MGS CNP 1, LLC
109 Post Oak Lane, Suite 140
Houston, TX 77024

May 6, 2025

Laura M. Crowder, Director
WV Department of Environmental Protection (WVDEP)
Division of Air Quality (DAQ)
601 57th Street SE
Charleston, WV 25304

Re: Application Status: Incomplete
MGS CNP 1, LLC/BECCS Plant
Permit Application No. R13-3708
Plant ID No. 053-00134

Ms. Crowder,

Please find our responses to each of your questions/comments in the incomplete application notice sent to MGS CNP 1, LLC (MGS) on April 25th 2025. MGS has provided a detailed response in *italics* to address all the questions surrounding the application for the BECCS plant.

The following items will be attached to address comments.

- Updated emission calculations
- Fuel analysis
- Updated Equipment Table (Attachment I)

If you have additional questions, please do not hesitate to contact us.

Sincerely,

William D (Jack) Calhoun, P.E.
Vice President, HSE

MGS CNP 1, LLC
109 Post Oak Lane, Suite 140
Houston, TX 77024

natural gas) for the CO2 dehydration unit and compression and whether these energy requirements for these activities will be part of the auxiliary load of the facility or require additional combustion units.

MGS Response

Electricity and steam for CO2 dehydration and compression are included in the total energy consumption of the facility. The total normal operating electrical demand for the facility is approximately 40,000 hp, of which, 23,275 hp is required for the carbon capture unit, CO2 compression and conditioning systems (i.e., dehydration and deoxygenation). The biomass boiler produces approximately 572 klb/hr of high-pressure steam (1,710 psig at 1,000°F), of which, approximately half of the high-pressure steam bypasses the steam turbine and is flashed to generate 314 klb/hr of low-pressure steam (100 psig at 338°F) of which 257 klb/hr is used by the carbon capture unit. The balance of the high-pressure steam is used to generate electricity in the steam turbine.

The DAQ has an unclear understanding of what will be the source of the electricity to start the proposed emissions units. Please keep in mind, the emergency engine for the emergency generator can only be operated for 50 hours per year of non-emergency use. This discussion needs to describe the electrical system that the steam turbine/generator will be connected to and the source of the electricity needed for normal startup/shutdown operations. Please explain in further detail exactly how the fluidized bed boiler will be preheated for startup with the use of steam from an auxiliary boiler or other steam generator.

MGS Response

A 3,000 hp natural gas generator will be used to provide electricity to start-up the auxiliary and utility systems (e.g., raw water treatment, boiler feedwater, instrument air, etc.) required prior to starting up the biomass boiler. The biomass boiler will combust natural gas to pre-heat the fluidized bed. Boiler feedwater will be introduced to the biomass boiler to generate high-pressure steam. Once the heat input on the boiler has been established, biomass is introduced to the boiler, natural gas to the boiler as fuel is decreased, and the high-pressure steam production rate increases. The high-pressure steam is sent to the steam generator to produce electricity to support the operation of the facility, and the natural gas generator is slowly phased out. The application includes durations for operating the natural gas generator (100 hours) and for start-up of the biomass boiler (55 hours).

Please note, the emergency engine is only used for the firewater pumps. The application includes a duration of 100 hours for emissions from the firewater pumps; however, these pumps are only anticipated to be operated for testing and maintenance. If this needs to be reduced to 50 hours, we are accepting the recommendation and emission calculation have been updated..

DAQ Question No. 2:

2. Missing completed individual control device sheets for the SCR, OxyCat, Wet FGD, and DSI for the boiler. Please identify key parameters that will be monitored to ensure compliance with the proposed emissions with respect to the pollutant(s) being controlled by the associated control device. Also, provide additional information regarding your proposed wet FGD system to determine if the residual moisture exiting the scrubber will pose a possible interference issue with a continuous opacity monitoring system as required in 45CSR2 and 45CSR2A. Given that the application is proposed to be a synthetic minor source under the Title V Program, please provide a monitoring plan for the CO Catalyst, Wet FGD and DSI control device to ensure compliance with proposed emission limits.

MGS Response

a. *Currently MGS CNP 1 does not have specification sheets from its vendors for each of these control devices, as the design of the plant is ongoing, and equipment vendors have not been finalized yet. All emission calculations are based on minimum guarantees provided by the vendors.*
b. *At this Time MGS CNP 1 does not have a complete monitoring plan as the plant design is not complete. Once design is finalized a modification will be filed to update these requirements.*

DAQ Question No. 3:

3. Please provide supporting information to support the claim that the proposed fuel will have sulfur content to satisfy the exemption criteria of 40CFR60.42b(k)(2). Regarding the wood (primary fuel) to be used as fuel for the boiler, the application does not identify the source(s) and species of wood to be used as fuel. If the source(s) of the wood fuel is going to be discarded from a manufacturing process, this/these source(s) of wood need to be identified and evaluated whether the material is a waste/fuel in accordance with 40 CFR 241.

