components and auxiliaries. These engines are of robust design and have been proven on low and medium calorific value gas fuels.

The engine package allows the engine to start, synchronise, operate continuously at base or part load and shut down.

The syngas engines are situated in containers as indicated on the plant layout and engine cooling will occur by means of external radiators.

Maintenance

Scheduled Maintenance

It is assumed that the plant will be subject to the same general routine maintenance discipline, in respect of cleanliness, neatness corrosion control etc. as the other plant and equipment in the factory.

General

- Work to be done must be cleared with the operator or his designee before commencement.
- Ensure the area is clean and free of contamination.
- Inspect labels and warning signs location, clear visibility and damage. Repair / replace if necessary.
- Inspect the equipment for any signs of build up or deposits.
- Check that all fasteners and mounting hardware is in place.
- Always stand to the side when observing interior or opening the Pyrolyser to avoid sudden exposure to heat.
- Frequent visual inspection of the equipment should be done. Any leaks, in piping, tanks, equipment casings, covers and all associated equipment or loose connections must be reported.
- If any fault occurs, analyse and permanently remove the cause. Do not remain on temporary repair.
- Immediately report any signs of abnormal equipment operation or unusual instrument readings.

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- After maintenance, ensure that all bolts, fittings, guards and other fasteners are correctly tightened.
- Metal parts must be painted to avoid corrosion. Where painting is not possible suitable oil or grease must be utilized

Maintenance Tasks

The maintenance schedule specifies the frequency of the inspections and checks that are expected under normal operating conditions. In the event that the prevailing conditions are abnormal, appropriate adjustments could be expected.

Weekly Maintenance

- Check seal integrity on front and rear pre-Pyrolyser and Pyrolyser bellows
- Check seal integrity on knife gate valves
- Check limit switches and/or proxy switches ensuring holding bolts are tight
- Check striker arms on limit switches are secure
- Check thermocouples are secure
- Check for uneven movement / misalignment of mechanisms
- Check temperature controller and over temperature controller for proper operation
- Check retort rollers are tight and no excessive wear is taking place
- Grease wheels with high temperature graphite grease
- Listen for undue mechanical noise from the installation, investigate and repair if necessary
- Check all seals and gaskets for possible leaks on the hydraulic system.
- Check that all bearings are properly greased and operating correctly.

Monthly Maintenance

- Repeat weekly scheduled maintenance
- Check all bolts are tight, tighten if necessary

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- Ensure all guards, louvers, brackets are in place and secure.
- Visually inspect modules and insulation blankets are properly in position and secure, repair / replace if necessary.
- Check ducts for foreign materials causing obstruction.
- Check structural steelwork for signs of corrosion and paint damage. Metal parts must be painted to avoid corrosion.
- Check blower impeller by hand to ensure free rotation. Check that there is not fouling between rotating and stationary components.
- Check that all blower fasteners are secure and that all components are in good order at the cooling section.
- Ensure that the blower guard is in place and secure.
- Keep electric motors' air inlets and outlets free and clean. The air blown out by the motor shall not enter again. The distance between the air inlet and the wall must be approximately ½ of the inlet opening diameter.
- Check retort mechanism main track roller for alignment
- Check all pre-Pyrolyser and Pyrolyser in feed system for any possible obstructions and charge clearances
- Check knife gate valves and proxy switch positions
- Check all pre-Pyrolyser and Pyrolyser front and rear door seal
- Check all booster fan clearance and rotation direction

Three Monthly Maintenance

- Repeat Monthly Maintenance
- Clean booster fan and clean all interconnecting pipes

Six Monthly Maintenance

- Repeat Three Monthly Maintenance
- Booster Fan Maintenance:

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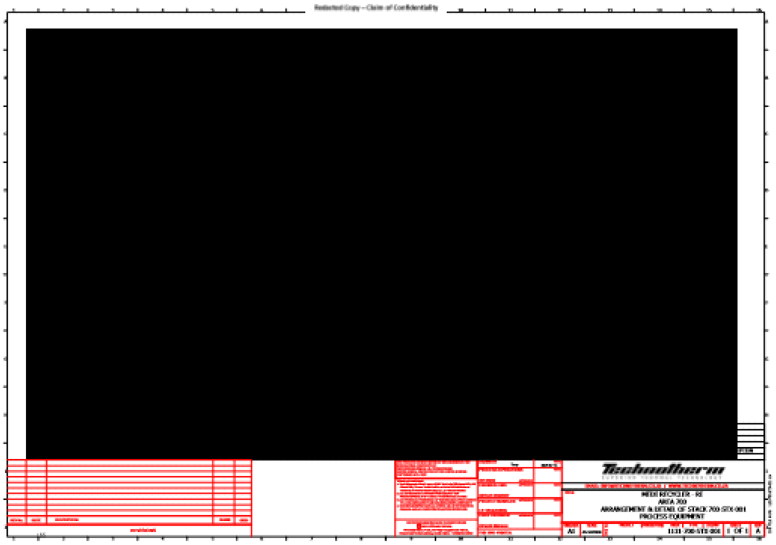
- Refer to the suppliers' manual for details.
- After initial cleaning it should be re-checked after 250 operating hours and should be checked every 3000 to 4000 operating hours depending on the operating conditions or at least every 6 months.

Annual Maintenance

- Lubricate all bearings including rollers and bearings. For high temperature applications mix high temperature grease with 20% graphite powder.
- Refer to the bearing supplier's manual for details.

Redacted Copy – Claim of Confidentiality



ATTACHMENT M – INTERNAL COMBUSTION ENGINE DATA SHEET			
Complete this data sheet for each internal combustion engine at the facility. Include manufacturer performance data sheet(s) or any other supporting document if applicable. Use extra pages if necessary. ***Generator(s) and microturbine generator(s) shall also use this form.***			
Emission Unit ID#[1]	GE-1, GE-2, GE-3, GE-4		
Engine Manufacturer/Model	[illegible]		
Manufacturer's Rated bhp/rpm	420, 1500/1800		
Source Status[2]	NS		
Date Installed/ Modified/Removed/Relocated[3]	2022		
Engine Manufactured /Reconstruction Date[4]			
Check all applicable Federal Rules for the engine (include EPA Certificate of Conformity if applicable)[5]	☒ 40CFR60 Subpart IIII ☐ JJJJ Certified? ☐ 40CFR60 Subpart JJJJ ☐ JJJJ Certified? ☐ 40CFR63 Subpart ZZZZ ☐ NESHAP ZZZZ/ NSPS IIII/JJJJ Window ☐ NESHAP ZZZZ Remote Sources	☐ 40CFR60 Subpart IIII ☐ IIII Certified? ☐ 40CFR60 Subpart JJJJ ☐ JJJJ Certified? ☐ 40CFR63 Subpart ZZZZ ☐ NESHAP ZZZZ/ NSPS IIII/JJJJ Window ☐ NESHAP ZZZZ Remote Sources	☐ 40CFR60 Subpart IIII ☐ IIII Certified? ☐ 40CFR60 Subpart JJJJ ☐ JJJJ Certified? ☐ 40CFR63 Subpart ZZZZ ☐ NESHAP ZZZZ/ NSPS IIII/JJJJ Window ☐ NESHAP ZZZZ Remote Sources
Engine Type[6]	4SLB		
APCD Type[7]	A/F		
Fuel Type[8]	syngas		
H₂S (gr/100 scf)	Varies with Feed		
Operating bhp/rpm	1500/1800rpm		
BSFC (BTU/bhp-hr)	[illegible]		
Hourly Fuel Throughput	5,036 ft³/hr gal/hr	ft³/hr gal/hr	ft³/hr gal/hr
Annual Fuel Throughput (Must use 8,760 hrs/yr unless emergency generator)	25.8 MMft³/yr gal/yr	MMft³/yr gal/yr	MMft³/yr gal/yr
Fuel Usage or Hours of Operation Metered	Yes ☒ No ☐	Yes ☐ No ☐	Yes ☐ No ☐

Calculation Methodology[9]	Pollutant[10]	Hourly PTE (lb/hr)[11] (EACH ENGINE)	Annual PTE (tons/year)[11] (EACH ENGINE)	Hourly PTE (lb/hr)[11]	Annual PTE (tons/year)[11]	Hourly PTE (lb/hr)[11]	Annual PTE (tons/year)[11]
MD/AP	NO_X	0.48	2.55				
MD/AP	CO	1.37	5.89				
MD/AP	VOC	0.48	1.78				
MD/AP	SO_2	0.002	0.01				
MD/AP	PM_{10}	0.05	0.18				
MD/AP	Formaldehyde	0.30	0.89				
MD/AP	Total HAPs	0.28	1.23				
MD/AP	GHG (CO_2e)	461.30	1,692				

PLEASE NOTE: ALL EMISSION VARY BY FEED AND ARE ROUTED TO THE DTO PRIOR TO BEING EMITTED TO THE ATMOSPHERE. PLEASE SEE GENERATOR EMISSIONS CALCULATIONS.

1. Enter the appropriate Source Identification Number for each natural gas-fueled reciprocating internal combustion compressor/generator engine located at the compressor station. Multiple compressor engines should be designated CE-1, CE-2, CE-3 etc. Generator engines should be designated GE-1, GE-2, GE-3 etc. Microturbine generator engines should be designated MT-1, MT-2, MT-3 etc. If more than three (3) engines exist, please use additional sheets.

2. Enter the Source Status using the following codes:

NS	Construction of New Source (installation)	ES	Existing Source
MS	Modification of Existing Source	RS	Relocated Source
REM	Removal of Source		

3. **Enter the date (or anticipated date) of the engine's installation (construction of source), modification, relocation or removal.**

4. Enter the date that the engine was manufactured, modified or reconstructed.

5. Is the engine a certified stationary spark ignition internal combustion engine according to 40CFR60 Subpart JJJJ? If so, the engine and control device **must be operated and maintained in accordance with the manufacturer's emission**-related written instructions. You must keep records of conducted maintenance to demonstrate compliance, but no performance testing is required. If the certified engine is not operated and maintained in accordance with **the manufacturer's emission**-related written instructions, the engine will be considered a non-certified engine and you must demonstrate compliance as appropriate.

Provide a manufacturer's data sheet for all engines being registered.

6. Enter the Engine Type designation(s) using the following codes:

2SLB	Two Stroke Lean Burn	4SRB	Four Stroke Rich Burn
4SLB	Four Stroke Lean Burn		

7. Enter the Air Pollution Control Device (APCD) type designation(s) using the following codes:

A/F	Air/Fuel Ratio	IR	Ignition Retard
HEIS	High Energy Ignition System	SIPC	Screw-in Precombustion Chambers
PSC	Prestratified Charge	LEC	Low Emission Combustion
NSCR	Rich Burn & Non-Selective Catalytic Reduction	OxCat	Oxidation Catalyst
SCR	Lean Burn & Selective Catalytic Reduction		

8. Enter the Fuel Type using the following codes:

PQ Pipeline Quality Natural Gas RG Raw Natural Gas / Production Gas D Diesel

9. Enter the Potential Emissions Data Reference designation using the following codes. Attach all reference data used.

MD	**Manufacturer's Data**	AP	AP-42
GR	GRI-HAPCalc™	OT	Other (please list)

10. **Enter each engine's Potential to Emit (PTE) for the listed regulated pollutants in pounds per hour and tons per year. PTE shall** be calculated at **manufacturer's rated brake horsepower and may reflect reduction efficiencies of listed Air Pollution Control D**evices. Emergency generator engines may use 500 hours of operation when calculating PTE. PTE data from this data sheet shall be incorporated in the ***Emissions Summary Sheet.***

11. **PTE for engines shall be calculated from manufacturer's data unless** unavailable.