MGS REsponse

a. *At this time MGS CNP 1 has determined that the Biomass analysis is proprietary information and will be following all procedures to maintain confidentiality for this analysis and for any future biomass samples. A redacted analysis will be provided that will include only the necessary information to verify the emissions. The Natural gas sample will be attached to this response.*

DAQ Question No. 4:

4. separate the startup emissions for control devices that the performance is impacted/cannot be operated during startup conditions (e.g. SCR, oxidation catalyst, wet FGD) on startup event basis. If a control device performance is impacted during an shutdown, thus shutdown emissions on a short-term basis needs to be identified as well. Any bypassing of a proposed control device needs to be identified for startup and

shutdown events. Please define the ending of a startup event. The emission calculations are based on NG firing for 10 hours per startup and a total of 55 hours per year for start operations. This accounts for 5 startup events per year with 5 hours unaccounted for. Please explain these 5 unaccounted for hours per year for startup and are the emissions based on firing 100% wood for these hours on an uncontrolled basis.

MGS Response

a. *The SCR and CO Catalyst are bypassed for 11 hours during start-up of the biomass boiler (5 x 11 = 55 hrs). During this duration, the biomass boiler combusts natural gas for 10 hours to pre-heat the fluidized bed. The application includes allowances for start-up emissions based on guarantees provided by the biomass boiler vendor.*
b. *Please note, no reduction in emissions were assumed for the Direct Contact Cooler / Polishing Scrubber (DCCPS) – this is the same device as the wet FGD.*
c. *Emission have been separated into normal operation and startup operations and are attached to this email.*

DAQ Question No. 5:

5. Please justify reducing the organic HAPs emission factors published in AP-42 by 88% for the use of CO catalyst when the VOC removal efficiency of 60% for the CO catalyst was applied to account for the control VOC emissions for the boiler.

MGS Response

a. *The organic HAPs were adjusted by multiplying the ratio of the biomass boiler vendor's guaranteed VOC emission factor to the AP-42 VOC emission factor. These adjusted emission factors are also used to calculate the biomass boiler's organic HAPs.*

DAQ Question No. 6:

6. Regarding haul road emissions: Please provide the minimum and maximum weight of the vehicles for each of the percentiles used to determine the average weight of the vehicle, and justification of the silt loading. Did the average weight of the vehicles and distance traveled account for equipment used to manage the open stockpile? Given that all haul roads are proposed to be paved, is the open stockpile going to be located on a paved surface?

MGS Response

a. *In the updated calculations, min and max weight for each vehicle type have been provided.*
b. *Due to BECCS facility not fitting into one of the defined categories in table 13.2.1-3. BECCS facility used Table 13.2.1-2. The Ubiquitous Baseline 0.6 g/m^2 and a multiplier of 4 is applied for low volume roads (< 500 Average Daily Traffic) to obtain a wintertime baseline silt loading of 4 X 0.6 = 2.4 g/m^2.*

c. *The biomass stockpile will be placed on a paved surface.*

DAQ Question No. 7:

7. provide additional details on how the HCl emissions from the wastewater treatment unit were determined and how these HCl emissions will be determined when the wastewater treatment unit is in operation.

MGS Response

a. *It was conservatively assumed that approximately 10% of the HCl would be absorbed in the solution from the flue gas in the Direct Contact Cooler/ Polishing Scrubber. The solution is then sent to WWTP and it is conservatively assumed that all the HCl will be emitted to the atmosphere.*
b. *Once the operation of the plant begins, HCL emissions from the WWTP will be determined by sampling for HCl periodically at the inlet and outlet of the WWTP. Sampling data will be used to estimate HCl emissions and verify compliance.*

Additional DAQ Questions:

8. I notice that some (not all) of the control devices have the same ID number as the emission point. Also, the equipment id is also used as the emission point id. A different ID needs to be used for the emission point.

MGS Response

The attachment I have been updated to have separate Emission unit IDs and Emission Point IDs. Control Device IDs have changed as well.

9. From Attachment I, I read that the makeup sand and sodium bicarbonate storage silos are venting into the BFB boiler and therefore the exhaust is controlled by the same boiler control devices. Also, there is a by-pass stack for the CCU (122-T-1001).

MGS Response

Correct; however, the bypass stack is 121-PKG-3001 not 122-T-1001.

10. For the Sand Receiving Bin (121-S-1002), it lists as the control device that vent is piped to BFB. If that is the case, the emission point for the sand receiving bin would be either 121-PKG-3001 or 122-T-1001 and not 121-S-1002.

MGS Response

The Sand Receiving Hopper (121-S-1002) is not vented to 121-PKG-3001 (BFB Boiler Stack) or 122-T-1001 (Absorber). The Sand Receiving Hopper collects sand from the truck and directs it to the Inclined Sand Conveyor. The sand from the conveyor is stored in the Makeup Sand Silo (121-S-5001) which vents to the BFB Boiler Stack, when the carbon capture unit is not in operation or the Absorber during normal operation. The Sand Receiving Hopper is open to the atmosphere.

11. For the capacity of silo and bins, please list the mass capacity for the silo or bin and not the throughput rate. The open storage pile for the wood chips needs a capacity value either on a mass or area basis.

MGS Response

All sizes are preliminary and not finalized. It should also be noted that the emissions from these sources are based on the throughput handled and not depended on size of the silo or bins.

a. *121-LS-1001 – Biomass Receiving Hopper = approx. 6,000 ft3*
b. *121-LS-1002 – Biomass Receiving Hopper = approx. 6,000 ft3*
c. *121-S-1001 – Biomass Feed Hopper = 1,800 ft3*
d. *121-S-1002 – Sand Receiving Hopper = 6,000 ft3*
e. *121-S-2001A/B – Biomass Fuel Metering Bin = 4,200 ft3 each*
f. *121-S-4001A/B – Fly Ash Storage Silo = 9,500 ft3 each (166 tons each)*
g. *121-S-5001 – Makeup Sand Silo = 1,660 ft3*
h. *121-S-9901 – Sodium Bicarbonate Storage Silo = 2,000 ft3*
i. *Chip Pile = 14 days of storage (71,265.6 klbs = 212.1 klb/hr x 24 hrs/day x 14 days)*

Natural Gas Analysis

Parameter	Units	Design Value
Higher Heating Value	BTU/scf	1,051
Lower Heating Value	BTU/scf	955
Pressure	psig	600
Temperature	°F	60
Composition (typical)		
Nitrogen	mol%	0.35
Carbon Dioxide	mol%	0.17
Methane	mol%	93.10
Ethane	mol%	5.99
Propane	mol%	0.33
n-Butane	mol%	0.03
i-Butane	mol%	0.02
n-Pentane	mol%	0.004
i-Pentane	mol%	0.007
Hexane	mol%	0.007
Total Sulfur	ppmv	10
Organic Sulfur	ppmv	10
H_2S	Grains / 100 SCF	0.25 (max)

Biomass Analysis

Parameter	Units	Value
[redacted]		
Composition (base case)		
[redacted]		
Sulfur	wt%, wet basis	0.01%
[redacted]		