187

Engine Air Pollution Control Device (Emission Unit ID# , use extra pages as necessary) N/A		
Air Pollution Control Device Manufacturer's Data Sheet included? Yes ☐ No ☐ N/A		
☐ NSCR	☐ SCR	☐ Oxidation Catalyst
Provide details of process control used for proper mixing/control of reducing agent with gas stream:		
Manufacturer:	Model #:	
Design Operating Temperature: °F	Design gas volume: scfm	
Service life of catalyst:	Provide manufacturer data? ☐Yes ☐ No	
Volume of gas handled: acfm at °F	Operating temperature range for NSCR/Ox Cat: From °F to °F	
Reducing agent used, if any:	Ammonia slip (ppm):	
Pressure drop against catalyst bed (delta P): inches of H_2O		
Provide description of warning/alarm system that protects unit when operation is not meeting design conditions:		
Is temperature and pressure drop of catalyst required to be monitored per 40CFR63 Subpart ZZZZ? ☐ Yes ☐ No		
How often is catalyst recommended or required to be replaced (hours of operation)?		
How often is performance test required? ☐ Initial ☐ Annual ☐ Every 8,760 hours of operation ☐ Field Testing Required ☐ No performance test required. If so, why (please list any maintenance required and the applicable sections in NSPS/GACT).		

188

Operation and Maintenance Manual for Technotherm Gas Generating Sets

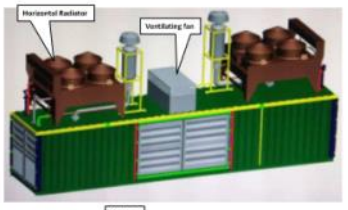
Notice(1): Engine overhaul period is related to use conditions, quality of lubricating oil, maintenance quality, load, install quality, fuel quality

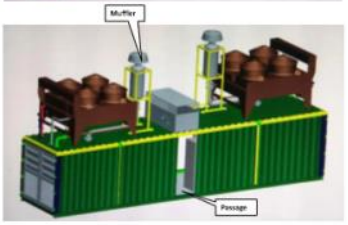
TGS series natural gas genset

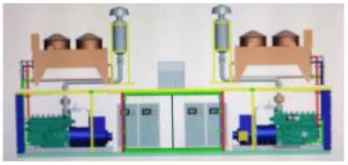
Genset Model		300TGS
Structure		Integrated
Exciting Mode of Alternator		Brushless/AVR
Rated Power(kW)		300
Rated Current（A）		540
Rated Voltage（V）		400/460
Rated Frequency（Hz）		50/60
Rated Power Factor		0.8LAG
No Load Voltage Range		95%-105%
Stable voltage regulation rate		≤±1%
Instantaneous voltage regulation rate		≤-15%—+20%
Voltage recover time		≤3s
Voltage fluctuation rate		≤±0.5%
Instantaneous frequency regulation rate		≤±10%
Frequency stabilization time		≤5s
[illegible]		≤2.5%
Engine	Type	TGS130D12
	Model	V-type、water cooled、4 strokes、electric control ignition, turbocharged and intercooled lean burn
	Cylinder Number	8
	Bore × **Stroke** (mm)	132×145
	Total Displacement(L)	15.9
	Compression Ratio	11.5
	Rated Power (kW)	320
	Rated Speed (r/min)	1500/1800
	Speed Regulation Mode	Electrical
	Starting Mode	Electrical
	Fuel	Natural gas or biogas
	Max Gas Consumption(m^3/h)	88.8
Noise dB(A)		<91
Overhaul cycle (h)		2,5000[1]
Overall dimension (L×W×H)(mm)		3290×1550×1950
Net Weight (kg)		2850

Page 10 of 30

189







Container size: (L*W*H) 11.5m*2.2m*2.45m

3 containers in total .

Attachment M
Air Pollution Control Device Sheet
(WET COLLECTING SYSTEM-SCRUBBER)

Control Device ID No. (must match Emission Units Table):

Equipment Information

1. Manufacturer: Poly Processing Model No. 5' X 5' Scrubber	2. Method: ☐ Packed Bed ☐ Venturi ☐ Spray Tower ☐ Cyclone ☐ Mechanical ☐ Orifice ☒ Other, specify
3. Provide diagram(s) of unit describing capture system with duct arrangement and size of duct, air volumes, capacity, horsepower of blowers. If applicable, state hood face velocity and hood collection efficiency.	
4. Provide a scale diagram of the scrubber showing internal construction. Please include packing type and size, spray configurations, baffle plates, and mist eliminators.	
5. What type of liquid entrainment eliminators or system will be used? Submit a schematic diagram showing thickness, mesh, and material of construction.	
6. Describe the scrubber's construction material: Polyethylene CSLPE tank with PVC internals and exterior piping. Water with NaOH is added to the vessel above the set level. Vent gas from the HCl tank passes through the gas diffuser where HCl fumes are neutralized before the scrubbed gas is vented from the top.	
7. What will be the power requirements of the collector? Fan: NA HP Inlet scrubbing liquid pump: NA HP	
8. What type of fan(s) will be used? Type of fan blade: None Number of blades: None Diameter of blade: None in. Also supply a fan curve for each fan to be used.	
9. Estimated gas pressure drop at maximum flow rate: 1 inches H_2O	

Scrubbing Liquor Characteristics

10. Scrubbing Liquor		11. Scrubbing liquor losses (evaporation, etc.): 0.5 gal/1000 ACF gas
Composition	Weight %	
1 Water	99	12. Liquor pressure to scrubber: 9.25 PSIA
2 NaOH	1	
3		13. Pressure drop through scrubber: 4 in. H_2O
4		
14. Source of liquor (explain): Batch liquid added to tank		15. Liquor flow rates to scrubber: Design maximum: 1,000 gal/min Average expected: 500 gal/min
16. Describe system to be used to supply liquor to collector: Manual drain and re-fill process		
17. Give the expected solids content of the liquor: No suspended solids will be created. The system will convert HCl gas vapors will react with NaOH to form water (H2O) and salt (NaCl). Water will be changed out well before NaCl concentration reaches saturation.		

18. If the liquor is to be recirculated, describe any treatment performed:

19. Data for Venturi Scrubber:	20. Data for Packed Towers:
Throat Dimensions: NA (Specify Units)	Type of Packing: NA
Throat Velocity: No ft/sec	Superficial Gas Velocity through Bed:

Gas Stream Characteristics

21. Gas flow into the collector: 1000 ACF @ 29 °F and 14.2 PSIA	22. Gas stream temperature: Inlet: ambient °F Outlet: ambient °F
23. Gas flow rate: Design Maximum: 115 ACFM Average Expected: 67 ACFM	24. Particulate Grain Loading in grains/scf: Inlet: NA Outlet: NA

25. Emission rate of each pollutant (specify) into and out of collector:

Pollutant	IN lb/hr	IN grains/scf	OUT lb/hr	OUT grains/scf	Guaranteed Minimum Collection Efficiency
A. HCl	0.0750lb/hr		0.00075lb/hr		99
B					
C					
D					
E					

26. Type of pollutant(s) controlled: ☐ SO2 ☐ Odor ☐ Particulate (type): ☒ Other: HCl
27. By what method were the uncontrolled emissions calculated? ☒ Material Balance ☐ Stack Test ☐ Pilot Test ☐ Other:
28. Dimensions of stack: Height 4'-9" ft. Diameter 5.1" ft
29. Supply an equilibrium curve and/or solubility data (at various temperatures) for the proposed system.
30. Supply a curve showing proposed collection efficiency versus gas volume from 25 to 100 percent of design rating of collector.

Particulate Distribution

31. Complete the table: Particulate Size Range (microns)	Particle Size Distribution at Inlet to Collector Weight % for Size Range	Fraction Efficiency of Collector Weight % for Size Range
0 – 2	NA, vapor to liquid solvent conversion	
2 – 4		
4 – 6		
6 – 8		
8 – 10		
10 – 12		
12 – 16		
16 – 20		
20 – 30		
30 – 40		
40 – 50		
50 – 60		
60 – 70		
70 – 80		
80 – 90		
90 – 100		
>100		

32. Describe any air pollution control device inlet and outlet gas conditioning processes (e.g., gas cooling, gas reheating, gas humidification.):
33. Describe the collection material disposal system. Neutralized HCl gas will become a salt brine that will be disposed of in accordance with local, state (PADEP), and federal regulations.
34. Have you included **Wet Collecting (Scrubber) Control Device** in the Emissions Points Data Summary Sheet? Yes

35. **Proposed Monitoring, Recordkeeping, Reporting, and Testing**
Please propose monitoring, recordkeeping, and reporting in order to demonstrate compliance with the proposed operating parameters. Please propose testing in order to demonstrate compliance with the proposed emissions limits.

MONITORING:	RECORDKEEPING:
REPORTING:	TESTING:

MONITORING: Please list and describe the process parameters and ranges that are proposed to be monitored in order to demonstrate compliance with the operation of this process equipment or air control device.
RECORDKEEPING: Please describe the proposed recordkeeping that will accompany the monitoring.
REPORTING: Please describe any proposed emissions testing for this process equipment on air pollution control device.
TESTING: Please describe any proposed emissions testing for this process equipment on air pollution control device.

36. Manufacturer's Guaranteed Capture Efficiency for each air pollutant.
37. Manufacturer's Guaranteed Control Efficiency for each air pollutant. 99%
38. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty.

Attachment L
EMISSIONS UNIT DATA SHEET
BULK LIQUID TRANSFER OPERATIONS

Furnish the following information for each new or modified bulk liquid transfer area or loading rack, as shown on the *Equipment List Form* and other parts of this application. This form is to be used for bulk liquid transfer operations such as to and from drums, marine vessels, rail tank cars, and tank trucks.

Identification Number (as assigned on *Equipment List Form*):	
1. Loading Area Name:	
2. Type of cargo vessels accommodated at this rack or transfer point (check as many as apply): ☐ Drums ☐ Marine Vessels ☐ Rail Tank Cars ☐ Tank Trucks	
3. Loading Rack or Transfer Point Data:	
Number of pumps	
Number of liquids loaded	2
Maximum number of marine vessels, tank trucks, tank cars, and/or drums loading at one time	1
4. Does ballasting of marine vessels occur at this loading area? ☐ Yes ☐ No ☐ Does not apply	
5. Describe cleaning location, compounds and procedure for cargo vessels using this transfer point:	
6. Are cargo vessels pressure tested for leaks at this or any other location? ☐ Yes ☐ No If YES, describe:	
7. Projected Maximum Operating Schedule (for rack or transfer point as a whole):	

Maximum	Jan. - Mar.	Apr. - June	July - Sept.	Oct. - Dec.
hours/day				
days/week				
weeks/quarter				

8. Bulk Liquid Data *(add pages as necessary)*:

Pump ID No.							
Liquid Name		HCL					
Max. daily throughput (1000 gal/day)		5k					
Max. annual throughput (1000 gal/yr)		1300					
Loading Method [1]		sub					
Max. Fill Rate (gal/min)		1000					
Average Fill Time (min/loading)		500					
Max. Bulk Liquid Temperature (°F)		75					
True Vapor Pressure [2]							
Cargo Vessel Condition [3]							
Control Equipment or Method [4]							
Minimum control efficiency (%)							
Maximum Emission Rate	Loading (lb/hr)						
	Annual (lb/yr)						
Estimation Method [5]							

[1] BF = Bottom Fill SP = Splash Fill SUB = Submerged Fill

[2] At maximum bulk liquid temperature

[3] B = Ballasted Vessel, C = Cleaned, U = Uncleaned (dedicated service), O = other (describe)

[4] List as many as apply (complete and submit appropriate *Air Pollution Control Device Sheet*): CA = Carbon Adsorption LOA = Lean Oil Adsorption CO = Condensation SC = Scrubber (Absorption) CRA = Compressor-Refrigeration-Absorption TO = Thermal Oxidation or Incineration CRC = Compression-Refrigeration-Condensation VB = Dedicated Vapor Balance (closed system) O = other (describe)

[5] EPA = EPA Emission Factor as stated in AP-42
MB = Material Balance
TM = Test Measurement based upon test data submittal
O = other (describe)

9. **Proposed Monitoring, Recordkeeping, Reporting, and Testing**
Please propose monitoring, recordkeeping, and reporting in order to demonstrate compliance with the proposed operating parameters. Please propose testing in order to demonstrate compliance with the proposed emissions limits.

MONITORING	RECORDKEEPING
REPORTING	TESTING

MONITORING. PLEASE LIST AND DESCRIBE THE PROCESS PARAMETERS AND RANGES THAT ARE PROPOSED TO BE MONITORED IN ORDER TO DEMONSTRATE COMPLIANCE WITH THE OPERATION OF THIS PROCESS EQUIPMENT/OPERATION/AIR POLLUTION CONTROL DEVICE.

RECORDKEEPING. PLEASE DESCRIBE THE PROPOSED RECORDKEEPING THAT WILL ACCOMPANY THE MONITORING.

REPORTING. PLEASE DESCRIBE THE PROPOSED FREQUENCY OF REPORTING OF THE RECORDKEEPING.

TESTING. PLEASE DESCRIBE ANY PROPOSED EMISSIONS TESTING FOR THIS PROCESS EQUIPMENT/AIR POLLUTION CONTROL DEVICE.

10. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty.

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Web: www.v-syst.com

Telephone: 412-826-8200
Fax: 412-826-8182

Quote #2023-560-H-R

July 26, 2023

Mr. Farley R. Wood, P.E.
Vice President of Engineering
Empire Diversified Energy
1400 Main Street
Follansbee, WV 26037

Subject: Chemical System - Scrubber -- Quote #2023-560-H-R

Dear Mr. Wood,

Please find attached our proposal for the above referenced equipment/project. We appreciate the opportunity to provide a quote for this opportunity.

You will also find our most recent line card attached for your reference. I hope you will think of us during your next project. If you would have any questions or require additional information, please give us a call at (412) 826-8200.

Sincerely,

Russell C. Huffmyer
President & CEO
V-Systems, Inc.
101 Fairview Avenue
Pittsburgh, PA 15238

Enclosure
smr

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Pittsburgh, PA 15238

Email: sales@v-syst.com
Web: www.v-syst.com

Telephone: 412-826-8200
Fax: 412-826-8182

Quotation:

Project Name: Chemical System - Scrubber
Company Name: Empire Diversified Energy
Address/Street: 1400 Main Street
City/State/Zip: Follansbee, WV 26037

Contact Name: Farley Wood
Email/Fax: fwood@empiredx.com
Phone: 304-914-2624
Date: July 21, 2023 / Revised July 26, 2023
Quote Number: 2023-560-H-R

Thank you for the opportunity to provide you with the following quote:

Quantity	Item Description	Net Price Each	Total Net Price
Tag: Scrubber Tank			
1	PolyScrub Scrubber Tank, 700 Open Top, Rated: 1.90 Specific Gravity Wall Thickness, Material: Crosslinked Polyethylene (XLPE)●, Color: Natural (yellowish white) • (1) Lid/Manway - 61" Cover Assembly Open Top /Stainless Steel Rv • (1) Vent - 6" U-Vent PVC • (1) Outlet / Overflow - 1" Scrubber Outlet/Overflow PVC/Hanga Viton Ao-276 • (1) Scrubber - 6" Scrubber Assembly PVC/Hanga Viton • (1) Fill - 1" Bulkhead Fitting Assembly Socket x thread PVC/Hanga Viton • Warranty - 5 Years, Full Replacement, Non-Prorated Includes Product Engineering / Permitting Support for Permit Application	$16,500.00	$16,580.00
Tag: Tank			
1	10,305-Gallon Vertical Tank, Rated: 1.90 Specific Gravity Wall Thickness, Material: Crosslinked Polyethylene (XLPE)●, Color: Natural (yellowish white) • (1) Lid/Manway - 24" Manway Cover 24" Fume Tight /Stainless Steel Ipe • (1) Fill - 2" Bulkhead Fitting Assembly Socket x thread PVC/EPDM • (2) Dome Fitting - 2" Bulkhead Fitting Assembly Socket x thread PVC/EPDM • (3) Sidewall Fitting - 2" Bolted Flange Fitting Socket PVCo-276/EPDM • (1) Vent - 6" U-vent with Bolted Flange PVCo-276/EPDM • WARRANTY:5 Years, Full Replacement, Non-Prorated	$39,675.00	$39,675.00

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Email: sales@v-syst.com
Web: www.v-syst.com

Telephone: 412-826-8200
Fax: 412-826-8182

Tag: Pump			
2	March Model # TE-10X-MD 3PH 10 HP - Inlet: 3"MPT, Outlet: 2"MPT, Wet End: Natural Kynar (Front Housing, Rear Housing), Glass Filled Kynar (Impeller) with 6.625" Impeller Trim, Viton (Gasket), Carbon (Bushing), Ceramic (Shaft, Throat Washers), and driven by a 10 HP, 3500 RPM, 3460230468, TEFC Motor **Note** • Lead Time is currently 1 Week, A.R.O. • FOB out of March in IL (must ship by LTL due to size and weight)	$7,920.00	$15,840.00
Tag: VFDs			
2	Xylem, Variable Frequency Drives, 10 HP, 460-3-60, NEMA 3R, BACnet **Note** • Lead Time is currently at 7 Weeks, A.R.O.	$7,790.00	$15,580.00
Tag: Chem Feed Skid			
1	SS1-C_FLOOR_650_PVCEPDM_PD PIPPE Prominent Skid for solenoid driven pumps, (30"W x 18"D x 40"H) 1/2" PVC/EPDM socket weld pipe and fittings Wye strainer 50mm PVC calibration column 16mm CPVC/EPDM pulsation dampeners Pressure relief valves Pressure gauge with isolator Back pressure valve Plumbing and components rated at 150 PSI regardless of pump pressure. • (1) GMXA078PVT2GI00UDC1300EN Prominent Gamma/X 2 GPH/102PSI, PVDF/PTFE, bleed valve wiping, 4-20mA output • (1) Prominent OPI ONE PUMP 120VAC SCADA PANEL	$21,595.00	$21,595.00
		Total Quoted Amount:	$109,080.00

QUOTED BY: RUSS HUFFMYER

If you need further information concerning the products that have been included in the quote, please feel free to contact me at 412-826-8200 and/or rhuffmyer@v-syst.com.

We appreciate the opportunity to provide you with this quote and look forward to working with you on this important project.

Thank you,

Russell C. Huffmyer
President & CEO
smr

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101 Fairview Avenue
Pittsburgh, PA 15238

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Web: www.vsinc.com

Telephone: 412-828-8800
Fax: 412-828-8102

THIS QUOTATION OR SELLER'S ACCEPTANCE OF THIS ORDER IS EXPRESSLY LIMITED TO, AND EXPRESSLY MADE CONDITIONAL ON, BUYER'S ACCEPTANCE OF THE V-SYSTEMS-TEC, INC. STANDARD TERMS AND CONDITIONS OF SALE. A COPY OF THESE TERMS AND CONDITIONS IS AVAILABLE AT https://v-sys.com/terms-and-conditions-of-sale-and-service. SELLER OBJECTS TO ANY DIFFERENT OR ADDITIONAL TERMS.

General Comments:
Warranty applies per Sales & Service Terms and Conditions if the following are met:

- Equipment installed per industry standards and manufacturer instruction manual.
- Operation of equipment in accordance with manufacturer instruction manual.
- Maintenance and lubrication per manufacturer instruction manual. Note, maintenance log showing dates required.
- Equipment must be stored per manufacturer instruction manual and protected from the weather.

If warranty items occur, V-Systems needs to be contacted in writing before any repairs are made, whereas a mutual course of action will be performed. Equipment cannot be disassembled without V-Systems being present.

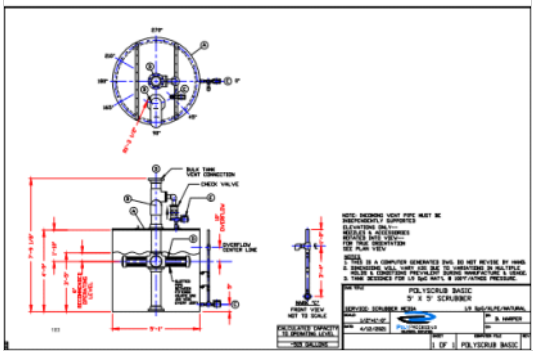
Acknowledged and Accepted by Buyer:

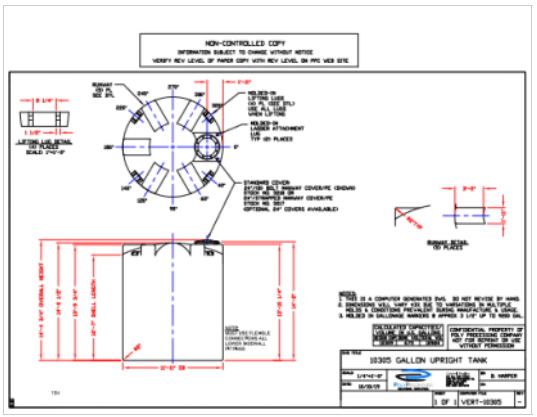
Name: _____ *Tax Exempt? Yes___ No___

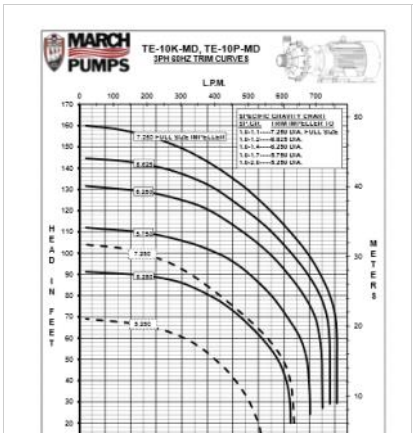
Signature: _____ PO #: _____

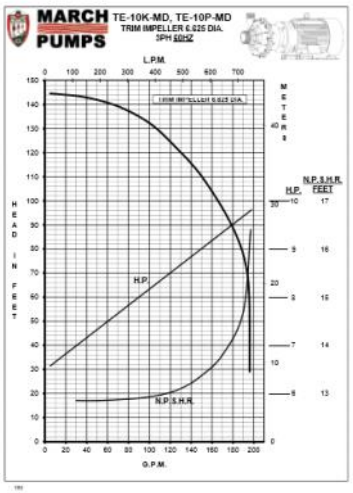
Date: _____ Ship To: _____

*IF APPLICABLE, please send a copy of your company's tax-exempt form. Otherwise, our accounting department will assume that this order is taxable.








MARCH PUMPS
TE-10K-MD, TE-10P-MD
TRIM IMPELLER 6.625 DIA.
1PH 60HZ
L.P.M.
HEAD IN FEET
METERS
H.P.
N.P.S.H.R.
N.P.S.H.R.
H.P.
FEET
G.P.M.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Products: Thermostatic Mixing Valves
Size: 1/2" to 4"

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Products: Cooling Towers, Packaged Cooling Systems, Air Strippers, Degasifiers, Odor Control Screens
Performance: 10 to 2000 ton Cooling capacity

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Carter Pump	Pumps 2000
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EBARA Pumps	Syncroflo
Xylem / B & L Pumps	Stancor / Flow Solutions
Hydroflo Pumps (Taco Group)	Tigerflow

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Lochinvar	

ELECTRICAL

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Baldor Motors (ABB)	SEE Water Controls
CSI Controls	Square D by Schneider
Danfoss	TECO & Westinghouse
Nidec Motor Corporation	WEG & Motors
Ohio Electric Control, Inc.	