MGS CNP 1, LLC Biomass Fired Power Plant Initial Minor NSR Application Emission Calculations Summary																										
Emission ID	NO_x		CO		PM		PM_{10}		$PM_{2.5}$		PM- Filterable		PM_{10} - Filterable		$PM_{2.5}$ - Filterable		VOC		SO_2		NH_3		H_2SO_4		Pb	
	lb/hr	Tons/Yr	lb/hr	Tons/Yr	lb/hr	Tons/Yr	lb/hr	Tons/Yr	lb/hr	Tons/Yr	lb/hr	Tons/Yr	lb/hr	Tons/Yr	lb/hr	Tons/Yr	lb/hr	Tons/Yr	lb/hr	Tons/Yr	lb/hr	Tons/Yr	lb/hr	Tons/Yr	lb/hr	Tons/Yr
121-H-2001	20.20	90.42	10.20	45.65	15.54	67.83	15.54	67.83	15.54	67.83	7.99	34.87	7.99	34.87	7.99	34.87	4.43	18.33	11.58	50.78	5.09	20.98	6.35	27.86	0.05	0.20
129-P-9402	3.95	0.10	3.45	0.09	0.20	<0.01	0.20	<0.01	0.20	<0.01	0.20	<0.01	0.20	<0.01	0.20	<0.01	3.95	0.10	<0.01	<0.01	--	--	--	--	--	--
129-PKG-0001	6.61	0.17	13.23	0.33	0.20	<0.01	0.20	<0.01	0.20	<0.01	0.20	<0.01	0.20	<0.01	0.20	<0.01	5.67	0.14	0.03	<0.01	--	--	--	--	--	--
127-PKG-0001	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.51	2.10	0.64	2.79	--	--
121-LS-1001 / 121-LS-1002	--	--	--	--	1.08	4.72	1.08	4.72	1.08	4.72	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
121-CV-1001	--	--	--	--	0.06	0.19	0.03	0.09	<0.01	0.01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
121-CV-1002	--	--	--	--	0.06		0.03		<0.01		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHIP-1	--	--	--	--	0.11	0.37	0.05	0.18	<0.01	0.03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
121-S-1001	--	--	--	--	0.11	0.37	0.05	0.18	<0.01	0.03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
121-CV-1003	--	--	--	--	0.06	0.19	0.03	0.09	<0.01	0.01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
121-CV-2001 A	--	--	--	--	0.06	0.19	0.03	0.09	<0.01	0.01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
121-CV-2001 B	--	--	--	--	0.06		0.03		<0.01		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
121-S-2001 A	--	--	--	--	0.06	0.19	0.03	0.09	<0.01	0.01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
121-S-2001 B	--	--	--	--	0.06		0.03		<0.01		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHIP-2	--	--	--	--	--	0.21	--	0.11	--	0.02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
121-CV-4001 A	--	--	--	--	0.54	1.79	0.25	0.85	0.04	0.13	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
121-CV-4001 B	--	--	--	--	0.54		0.25		0.04		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
121-CV-4002	--	--	--	--	0.54	1.79	0.25	0.85	0.04	0.13	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
121-CV-4003	--	--	--	--	0.54	1.79	0.25	0.85	0.04	0.13	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
121-CV-4004	--	--	--	--	0.54	1.79	0.25	0.85	0.04	0.13	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
121-CV-4005	--	--	--	--	0.54	1.79	0.25	0.85	0.04	0.13	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
121-CV-4006 A	--	--	--	--	0.39	1.31	0.19	0.62	0.03	0.09	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
121-CV-4006 B	--	--	--	--	0.39		0.19		0.03		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
121-CV-4007 A	--	--	--	--	0.39	1.31	0.19	0.62	0.03	0.09	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
121-CV-4007 B	--	--	--	--	0.39		0.19		0.03		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
121-S-4001 A	--	--	--	--	0.02	0.06	<0.01	0.03	<0.01	<0.01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
121-S-4001 B	--	--	--	--	0.02		<0.01		<0.01		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
121-TL-0001	--	--	--	--	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
121-CV-5001 A	--	--	--	--	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
121-CV-5001 B	--	--	--	--	<0.01		<0.01		<0.01		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
121-CV-5002A	--	--	--	--	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
121-CV-5002B	--	--	--	--	<0.01		<0.01		<0.01		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
121-S-1002	--	--	--	--	0.35	<0.01	0.17	<0.01	0.17	<0.01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
121-CV-1004	--	--	--	--	0.17	<0.01	0.08	<0.01	0.08	<0.01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
121-CV-5003 A	--	--	--	--	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
121-CV-5003 B	--	--	--	--	<0.01		<0.01		<0.01		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
121-CV-5004 A	--	--	--	--	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
121-CV-5004 B	--	--	--	--	<0.01		<0.01		<0.01		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
121-S-9902 A	--	--	--	--	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
121-S-9902 B	--	--	--	--	<0.01		<0.01		<0.01		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
121-X-9901 A / 121-X-9901 B	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
129-CT-9301	--	--	--	--	2.02	3.01	1.48	2.52	0.67	1.26	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PM-PlantRd	--	--	--	--	10.74	9.38	2.15	1.88	0.53	0.46	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
129-TK-9402	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
122-TK-9902	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.01	<0.01	--	--	--	--	--	--	--	--
122-TK-9901	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.01	<0.01	--	--	--	--	--	--	--	--
BECCS-FUG	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	8.32	36.46	--	--	0.60	2.64	--	--	--	--
VOC - Amine -LOAD	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.01	<0.01	--	--	--	--	--	--	--	--
Totals:	**30.76**	**90.68**	**26.88**	**46.06**	**35.76**	**98.38**	**23.48**	**83.31**	**18.86**	**75.26**	**8.38**	**34.88**	**8.38**	**34.88**	**8.38**	**34.88**	**22.40**	**55.03**	**11.62**	**50.78**	**6.20**	**25.72**	**6.99**	**30.65**	**0.05**	**0.20**