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American Wheatley	Niles Steel Tank
Containment Solutions	Spirotherm
Eljen of America	TOPP Industries
Highland Tank	Wessels Company

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Flo-Tite	Ohio Valve Company
Flomatic Valves	Sure Flow Company
Holby Valve Co.	Titan Flow Control
Mason Controls	

GAUGES

Trerice	Weiss Instruments

HYDRONICS

Gerand Engineering	Turbotel
Pro Hydronic Specialties	

FIRE PROTECTION

Armstrong	Tornatech

PIPING

Energy Task Force (Underground Piping Solutions)

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Active Water Solutions	Equip Water
Concord Screen	Modular Water Systems
Custom Conveyor Corp.	Neptune

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Ohio Medical Products:
Medical Gas Systems, Portable Suction, Flowmeters, Oxygen Analyzers, Alarms, Suction Regulators

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Warren Design & Build

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Warren, OH 44485

(330) 394-4747, Ext. 1502

About Us	Facilities & Equipment	Bottom Line
Warren Design & Build is a multi-disciplined machine shop and engineering design services company. We specialize in emergency repairs of part and machines, as well as building custom machines. Our team is comprised of 10 machinists, 4 welders, 4 mechanical and electrical design engineers with in-house PLC and computer systems programming capability.	Located in **Warren Ohio, WDB's** 10,000 square foot corporate facility houses a variety of engineering, machining, assembly, and fabricating capabilities. Our large assembly area can handle everything from a single station to a full assembly line with all utilities available utilizing ceiling drops from electrical bus bar and pneumatic lines covering most of the floor space. Located in the Northeast Ohio Manufacturing Corridor we also have the availability to outsource many special processes that can be brought inbound on short notice to assist in peak design periods or on special projects.	**With WDB's unique position of** having all Design, Machining, Paint, Mechanical and Electrical Assembly under one roof, our engineering team has the ability to assist in all aspects of the program build cycle to ensure design integrity; and when necessary, capture all changes and updates as required by manufacturing, and/or requested by the customer, in a very economical time frame. With some of Northeast Ohio's most talented, experienced, and highly trained engineering and manufacturing staff we can help guide you with suggestions and input that will help maximize your project's efficiency, while often lowering costs.

Custom Machining & Design

201 Chambers Street
McKees Rocks, PA 15136

(412) 771-5160

About Us	Facilities & Equipment	Bottom Line
AJ Degen, a subsidiary of Custom Machine and Design is a multi-disciplined machine shop and engineering design services company. We specialize in emergency machining services and repairs of parts and machines, as well as building custom machines. Our team is comprised of 4 machinists, 1 welder and 1 mechanical design engineer. Additionally, we partner with our sister company, Warren Design & Build for many other services.	Located in McKees Rocks PA, AJ **Degen's 8,000 square foot facility** houses a variety of engineering, machining, assembly, and fabricating capabilities. Located near downtown Pittsburgh, we also have the availability to outsource many special processes that can be brought inbound on short notice to assist in peak design periods or on special projects.	**With AJ Degen's unique position of** having all Design, Machining, Paint, Mechanical and Electrical Assembly under one roof, our engineering team has the ability to assist in all aspects of the program build cycle to ensure design integrity; and when necessary, capture all changes and updates as required by manufacturing, and/or requested by the customer, in a very economical time frame. With **some of Pittsburgh's most** talented, experienced, and highly trained engineering and machining staff we can help guide you with suggestions and input that will help maximize your project's efficiency, while often lowering costs.

Capabilities

- Emergency Repair: We fix all electro-mechanical devices. We have field tech service and in-house staff that will repair all forms of equipment.
- Water Jet: We have a water jet for cutting all types of material in almost any shape.
- Design Engineering: Senior mechanical designers. Each is ready to provide support from concept to build, installation and runoff of the solution to your manufacturing or operational bottleneck.
- Electrical Engineering: Electrical engineers ready to design electrical solutions, write control programming, and perform data analytics.
- Robotic Cell Design and Assembly: Project design & management of all needs and programming related to robot cells.
- Machining: We offer a wide variety of precision machining capabilities, including CNC turning and milling, general machining, grinding, and boring mill work. Our machining capabilities may be used for both short-run and sustained production work.
- Fabrication: We can meet all your prototyping and production needs with complete sheet metal and welding services that include quick delivery on small quantity prototypes, close tolerance fabrications and high-volume production runs.
- Assembly: We can meet your entire contract manufacturing needs with our diverse assembly capabilities and wide range of electrical, mechanical, and electro-mechanical assembly services, ranging from special, one-of-a-kind automation machinery to ongoing, low to medium volume production assembly. Our assembly capability includes turn-key production of build-to-print assembly work, including full management of key suppliers. WDB is capable of handling full production volumes.
- Painting: Using high-solids and water-based materials, our state-of-the-art paint shop can produce finishes from Class 1A to Mil-Spec, including textured finishes color matched to your specifications. Powder coated finishes also available.

MECHANICAL AUTOMATION DESIGN

CONTROLS PROGRAMMING

ON-SITE AUTOMATION DESIGN

MACHINE BUILDING

COMPLETE MACHINE SHOP

AUTOMATION

153

ATTACHMENT N

Supporting Emission Calculations

151

4. OVERALL EMISSIONS CALCULATIONS ALL DEVICES

Plastic waste has significant variation in form and quantity. It seems the best way to describe it as a heterogeneous mixture of solids and semi-solids. Literature review showed a. References to the papers are given at the end of this section. They state a. hotrogeneous plastic waste composition based on the. is reposted in Table 2. Municipal Solid Waste (MSW) data by Stepien, et al., [4] given for comparison purposes.

Table 2. Range of Heterogeneous ("Imperfect or "Techno")

Plastic Waste Composition	Bayu Waste Range (wt. %)
C	80.5
H2	7
O2	21.1
N2	1.9
S	0.46
Cl	1.2
Oxide	
Metal	
H2O	21.54
HHV (Btu/lb)	

Composition of the plastic waste and the pyrolysis output are shown in Table 3. Pyrolysis emissions are also shown for plastic waste by Dandamrongrak and MSW by Technotherm[4].

Table 3. Plastic Composition and Pyrolysis Output

Component Formula	Plastics Composition (Wt. %)	Pyrolysis Component	Pyrolysis Syngas, (Wt. %)	Pyrolysis Syngas, (Wt. %)	Pyrolysis Syngas, (Wt. %)
O2	42.79	O2	7.54	2.64	4.21
C	20.90	CO2	19.28	18.2	34.77
H2	20.90	CO	30.81	27.3	32.81
N2	2.85	CH4	2.16	1.8	21.49
CaO	1.39	H2	11.55	37.9	2.97
K2O	1.52	C4H10 (all)	3.66		
S	2.85	C3H8 (iso)	3.66		
Na2O	4.56	N2	2.19		3.47
Cl	6.54	C4O	1.23		
MgO	2.39	K2O	1.55		
Fe2O3	1.46	Na2O	4.38		
H2O	2.00	H2O	6.59	8.63	
C2H4	8.38	H2S	4.38		
		MgO	1.64		
		Fe2O3	2.28		
		SO2	2.19		
Total	100		100		

**Rounding errors may apply

154

Pyrolysis syngas and solids can vary about 30% or greater based on the input feed. An attempt was made to produce a syngas composition where some of the elements and compounds were near the middle and greater than the middle of the feed composition shown in Table 2. Metal-oxides are shown as individual compounds instead of just the term "glass".

Once a syngas was established within the variations described, the next step was to combust those available compounds through the Engine, Vitrifier and Thermal Oxidizer. Stoichiometric combustion equations are shown below:

2CO	+	O2	→	2CO2		
2C14H30	+	43O2	→	28CO2	+	30H2O
2C20H42	+	61O2	→	40CO2	+	42H2O
CH4	+	O2	→	CO2	+	H2O
2H2	+	O2	→		+	2H2O

Emissions for all devices are shown in Figure 2 (see Attachment 2, end of this TAB) and are shown as an expanded Block Flow Diagram in the following narrative.

The daily throughput for the pyrolysis process system shall be 70 U.S. tons per day and will operate twenty-four (24) hours a day, seven (7) days a week, for 310 days per year. This equates to 85% availability for processing equipment. All calculations are based on 70 tons/day which equals to only four (4) tractor-trailer loads. All major chambers have the design life of twenty (20) years before replacement.

Throughput calculations are as follows:

Calculation 1: **Throughput**

- Hourly Throughput: (2,646.700 kg/hour) / (2.204 lb/kg) = 5,833.33 lb/hr
- Annual Throughput

  5,833.33 lb/hr x 24 hr/day x 310 days/year x 1 ton/2000 lb = 21,699.99 tons/year → 21,700 Tons/year
- **Annual Throughput: 21,700 Tons/year**

  (lbs/hr x 24 hr/day x 310 day/yr) / 2000 lbs/ton = tons/year (annual output)

Table 5: Hourly, Daily and Annual Emission Outputs (from model results Figure 2)

Offgas/Solids Component	kg/hour	lbs/hr	lbs/day	US tons/yr
CO2	2,546.81	5,613.18	134,716.31	20,881.03
H2O	5,725.07	12,618.06	302,833.41	46,939.18
N2	22,861.83	50,387.47	1,209,299.24	187,441.38
Ar	293.33	646.51	15,516.18	2,405.01
CAO	3.25 x10[illegible]	7.16 X 10[illegible]	1.72 x 10[illegible]	2.65 x 10[illegible]
K2O	5.11 x 10[illegible]	1.13 x 10[illegible]	2.70 x 10[illegible]	4.19 x 10[illegible]
NA2O	1.16 x 10[illegible]	2.56 x 10[illegible]	6.14 x 10[illegible]	9.51 x 10[illegible]
HCl	1.74 x 10[illegible]	3.84 x 10[illegible]	9.21 x 10[illegible]	1.43 x 10[illegible]
H2O	0.0116	0.0256	0.0614	0.0951
MgO	4.87 x 10[illegible]	1.07 x 10[illegible]	2.58 x 10[illegible]	3.99 x 10[illegible]
FE2O3	6.03 x 10[illegible]	1.33 x 10[illegible]	3.19 x 10[illegible]	4.95 x 10[illegible]
SO2	5.80 x 10[illegible]	1.28 x 10[illegible]	3.07 x 10[illegible]	4.76 x 10[illegible]
NO	3.00 x 10[illegible]	6.61 x 10[illegible]	2.69 x 10[illegible]	4.12 x 10[illegible]
NO2	4.00 x 10[illegible]	8.82 x 10[illegible]	3.66 x 10[illegible]	5.68 x 10[illegible]
TOTAL	**31,427.08**	**69,265.24**	**1,662,365.77**	**257,666.69**
SOLIDS OUTPUT				
CAO	32.46	71.54	1,717.06	266.14
K2O	51.06	112.53	2,700.87	418.60
NA2O	116.06	255.75	6,137.88	951.37
MgO	48.74	107.41	2,577.81	399.56
FE2O3	60.35	133.00	3,192.02	494.76
NACL	280.22	617.60	14,822.52	2,297.49
NA2SO3	129.54	285.51	6,852.15	1,062.08
TOTAL	**718.39**	**1,583.34**	**38,000.21**	**5,890.03**

Calculations Used:

- kg/hr x 2.204 lbs/kg = lb/hr

CALCULATION WORKSHEET PAGE 4 of 5

CLIENT Empire Green Generation, LLC | DATE 9/6/2023

SUBJECT Empire Green Generation Plastics Pyrolysis Facility - Syngas Emissions from Pyrolysers

Pyroliser Syngas Emissions

Component	mol %	Molecular weight (kg/kmol)	60°F, 14.7psig Density (lb/scf)	wt%	normalized wt%	lb/hr	tpy	kJ/kg of component 1	kJ/kg
Oxygen	0.18	32	0.08441	0.18	0.37	7.77	28.90	0	0
Carbon dioxide	20.00	44.01	0.11666	27.48	56.49	1186.19	4412.6	0	0
Carbon monoxi	10.60	28.01	0.073866	9.27	19.05	400.14	1488.5	10122	1928.69
Methane	18.40	16.04	0.042358	9.22	18.95	397.99	1480.5	55530	10523.9
Hydrogen	12.00	2	0.0053104	0.75	1.54	32.37	120.43	141790	2185.87
Nitrogen	2.00	28.013	0.07386	1.75	3.60	75.54	281.01	0	0
Overall	**63.18**	**150.073**	**0.0852**	**48.65**	**100.00**	**2092**	**7783.1**		**14636.4**

Syngas Speciation Results/Inputs		
Gross Calorific Value	31,626	kJ/kg
	13,567.54	Btu/lb
Gas Yield	36	% mass
Feed Input to Facility	70	tpd plastics
Gas Produced	25.2	tpd gas produced

Source: Provided by Technotherm. See Overall Emission Calculations
Note: All Gases will be routed to the engine and/or RTO prior to release into the atmosphere.
Density Source: http://webbook.nist.gov/chemistry/fluid/

6. Conversion Factors:

35.31 ft3/m3
0.4536 kg/lb
1.00E+06 scf/MMscf
1.00E+06 Btu/MMBtu
60 min/hr
7440 hrs/yr (based on 310 days per yr as given by Technotherm)
2.326 kJ/kg per Btu/lb
2000 lb/ton

Calculations

Calculate the estimated amount of syngas produced from the pyrolysers in tpd.

$FR_{Gas-tpd}$ = $(mass\%_{syngas}) / (CF_{DecEq-wt\%}) * (FR_{Feed-tpd})$

= | 36 ~~wt%~~ | 1 ~~DecEq~~ | 70 tons | = 25 tpd syngas
| | 100 ~~wt%~~ | day |

Calculate the maximum hourly emission rate for the components ER_{Max-hr}.

Using O_2 as an example.

$ER_{MaxHr,O2}$ = $(nwt\%_{O2}) / (CF_{DecEq-nwt\%}) * (FR_{Gas-tpd}) * (CF_{lb-ton}) / (CF_{hr-day})$

= | 0.37 ~~nwt%~~ | 1 ~~DecEq~~ | 25 ~~ton~~ | 2000 lb | 1 ~~day~~ | = 7.77 lb/hr O_2
| | 100 ~~nwt%~~ | ~~day~~ | 1 ~~ton~~ | 24 hrs |

Calculations (continued)

CALCULATION WORKSHEET PAGE 5 of 5

CLIENT Empire Green Generation, LLC	DATE 9/6/2023
SUBJECT Empire Green Generation Plastics Pyrolysis Facility - Syngas Emissions from Pyrolysers	

3. Calculate the annual average emission rate for the components ER_{tpy}.
   Using O_2 as an example:
   $ER_{tons/yr,O2} = (ER_{lb/hr,O2}) * (CF_{hrs/yr}) / (CF_{lb/ton})$

$$= \frac{7.77 \text{ lb}}{\text{hr}} \cdot \frac{7{,}440 \text{ hr}}{1 \text{ yr}} \cdot \frac{1 \text{ t}}{2{,}000 \text{ lb}} = 28.90 \text{ tpy } O_2$$

4. Calculate the heat value of the syngas for each component in kJ/kg.
   Using CO as an example:
   $HV_{CO} = (HV_{CO\,kJ/kg}) * (mol\%) / (CF_{\%})$

$$= \frac{10122 \text{ kJ}}{\text{kg}} \cdot 19.1 \cdot \frac{1}{100} = 1928.60 \text{ kJ/kg CO}$$

5. Calculate the gross calorific heat value of the syngas in Btu/lb.
   $HV_{syngas} = \sum(HV_{components,kJ/kg}) / (CF_{kJ/kg-Btu/lb})$

$$= \frac{31625.86 \text{ kJ}}{\text{kg}} \cdot \frac{1 \text{ Btu/lb}}{2.326 \text{ kJ/kg}} = 13596.72 \text{ Btu/lb}$$

Empire Green Generation, LLC
Plastic Recycling Pyrolysis Facility
Generator Emissions Calculations

Inputs/Assumptions

Number of Engines	4
Control Device	(none)
Gross Calorific Value	13,174.00 Btu/lb
Average Amount of Gas Produced	36 mass % gas
Amount of Plastics Processed	70 tpd plastics
Amount of Gas Produced per day	25.0 tpd of gas
Amount of Gas to Each Engine	520 lb/hr of gas
Fuel Consumption	6,849 Btu*1000/hr
Density	0.0844 lb/scf
Engine Rating	320 kW
Horse Power	429 HP
Annual Operating Hours	7,440 hours
Fuel Heat Value	1,112 Btu/scf
NOx Factor	1.09 g/HP-hr
CO Factor	2.18 g/HP-hr
VOC Factor	0.76 g/HP-hr
PM10 Factor	1.09E-02 lb/MMBtu
SO2 Factor	6.41E-04 lb/MMBtu
CO2 Factor	52.07 kg/MMBtu
N2O Factor	0.00320 kg/MMBtu
CH4 Factor	0.0006 kg/MMBtu

	Per Engine		Total	
Pollutant	lb/hr	tpy	lb/hr	tpy
NOx	1.03	3.84	4.12	15.34
CO	2.06	7.67	8.25	30.68
VOC	0.72	2.68	2.89	10.74
PM	0.07	0.28	0.30	1.11
SO2	0.004	0.02	0.02	0.07
CO2	786.23	2,925	3,145	11,699
N2O	0.05	0.18	0.19	0.72
CH4	0.01	0.04	0.04	0.14
CO2e	790.28	2,940	3,161	11,759

Notes
1) All engine emissions will be subjected to the Regenerative Thermal Oxidiser (RTO) prior to emitting to atmo
2) Engines will run on syngas only.
3) NO_x, CO and VOC factors are from 40 CFR 60 Subpart JJJJ, Table 1 and adjusted for syngas using a ratio
   Heating Values. (per 40 CFR 60.4233(e))
4) PM and SO_2 factors are from AP-42, Table 3.2-2, 5th Edition, July, 2000 and adjusted for syngas.
5) Emission Factor for CO_2 is from 40 CFR 98, Table C-1 - Default CO2 Emissions Factors
6) Emission Factor for N_2O and CH_4 are from 40 CFR 98, Table C-2, Default CH4 and N2O Emission Factors.
7) NOx Emissions, lb/hr = Emission Factor, lb/MMBtu, x Fuel Consumption, Btu*1000/hr, / 1000 (MMBtu/Btu*1
8) CO_2 Emissions, lb/hr = Emission Factor, kg/MMBtu, x 2.2046 lb/kg, x Fuel Consumption, Btu*1000/hr, / 1000 (MMBtu/Btu*1000)
9) NOx Emissions, tons/yr = NOx Emissions, lb/hr, x 7,440 hrs/yr (310 days/yr), / 2,000 lb/ton
10) Fuel Consumption based on estimates provided by Technotherm. See Overall Emissions Calculations.
11) PM = PM, PM10, and PM2.5
12) CO2e calculated using the following: $(ER_{CO2} * 1) + (ER_{N2O} * 25) + (ER_{CH4} * 298)$

Empire Green Generation, LLC
Plastic Recycling Pyrolysis Facility
Generator Emissions Calculations

Number of Engines	4
Engine Type	4SLB
[illegible]	13,174
[illegible]	6,849
Amount of Plastics Processed (tpd)	tpd plastics
Annual Aggregate Heat Input (MMBtu/yr)	[illegible]
Hourly Aggregate Heat Input (MMBtu/hr)	[illegible]

Pollutant	CAS	Emission Factor (lb/MMBtu)	Per Engine lb/hr	Per Engine lb/yr	Per Engine tons/yr	Total lb/hr	Total lb/yr	Total tons/yr
1,1,2,2-Tetrachloroethane	79-34-5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,1,2-Trichloroethane	79-00-5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,3-Butadiene	106-99-0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1,3-Dichloropropene	542-75-6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2,2,4-Trimethylpentane	540-84-1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2-Methylnaphthalene	91-57-6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Acenaphthene	83-32-9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Acenaphthylene	208-96-8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Acetaldehyde	75-07-0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Acrolein	107-02-8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Benzene	71-43-2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Benzo(b)fluoranthene	205-99-2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Benzo(e)pyrene	192-97-2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Benzo(g,h,i)perylene	191-24-2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Biphenyl	92-52-4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Carbon Tetrachloride	56-23-5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Chlorobenzene	108-90-7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Chloroform	67-66-3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Chrysene	218-01-9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Ethylbenzene	100-41-4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Ethylene Dibromide	106-93-4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fluoranthene	206-44-0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fluorene	86-73-7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Formaldehyde	50-00-0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Methanol	67-56-1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Methylene Chloride	75-09-2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
n-Hexane	110-54-3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Naphthalene	91-20-3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Phenanthrene	85-01-8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Phenol	108-95-2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Pyrene	129-00-0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Styrene	100-42-5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Toluene	108-88-3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Vinyl Chloride	75-01-4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Xylenes	1330-20-7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		Total HAPs	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

HAP Emissions based on AP-42, 5th ed. (July 2000) emission factors for 4SLB engine.
Please Note: All engine emissions will be subjected to the Regenerative Thermal Oxidiser (RTO) prior to emitting to atmosphere.

Hourly and Annual Aggregate Heat Input (MMBtu/hr, MMBtu/yr)

[illegible]

Sample Calculations for Formaldehyde

[illegible]

CALCULATION WORKSHEET PAGE 1 of 1

CLIENT Empire Pyrolysis	JOB NUMBER 2120-PE-02161.100
SUBJECT Follansbee WV Unpaved Roads Particulate matter emissions	
BASED ON Client provided information	DRAWING NUMBER Roadway Layout.pdf
BY VJPlachy / CHECKED BY AMO'Bradovich	DATE 4/7/2022

Objective: Calculate the Particulate Matter emissions associated with vehicle traffic.

Inputs and Assumptions:

1. WVDEP Input data

	Class 8 Truck		Ford F250	
	PM	PM-10	PM	PM-10
k =	0.80	0.36	0.80	0.36
s =	4.8	4.8	4.8	4.8
S =	5	5	5	5
W =	11.4	11.4	3.8	3.8
w =	10	10	10	10
p =	140	140	140	140
VMT/trip =	0.07	0.07	0.29	0.29
trips/hr =	10.0	10.0	4	4

2. Vehicle data

no. Wheels = 10 4

3. AP-42 Fifth Edition - 13.2.2 Unpaved Roads

E = k * 5.9 * (s/12) * (S/30) * (W/3)^0.7 * (w/4)^0.5 * ((365 - p)/365) = lb/VMT

4. WVDEP emissions lb/hr

E(lb/hr) = (lb/VMT)*(VMT/trip)*(trips/hr)

E(tpy) = (lb/VMT)*(VMT/trip)*(trips/hr)*(1/2,000 lb)

Calculations:

1. Calculate PM emission for Class 8 vehicle

E = k * 5.9 * (s/12) * (S/30) * (W/3)^0.7 * (w/4)^0.5 * ((365 - p)/365) = lb/VMT

	Class 8 Truck		Ford F250	
	PM	PM-10	PM	PM-10
k =	0.80	0.36	0.80	0.36
s =	4.80	4.8	4.80	4.8
S =	5	5	5	5
W =	11.4	11.4	3.8	3.8
w =	10	10	10	10
p =	140	140	140	140
E (lb/VMT) =	0.78	0.35	0.34	0.15
E (lb/hr) =	0.56	0.25	0.39	0.18
E (t/yr) =	0.0003	0.0001	0.0002	0.0001

Attachment L
EMISSIONS UNIT DATA SHEET
CHEMICAL PROCESS

For chemical processes please fill out this sheet and all supplementary forms (see below) that apply. Please check all supplementary forms that have been completed.

- ☒ *Emergency Vent Summary Sheet*
- ☒ *Leak Sources Data Sheet*
- ☐ *Toxicology Data Sheet*
- ☐ *Reactor Data Sheet*
- ☐ *Distillation Column Data Sheet*

1. Chemical process area name and equipment ID number (as shown in *Equipment List Form*)
Plastic to syngas plant.

2. Standard Industrial Classification Codes (SICs) for process(es)
562920

3. List raw materials and ☐ attach MSDSs
Plastic waste

4. List Products and Maximum Production and ☐ attach MSDSs

Description and CAS Number	Maximum Hourly (lb/hr)	Maximum Annual (ton/year)
Syngas	1091	9557160

5. Complete the *Emergency Vent Summary Sheet* for all emergency relief devices.

6. Complete the *Leak Source Data Sheet* and describe below or attach to application the leak detection or maintenance program to minimize fugitive emissions. Include detection instruments, calibration gases or methods, planned inspection frequency, and record-keeping, and similar pertinent information. If subject to a rule requirement (e.g. 40CFR60, Subpart VV), please list those here.

7. Clearly describe below or attach to application Accident Procedures to be followed in the event of an accidental spill or release.
In the case of an accidental release the plant will be immediately shut down the source and cause of the leak will be located and repaired.

8. **Waste Products** - Waste products status. (If source is subject to RCRA or 45CSR25, please contact the Hazardous Waste Section of WVDEP, DAQ at (304) 926-3647.)

9A. Types and amounts of wastes to be disposed.

9B. Method of disposal and location of waste disposal facilities. N/A
Carrier: Phone:

9C. Check here if approved USEPA/State Hazardous Waste Landfill will be used ☐

10. Maximum and Projected Typical Operating Schedule for process or project as a whole (circle appropriate units).

circle units:	(hrs/day) (hr/batch)	(days), (batches/day), (batches/week)	(days/yr), (weeks/year)
10A. Maximum			
10B. Typical	24/7		50 weeks per year

11. Complete a *Reactor Data Sheet* for each reactor in this chemical process.

12. Complete a *Distillation Column Data Sheet* for each distillation column in this chemical process.

13. Proposed Monitoring, Recordkeeping, Reporting, and Testing
Please propose monitoring, recordkeeping, and reporting in order to demonstrate compliance with the proposed operating parameters. Please propose testing in order to demonstrate compliance with the proposed emissions limits.

MONITORING	RECORDKEEPING
REPORTING	TESTING

MONITORING. Please list and describe the process parameters and ranges that are proposed to be monitored in order to demonstrate compliance with the operation of this process equipment operation or air pollution control device.

RECORDKEEPING. Please describe the proposed recordkeeping that will accompany the monitoring.

REPORTING. Please describe the proposed frequency of reporting of the recordkeeping.

TESTING. Please describe any proposed emissions testing for this process equipment or air pollution control device.

14. Describe all operating ranges and maintenance procedures required by Manufacturer to maintain warranty

INFORMATION REQUIRED FOR CHEMICAL PROCESSES

The notes listed below for chemical processes are intended to help the applicant submit a complete application to the DAQ; these notes are not intended to be all inclusive. The requirements for a complete application for a permit issued under 45CSR13 are assigned to provided enough information for a permit reviewer to begin a technical review. Additional information beyond that identified may be required to complete the technical review of any individual application.

Process Description

Please keep these points in mind when compiling your process description as part of this permit application.

1. Provide a general process overview. The brief, but complete, process description should include chemical or registered trademark names of chemicals, products, intermediates, and/or raw materials to be produced or consumed, and the ultimate use(s) of the product(s). A list of the various chemical compounds is helpful.
2. Describe each process step. Include the process chemistry and stoichiometrically balanced reaction equation or material mass balance on all components.
3. Describe the methods and equipment used to receive, store, handle, and charge raw materials.
4. Describe the methods and equipment used to handle, store, or package final products and intermediates.
5. Provide process flow diagrams or equipment layout drawings which clearly show the process flow relationships among all pieces of process and control equipment. Identify all air emission discharge points. Discuss instrumentation and controls for the process.
6. Discuss the possibilities of process upsets, the duration and frequency of upsets, and consequences (including air emissions) of these upsets. Include a description of rupture discs, pressure relief valves, and secondary containment systems.
7. Discuss any fugitive emissions and the methods used to minimize them.
8. Include the following plans for the process if available:
   a. preventative maintenance and malfunction abatement plan (recommended for all control equipment).
   b. continuous emissions (in-stack) monitoring plan
   c. ambient monitoring plan
   d. emergency response plan

Regulatory Discussion

The following state and federal air pollution control regulations may be applicable to your chemical process. You should review these regulations carefully to determine if they apply to your process. Please summarize the results of your review in your permit application along with any other regulations you believe are applicable.

- Title 45 Legislative Rule Division of Environmental Protection, Office of Air Quality contains West Virginia's air pollution control regulations, including the following promulgated rules which may require emissions reductions or control technologies for your chemical process.
  a. 45CSR27 - Best Available Technology (BAT) for Toxic Air Pollutants (TAPs)
  b. 45CSR31 - VOC emissions controls for ozone maintenance in Hancock, Ohio, Putnam, Wayne, and Wood counties.
  c. 45CSR13 (Table 45-13A) - particulate emission thresholds for permitting for certain pollutants.
- Federal Guidelines for case-by-case MACT determinations under section 112(g) of the 1990 CAAA for individual and total HAPs greater than 10 and 25 tons per year, respectively.
- There are also subparts of the federal Standards of Performance for New Stationary Sources (NSPS), 40CFR60, and the National Emission Standards for Hazardous Air Pollutants (NESHAP) at 40CFR61 and 40CFR63, which apply to various chemical and nonchemical processes. These subparts are too numerous to list here, but these areas of the federal regulations should be consulted carefully to determine applicability to your process.

Emissions Summary and Calculations

Please keep these points in mind when submitting your emissions calculations as part of this permit application.

1. For each pollutant, provide the basis for the emissions estimate and for all emission reduction(s) or control efficiency(ies) claimed.
2. For all batch processes provide the following:
   a. Emissions of each pollutant in pound(s) per batch, from each process step
   b. Annual emissions based on number of batches requested per year
   c. The total time for each process step and the duration of the emissions during the process step
   d. Total batch time, total emissions per batch (or per day), and annual emissions based on the number of batches requested per year.

EMERGENCY VENT SUMMARY SHEET

List below all emergency relief devices, rupture discs, safety relief valves, and similar openings that will vent only under abnormal conditions.

Emission Point ID[1]	Equipment to Relief Vent (type, ID if available)[2]	Relief Vents (type) & Set Pressure (psig)	Name of Chemical(s) or Pollutants Controlled	Worst Case Emission per Release Event (lbs)
Pyrolyser A outlet	Pyrolyser A	Spring loaded explosion hatch set at 35psig	Syngas	29
Pyrolyser B outlet	Pyrolyser A	Spring loaded explosion hatch set at 35psig	Syngas	29

All routine vents (non-emergency) should be listed on the *Emission Points Data Summary Sheet*.

[1] Indicate the emission point, if any, to which source equipment normally vents. Do not assign emission point ID numbers to each emergency relief vent or device.

[2] List all emergency relief devices next to the piece of equipment from which they control releases.

LEAK SOURCE DATA SHEET

Source Category	Pollutant	Number of Source Components[1]	Number of Components Monitored by Frequency[2]	Average Time to Repair (days)[3]	Estimated Annual Emission Rate (lb/yr)[4]
Pumps[5]	light liquid VOC[6]				
	heavy liquid VOC[7]				
	Non-VOC[8]				
Valves[9]	Gas VOC	188		1	10.7
	Light Liquid VOC				
	Heavy Liquid VOC				
	Non-VOC				
Safety Relief Valves[10]	Gas VOC	2		1	0.11
	Non VOC				
Open-ended Lines[11]	VOC	0			
	Non-VOC				
Sampling Connections[12]	VOC	25		1	1.44
	Non-VOC				
Compressors	VOC	3		2	0.17
	Non-VOC				
Flanges	VOC	440		1	25.3
	Non-VOC				
Other	VOC	220		1	12.69
	Non-VOC				

[1] [2] [3] [4] See notes on the following page.

Notes for Leak Source Data Sheet

1. For VOC sources, include components on streams and equipment that contain greater than 10% w/w VOC, including feed streams, reaction/separation facilities, and product/by-product delivery lines. Do not include certain sealless equipment as defined herein by category.

2. By monitoring frequency, give the number of sources routinely monitored for leaks, using a portable detection device that measures concentration in ppm. Do not include monitoring by visual or soapy-bubble leak detection methods. "W/Q/M/Q/SA/A/O" means the time period between inspections as follows:

   Monthly/Quarterly, with Monthly follow-up of repaired leakers/Quarterly/Semi-annual/Annually/Other (specify time period)

   If source category is not monitored, a single zero in the space will suffice. For example, if 50 gas-service valves are monitored quarterly, with monthly follow-up of those repaired, 75 are monitored semi-annually, and 50 are checked bimonthly (alternate months), with non checked at any other frequency, you would put in the category "valves, gas service": 0/50/0/75/0/50 (bimonthly).

3. Give the average number of days, after a leak is discovered, that an attempt will be made to repair the leak.

4. Note the method used: MB - material balance, EE - engineering estimate, EPA - emission factors established by EPA (cite document used), O - other method, such as in-house emission factor (specify).

5. Do not include in the equipment count sealless pumps (canned motor or diaphragm) or those with enclosed venting to a control device. Emissions from vented equipment should be included in the estimates given in the Emission Points Data Sheet.

6. Volatile organic compounds (VOC) means the term as defined in 40 CFR 51.100 (s).

7. A light liquid is defined as a fluid with vapor pressure equal to or greater than 0.04 psi (0.3 Kpa) at 20°C. For mixtures, if 20% w/w or more of the stream is composed of fluids with vapor pressures greater than 0.04 psi (0.3 Kpa) at 20 °C, then the fluid is defined as a light liquid.

8. A heavy liquid is defined as a fluid with a vapor pressure less than 0.04 psi (0.3 Kpa) at 20°C. For mixtures, if less than 20% w/w of the stream is composed of fluids with vapor pressures greater than 0.04 psi (0.3 Kpa) at 20 °C, then the fluid is defined as a heavy liquid.

9. LIST CO, H_2S, mineral acids, NC, NO_x, SO_x, etc. DO NOT LIST CO2, H_2, H_2O, N_2, O_2, and Noble Gases.

10. Include all process valves whether in-line or on an open-ended line such as sample, drain and purge valves. Do not include safety-relief valves, or leakless valves such as check, diaphragm, and bellows seal valves.

11. Do not include a safety-relief valve if there is a rupture disk in place upstream of the valve, or if the valve vents to a control device.

12. Open-ended lines include purge, drain and vent lines. Do not include sampling connections, or lines sealed by plugs, caps, blinds or second valves.

13. Do not include closed-purge sampling connections.

TOXICOLOGY DATA SHEET[1]

Descriptor Name/CAS Number	OSHA Limits[2]		Acute[3] TC_{LO} = Animal; LC_{50} = Animal; LD_{50} = Animal	Chronic[3]	Irritation[4]	References
	TWA	CL				
Propane/74-98-6	1000 ppm		>20000 ppm			SDS
Synthetic Natural Gas/74-82-8	600 ppm		224 g/m3 3 hrs			SDS

[1] Indicate by "ND" where no data exists, in company's knowledge.
[2] Time Weighted Average, Ceiling Limit, or other, with units.
[3] If inhalation data is not available, provide other data as available.
[4] Relying on animal or human studies. Indicate if any data suggests: C = carcinogenicity, M = mutagenicity, T = teratogenicity, O = sinsagenicity.
[4] Indicate if there are dermal or eye irritation effects and whether they are considered to be low, moderate, or severe.

REACTOR DATA SHEET

Provide the following information for each piece of equipment that is a potential or actual source of emissions as shown on the Equipment List Form and other parts of application.

Identification Number (as shown on Equipment List Form):

1. Name and type of equipment (e.g. CSTR, plug flow, batch, etc.)

2. Type of operation ☐ Batch ☐ Continuous ☐ Semi-batch

3. Projected Actual Equipment Operating Schedule (complete appropriate lines):
   ____ hrs/day ____ days/week ____ weeks/year
   ____ hrs/batch ____ batches/day, weeks (Circle one) ____ day, weeks/yr (Circle one)

4. Feed Data: Flow in = gal/hr, or gal/batch

Material Name & CAS No.	Phase[a]	Specific Gravity	Vapor Pressure[b]	Charge Rate Normal	Charge Rate Max	Charge Rate Units	Fill time (min/batch, run)[c]

a. S = Solid, L = Liquid, G = gas or vapor
b. At feed conditions
c. Total time that equipment is filling per batch or run (start-up), for tank or vessel-type equipment.

5. Provide all chemical reactions that will be involved (if applicable), including the residence time and any side reactions that may occur as well as gases that may be generated during these reactions. Indicate if the reaction(s) are exothermic or endothermic.

6. Maximum Temperature		7A. Maximum Pressure 7B. Max. Set Pressure for venting	
°C		mmHg	mmHg
°F		psig	psig

8. Output Data: Flow Out = gal/hr or gal/batch

Material Name and CAS No.	Phase	Specific Gravity	Vapor Pressure	Hourly or Batch Output Rate		
				Normal	Maximum	Units

9. Complete the following emission data for equipment connected to a header exhaust system, giving emissions levels before entering header system (i.e. before control equipment).

☐ Check here if not applicable

Emission Point ID (exhaust point of header system):

Material Name and CAS No.	Maximum Potential Emission Rate (lb/hr)	Method **

** ME - material balance; EE - Engineering Estimate; TM - Test Measurement (submit test data); O - other (Explain)

10. Provide the following information pertaining to each condenser that may be attached to this reactor. Attach additional pages as necessary if more than one condenser is used for this reactor. Complete the Condenser Air Pollution Control Device Sheet if necessary.

☐ Check here if not applicable

10A. Cooling material

10B. Minimum and Maximum flowrate of cooling material (gal/hr)

10C. Inlet temperature of cooling material (°F)

10D. Outlet temperature of cooling material (°F)

10E. Pressure drop of gas to be condensed from inlet to outlet (psig)

10F. Inlet temperature of gas stream (°F)

10G. Outlet temperature of gas stream (°F)

10H. Number of passes

10I. Cooling surface area

11. Provide the following pertaining to auxiliary equipment that burns fuel (heaters, dryers, etc.):

☐ Check here if not applicable

11A. Type of fuel and maximum fuel burn rate, per hour.

11B. Provide maximum percent sulfur (S), ash content of fuel, and the energy content using appropriate units:

%S % Ash BTU/lb, scf, ft³/lb, gal (circle one)

11C. Theoretical combustion air requirement in SCFD per unit of fuel (circle appropriate unit) @ 70°F and 14.7 PSIA.

SCFD/lb, SCFD, gal (circle one)

11D. Percent excess air: %

11E. Type, amount, and BTU rating of burners and all other firing equipment that are planned to be used.

11F. Total maximum design heat input: $\times 10^6$ BTU/hr.

12. Proposed Monitoring, Recordkeeping, Reporting, and Testing

Please propose monitoring, recordkeeping, and reporting in order to demonstrate compliance with the proposed operating parameters. Please propose testing in order to demonstrate compliance with the proposed emissions limits.

MONITORING	RECORDKEEPING
REPORTING	**TESTING**

MONITORING: PLEASE LIST AND DESCRIBE THE PROCESS PARAMETERS AND RANGES THAT ARE PROPOSED TO BE MONITORED IN ORDER TO DEMONSTRATE COMPLIANCE WITH THE OPERATION OF THIS PROCESS EQUIPMENT OPERATION OR AIR POLLUTION CONTROL DEVICE.

RECORDKEEPING: PLEASE DESCRIBE THE PROPOSED RECORDKEEPING THAT WILL ACCOMPANY THE MONITORING.

REPORTING: PLEASE DESCRIBE THE PROPOSED FREQUENCY OF REPORTING OF THE RECORDKEEPING.

TESTING: PLEASE DESCRIBE ANY PROPOSED EMISSIONS TESTING FOR THIS PROCESS EQUIPMENT OR AIR POLLUTION CONTROL DEVICE.

13. Describe all operating ranges and maintenance procedures required by manufacturer to maintain warranty.

NOTE: An AIR POLLUTION CONTROL DEVICE SHEET must be completed for any air pollution device(s) (except emergency relief devices) used to control emissions from this reactor.

DISTILLATION COLUMN DATA SHEET

Identification Number (as assigned on Equipment List Form):

1. Name and type of equipment

4. Projected actual equipment operating schedule (complete appropriate lines):

hr/day | days/week | weeks/year

hrs/batch | batches/day, batches/week (circle one) | days/yr, weeks/yr (circle one)

2. Number of stages (plates), excluding condenser

3. Number of feed plates and stage location

4. Specify details of any reheating, recycling, or stage conditioning along with the stage locations

5. Specify reflux ratio, R (where R is defined as the ratio of the reflux to the overhead product, given symbolically as R=L/D, where L = liquid down column, D = distillation product)

6. Specify the fraction of feed which is vaporized, f (where f is the molar fraction of the feed that leaves the feed plate continuously as vapor).

7A. Type of condenser used: ☐ total ☐ partial ☐ multiple ☐ other

7B. For each condenser provide process operating details including all inlet and outlet temperatures, pressures, and compositions.

8. Feed Characteristics
   A. Molar composition
   B. Individual vapor pressure of each component
   C. Total feed stage pressure
   D. Total feed stage temperature
   E. Total mass flow rate of each stream into the system

9. Overhead Product
   A. Molar composition of components
   B. Vapor pressure of components
   C. Total mass flow rate of all streams leaving the system as overhead products

10. Bottom Product
   A. Molar composition of all components
   B. Total mass flow rate of all streams leaving the system as bottom products

11. General Information
   A. Distillation column diameter
   B. Distillation column height
   C. Type of plates
   D. Plate spacing
   E. Murphree plate efficiency
   F. Any other information necessary to describe the operation of this distillation column.

12. Proposed Monitoring, Recordkeeping, Reporting, and Testing
Please propose monitoring, recordkeeping, and reporting in order to demonstrate compliance with the proposed operating parameters. Please propose testing in order to demonstrate compliance with the proposed emissions limits.

MONITORING	RECORDKEEPING
REPORTING	**TESTING**

MONITORING: PLEASE LIST AND DESCRIBE THE PROCESS PARAMETERS AND RANGES THAT ARE PROPOSED TO BE MONITORED IN ORDER TO DEMONSTRATE CONTINUOUS WITH THE OPERATION OF THIS PROCESS EQUIPMENT OPERATION OR AIR POLLUTION CONTROL DEVICE.

RECORDKEEPING: PLEASE DESCRIBE THE PROPOSED RECORDKEEPING THAT WILL ACCOMPANY THE MONITORING.

REPORTING: PLEASE DESCRIBE THE PROPOSED FREQUENCY OF REPORTING OF THE RECORDKEEPING.

TESTING: PLEASE DESCRIBE ANY PROPOSED EMISSIONS TESTING FOR THIS PROCESS EQUIPMENT OR AIR POLLUTION CONTROL DEVICE.

12. Describe all operating ranges and maintenance procedures required by manufacturer to maintain warranty.

NOTE: An AIR POLLUTION CONTROL DEVICE SHEET must be completed for any air pollution device(s) (except emergency relief devices) used to control emissions from this distillation column.

ATTACHMENT O

Monitoring/Recordkeeping/Reporting/Testing Plans

ATTACHMENT O - MONITORING, RECORDING, REPORTING, AND TESTING PLANS

Plan Type	Emission Unit	Pollutant	Requirements	Frequency	Method of Measurement	Regulatory Reference
Recordkeeping	Regenerative Thermal Oxidizer (10E)	PM/PM_{10}/$PM_{2.5}$ VOC and ortone pollutants	Control of visible particulate emissions Temperature monitoring	Daily Continuous	Visual	40 CFR 63, Subpart FFFF 40 CFR 60.18
Recordkeeping	Pyrolyzers (30S)	Syngas	Operate and maintain the source in a manner consistent with safety and good air pollution control practices to minimize emissions. Monitor for temperature.	Continuous during operations Weekly and monthly maintenance	Operate the control equipment in accordance with manufacturer's recommendations	N/A
Monitoring/ Recordkeeping	Scrubbers (42S)	PM/PM_{10}/$PM_{2.5}$ Solids	Pressure Drop monitoring	Hourly average Annual	The pressure drop across the system, the production rate Catalyst Management Plan will monitor Catalyst Activity by pulling sample blocks and sending them to the laboratory for activity testing.	N/A

ATTACHMENT P

Public Notice

AIR QUALITY PERMIT NOTICE
Notice of Application

Notice is given that Empire Green Generation, LLC has applied to the West Virginia Department of Environmental Protection, Division of Air Quality, for a Modification of Permit R13-3555 for a Plastics Recycling Plant located on 301 Koppers Road, near Follansbee, in Brooke County, West Virginia. The latitude and longitude coordinates are: 40.330850 N, -80.606429 W

The applicant estimates the potential to discharge the following Regulated Air Pollutants will be less than 24.0 tons per year (tpy) of VOCs, 14.0 tpy of PM, 99.0 tpy of CO, 24.0 tpy of NO_x, 2.0 tpy of HAPs and 39.0 tpy of SO_2.

Startup of operation is planned to begin on or about the 15th day of July 2023. Written comments will be received by the West Virginia Department of Environmental Protection, Division of Air Quality, 601 57th Street, SE, Charleston, WV, 25304, for at least 30 calendar days from the date of publication of this notice. Written comments will also be received via email at DEPAirQualityPermitting@WV.gov.

Any questions regarding this permit application should be directed to the DAQ at (304) 926-0499, extension 41281, during normal business hours.

Dated this the (Day) day of (Month), (2023).

By: Empire Green Generation, LLC
Bernard Brown
Chief Technology Officer
1400 Main Street
Follansbee, WV 26037

Daily Times

AFFIDAVIT OF PUBLICATION

State of Florida, County of Orange, ss:

Kade Hill, being first duly sworn, deposes and says: That (s)he is a duly authorized signatory of Column Software, PBC, duly authorized agent of Weirton Daily Times, a newspaper printed and published in the City of Weirton, County of Hancock, State of West Virginia, and that this affidavit is Page 1 of 1 with the full text of the sworn-to notice set forth on the pages that follow, and the hereto attached:

PUBLICATION DATES:
Dec. 8, 2023

NOTICE ID: [illegible]
PUBLISHER ID: [illegible]
NOTICE NAME: Green Gen Public Notice Modification
Publication Fee: 42.15

Kade Hill

VERIFICATION

State of Florida
County of Orange

Subscribed in my presence and sworn to before me on this: 12/?/2023

Notary Public
Notarized online using audio-video communication

AIR QUALITY PERMIT NOTICE
Notice of Application

Notice is given that Empire Green Generation, LLC has applied to the West Virginia Department of Environmental Protection, Division of Air Quality, for a Modification of Permit R13-3555 for a Plastics Recycling Plant located on 801 Koppers Road, near Follansbee, in Brooke County, West Virginia. The latitude and longitude coordinates are: [illegible] N, [illegible] W

The applicant estimates the potential to discharge the following Regulated Air Pollutants will be less than [illegible] tons per year (tpy) of VOCs, [illegible] tpy of PM, [illegible] tpy of CO, [illegible] tpy of NOx, [illegible] tpy of HAPs and [illegible] tpy of SOx.

Startup of operation is planned to begin on or about the [illegible] day of July 2023. Written comments will be received by the West Virginia Department of Environmental Protection, Division of Air Quality, 601 57th Street, SE, Charleston, WV 25304, for at least 30 calendar days from the date of publication of this notice. Written comments will also be received via email at:

DEPAirQuality
Permitting@WV.gov.

Any questions regarding this permit application should be directed to the DAQ at:

(304) 926-0499
extension [illegible]

during normal business hours.
Dated this the [illegible] day of December, 2023.
By: Empire Green Generation, LLC
Bernard Brown
Chief Technology Officer
1400 Main Street
Follansbee, WV 26037
WDT Dec 8, 2023

ATTACHMENT Q

Business Confidential Claims

Empire Green Generation

November 16, 2023

Mr. Edwards Andrews, P.E.
West Viginia Department of Environmental Protection
Division of air Quality
601 57th Street, SE
Charleston, WV 25304

RE: Empire Green Generation Confidential Business Information

Dear Mr. Andrews,

Please find enclosed Empire Green Generation's submittal of Confidential Business Information for the modification application for permit number R13-3555. This claim of confidentiality is due to trade secrets and intellectual property. A redacted version of this submittal has been sent to you via email.

Sincerely,

Bernard R. Brown

Bernard Brown
Chief Operating Officer

Encl.

1,400 Main Street, Follansbee, WV 26037
304-914-4624

Precautionary Notice — Claims of Confidentiality

The person submitting this information may assert that some or all of the information submitted is entitled to confidential treatment as provided by West Virginia Legislative Rule 45CSR31, entitled "Confidential Information." Information covered by such a claim will be disclosed by the Division of Air Quality (DAQ) only to the extent, and by means of the procedures, set forth in 45CSR31. Please contact the West Virginia Secretary of State's Office at 304/558-6000 or http://apps.sos.wv.gov/adlaw/csr to obtain a copy of 45CSR31 in order to ensure that all required procedures are followed.

Information concerning the "types and amounts of air pollutants discharged," as that term is defined in WVCSR §45-31-2.4, shall not be claimed as confidential.

Any claim of confidentiality shall be made in accordance with the requirements of 45CSR31 and must accompany the information at the time it is submitted to the DAQ. **If no claim of confidentiality is made at the time of submission or is not made in accordance with the requirements of 45CSR31, the DAQ may make the information available to the public without further notice.**

Included below are procedures, and an example form, to be followed in submitting information claimed as confidential. This information is intended to assist a person with claiming confidential information and is not meant to relieve a person of his/her obligation to review the provisions of 45CSR31 and to comply with such rule. The procedures are as follows:

1. Indicate clearly the items of information claimed confidential by marking each page with the term "Claimed Confidential," with the date of such claim of confidentiality. With the exception of documents of a size greater than 8½" x 14", information claimed confidential must be submitted on colored paper.

2. Include a cover document (See below) which justifies the claim of confidentiality in accordance with the specific criteria under WVCSR §45-31-4.1. A sample cover document is attached for your information and use. The cover document will be available for public disclosure and must include the following information:

   (a) The identity of the person making the submission of information claimed confidential;

   (b) The reason for the submission of information;

   (c) The name, an address in the State of West Virginia and telephone number of the designee who shall be contacted in accordance with 45CSR31;

   (d) Identification of each segment of information within each page that is submitted as confidential and the justification for each segment claimed confidential, including the criteria under WVCSR §45-31-4.1;

   (e) The period of time for which confidential treatment is desired (e.g., until a certain date, until the occurrence of a specified event or permanently); and,

   (f) Signature of a responsible official or an authorized representative of such person.

3. At the same time as the information claimed confidential is submitted to the DAQ on colored paper, a complete set of the information, including the cover document previously required under paragraph 2, must be submitted with the information claimed to be confidential blacked or whited out and the words "Redacted Copy — Claim of Confidentiality" marked clearly on each such page, so that the information is suitable for public disclosure. In the case of drawings and blueprints, mark each page with the words "Redacted Copy — Claim of Confidentiality," include the title or legend of the drawing, and black or white out the information claimed confidential. The redacted page may be 8½" x 11" in size.

4. In the case of a permit application or supplemental information to an application which contains confidential information, DAQ requires the "Redacted Copy – Claim of Confidentiality" pages and the cover document which justifies the claim of confidentiality to be submitted by e-mail as a PDF file to: DEPAirQualityPermitting@wv.gov

   See instructions at: https://dep.wv.gov/daq/permitting/Pages/nsr-forms.aspx OR https://dep.wv.gov/daq/permitting/Pages/TitleVGuidanceandForms.aspx

5. "Claimed Confidential" pages **may not be e-mailed** and shall be submitted, as hardcopy, on colored paper and mailed to:

   WVDEP – DAQ – Permitting
   Attn: NSR *or* Title V Permitting Secretary *
   601 57th Street, SE
   Charleston, WV 25304

   * For a 45CSR13 application, send to NSR Permitting Secretary. For a 45CSR30 application, send to Title V Permitting Secretary. If this is a combined NSR/Title V Permit Application, send one copy to the NSR Permitting Secretary and one copy to the Title V Permitting Secretary.

Sample Cover Document
Confidential Information

This sample form contains each of the required elements for the cover document required under 45CSR31. The person submitting this form may wish to attach an additional page(s) to provide adequate justification under the "Rationale" section of the form.

Company Name	Empire Green Generation, LLC	Responsible Official		Bernard Brown
Company Address	1400 Main Street Follansbee, WV	Confidential Information Designee in State of WV	Name	
			Title	
			Address	
Person/Title Submitting Confidential Information				
			Phone	
			Fax	

Reason for Submittal of Confidential Information:

Identification of Confidential Information	Rationale for Confidential Claim	Confidential Treatment Time Period
	Provide justification that the criteria set forth in § 45CSR31-4.1.a - e have been met.	

Responsible Official Signature:	Bernard R. Brown
Responsible Official Title:	Chief Operating Officer
Date Signed:	11/30/2023

NOTE: Must be signed and dated in **BLUE INK**.

ATTACHMENT R

Authority Form

211

AUTHORITY OF LIMITED LIABILITY COMPANY (LLC)

TO: The West Virginia Department of Environmental Protection, Division of Air Quality
DATE: April 8, 2022
ATTN: Director
LLC's Federal Employer I.D. Number 87-3187526

The undersigned hereby files with the West Virginia Department of Environmental Protection, Division of Air Quality, a permit application and hereby certifies that the said name is a trade name which we are using in the conduct of an unincorporated business.

Further, we have agreed or certified as follows:

(1) The undersigned is a member and in that capacity may represent the interests of the LLC and may obligate and legally bind all current or future members and the LLC.

(2) The LLC is authorized to do business in the State of West Virginia.

(3) The name and business address of each member:

Member: Frank Rosso
Address: 401 East Las Olas Blvd., Suite 1400, Fort Lauderdale, FL 33301

Telephone No.: 954-332-2423

Member:
Address:

Telephone No.:

Member:
Address:

Telephone No.:

(4) If any other persons become members of the undersigned or our relations as such be altered in any way or if the business should become incorporated, the undersigned will notify you promptly.

Frank J Rosso
MEMBER OF LLC (Signature)

Address: 401 East Las Olas Blvd., Suite 1400
Fort Lauderdale, FL 33301
Telephone No.: 954-332-2423

Frank J Rosso
MEMBER OF LLC (Typed)

LIMITED LIABILITY COMPANY=S NAME

(Limited Liability.wpd)
WVDEP-DAQ-Revised 7/01

212

ATTACHMENT S

Title V Permit Revision Information
(Not Applicable)

213

Inc App Email 12/20/2024

Tuesday, February 6, 2024 1:30 PM

Andrews, Edward S <edward.s.andrews@wv.gov>

Incomplete App Email for Permit App R13-3555A

1 message

Andrews, Edward S <edward.s.andrews@wv.gov> Wed, Dec 20, 2023 at 2:33 PM
To: Bernard Brown <bbrown@empirede.com>, Farley Wood <fwood@empirede.com>, "Pugh, Katie" <Katie.Pugh@tetratech.com>
Cc: Beverly D Mckeone <beverly.d.mckeone@wv.gov>, Brian S Tephabock <Brian.S.Tephabock@wv.gov>, Eric Blend <eric.n.blend@wv.gov>

RE: Application Status: Incomplete
Empire Green Generation
Permit Application No. R13-3555A
Plant ID No. 009-00141

Mr. Brown:

Your application for a modification permit for a plastic recycling by pyrolysis facility was received by this Division on December 1, 2023, and assigned to the writer for review. Upon initial review of said application, it has been determined that the application as submitted is incomplete based on the following items:

1. Affidavit of Publication of Class I Legal Ad.

2. Discussion of the proposed physical change(s), if applicable, and/or change in the method of operation. Specifically, this discussion needs to either outline or go into detail regarding proposed/suggested changes to the permit, if applicable; type and source(s)/origin of the plastic feedstock going to be process by the facility; any processing/pretearting/sorting going to be conduct on the plastic prior to being introduce into the pyrolysis unit(s), if these preprocessing is going to occur of off-site, it still needs to be identified and discussed; a discussion how the facility will switch back and forth in processing medical waste and plastic feedstock; and a discussion why processing the proposed plastic feedstock is not viewed as waste disposal through incineration in the content of the Clean Air Act and meet the criteria as a fuel(s) within the requirements and procedures of 40 CFR 241 - SOLID WASTES USED AS FUELS OR INGREDIENTS IN COMBUSTION UNITS.

3. Plot plan (Attachment E) needs to be updated to identify emission units and emission points.

4. Attachment J needs to be complete for each emission point.

5. Attachments K and L need to be completed. The potential for leaking equipement (e.g., valves, pumps, compressors, connectors, pressure relief devices) needs to be quantified and documented in these two attachments.

6. Each of the redacted pages that contain confidential business information (CBI) needs to be remarks "redacted copy - claim of confidentiality" in accordance with 45CSR31-3.4.

In addressing issues 2 through 6 needs to be reflective within the redacted application as a single PDF file.

The emissions estimates appear to be identical to the emission estimates for processing medical waste with the same pyrolysis unit. Please review these estimates and revise as necessary and/or justify in detail why the emission will not change given the change in feedstocks.

Please address the above deficiencies in writing by no later than January 16, 2024. Application review will not commence until the application has been deemed to be technically complete. Failure to respond to this request in a timely manner may result in the denial of the application.

Should you have any questions, please contact Ed Andrews at (304) 926-0499 ext. 41244 or reply to this email.

--
Edward Andrews, P.E.
Engineer
WVDEP/Division of Air Quality
304-926-0499 Ext 41244
601 57th Street, SE
Charleston, WV 20304

Parcel Notice 12-5-2023

Wednesday, December 6, 2023 8:03 AM

Andrews, Edward S <edward.s.andrews@wv.gov>

You received a parcel! Please come pick it up

1 message

ilobby@ilobbycloud.com <ilobby@ilobbycloud.com> Tue, Dec 5, 2023 at 10:26 AM
To: edward.s.andrews@wv.gov

DeliveryOS

ilobby®

Parcel Pending Pick Up

Shipping Label	Date Received	Tracking #	Site Name
	Dec 05, 2023	0077429849	WV Department of Environmental Protection

Note: AIR

Mark as picked up

App Submittal 12/1/2023

Wednesday, December 6, 2023 8:00 AM

Andrews, Edward S <edward.s.andrews@wv.gov>

Empire Green Generation Permit Modification Application

1 message

Wood, Katie <Katie.Pugh@tetratech.com> Fri, Dec 1, 2023 at 4:09 PM
To: Edward Andrews <edward.s.andrews@wv.gov>
Cc: Farley R Wood <fwood@empirede.com>

Ed,

Please find attached Empire Green Generations (EGG) permit modification application attached. EGG is making a claim for confidentiality so the attached file is redacted and the pages that are confidential will arrive via FedEx next week. Please feel free to reach out to me with any questions or concerns.

Thank you,

Katie Wood* | Environmental Scientist
Direct **+1 (740) 298-9062** | Mobile **+1 (304) 559-9980** | katie.wood@tetratech.com
Formerly Katie Pugh, please note name change
Tetra Tech | *Leading with Science®* | OGA
47443 National Rd Suite 3 | St. Clairesville, OH 47443 | tetratech.com

R13-3555 Modification_Application_EGG - Redacted_Final 12-1-23.pdf
21661K