MGS CNP 1, LLC Biomass Fired Power Plant Initial Minor NSR Application Emission Calculations HAPs Summary																
Emission ID	**Total HAPs**		**Acetaldehyde**		**Acrolein**		**Benzene**		**Formaldehyde**		**HCl**		**Styrene**		**Toluene**	
	lb/hr	**Tons/Yr**	**lb/hr**	**Tons/Yr**	**lb/hr**	**Tons/Yr**	**lb/hr**	**Tons/Yr**	**lb/hr**	**Tons/Yr**	**lb/hr**	**Tons/Yr**	**lb/hr**	**Tons/Yr**	**lb/hr**	**Tons/Yr**
121-H-2001	5.43	23.36	--	8.14	--	1.95	--	2.05	--	2.56	1.18	5.65	--	0.93	--	0.45
129-P-9402	0.02	<0.01	--	<0.01	--	<0.01	--	<0.01	--	<0.01	--	--	--	--	--	<0.01
129-PKG-0001	1.43	0.04	--	<0.01	--	<0.01	--	<0.01	--	0.03	--	--	--	<0.01	--	<0.01
127-PKG-0001	0.12	0.57	--	--	--	--	--	--	--	--	0.12	0.57	--	--	--	--
Totals:	**6.99**	**23.96**	**<0.01**	**8.14**	**<0.01**	**1.96**	**<0.01**	**2.05**	**<0.01**	**2.58**	**1.30**	**6.22**	**<0.01**	**0.93**	**<0.01**	**0.45**

List of Tables in Attachment N - Emission Calculations

Table N-1 Bubbling Fluidized Bed Boiler
MGS CNP 1, LLC

Source Name:	Wood Chip Fired Fluidized Bed Boiler	**EPN:**	121-PKG-3001; 122-T-1001	
Proposed MAERT Limits		**Date:**	5/6/2025	
FIN	**EPN**	**Air Contaminant**	**lbs/hr [1]**	**tpy**
121-H-2001	121-PKG-3001 122-T-1001	NOx	20.20	90.42
		CO	10.20	45.65
		PM- Filterable	7.99	34.87
		PM10 - Filterable	7.99	34.87
		PM2.5 - Filterable	7.99	34.87
		PM	15.54	67.67
		PM10	15.54	67.67
		PM2.5	15.54	67.67
		Total VOC	4.43	18.33
		SO2	11.58	50.78
		NH3	5.09	20.98
		H2SO4	6.35	27.86
		Pb	0.05	0.20
		HCl	1.18	5.65
		HAPs	5.42	23.34

[1] hourly emission rate is the emission rate under normal operating conditions.

Process Description:

Emissions from the boiler result from combustion of clean wood products. Emissions from the boiler are controlled by the following equipment:
-Pulse Jet Fabric Filter to control PM/PM10/PM2.5
-Selective Catalytic Reduction unit fed with aqueous ammonia to control NOx
-CO Oxidation Catalyst to control CO
-Injection of Caustic to Control SOx (Wet Flue Gas Desulfurization)
-Dry Sorbent injection system injects Sodium Bicarbonate (NaHCO3) into the flue gas to control HCl and H2SO4

Bases and Factors:

Factors are based on Vendor's Guarantee. The emission calculations are based on emission factors provided by the boiler supplier.

The carbon capture unit will capture 95% of the CO2 in the boiler flue gas. It is assumed that the carbon capture unit will not reduce the NO_X, CO and VOC emissions from boiler combustion.

As a result of the absorption process and reactions in the CCU, a small amount of solvent amines, nitrosamines, nitramines, acetaldehyde, formaldehyde and ammonia are produced and released into the atmosphere along with the CO2-depleted gas stream. These emissions are added to those from boiler combustion to arrive at total emissions of these compounds.
Emissions of these compounds are estimated based on the best information currently available.

Since the flue gas temperature after the CCCU is close to the ambient air temperature, it is assumed that no condensable particulate matter will be formed in the flue gas after the CCU.

Pounds per Hour Emissions:

Max Emissions (lb/hr) = Emission Factor (lb/MMBtu) x Boiler Max Heat Input (MMBtu/hr)

Tons per Year Emissions:

Max Emissions (tpy) = [Max Emissions (lbs/hr) x Annual Operating Hours (hr/yr)] / 2,000 (lbs/ton)

Emission Calculations

Ideal Gas Law Constant R:	0.73024	$atm.ft^3.lbmol^{-1}.°R^{-1}$	
Volume of 1 lbmol gas @ 1.04 atm and 104 °F	396.04	ft3/lbmol	
Volume of 1 lbmol gas @ 1 atm and 32 °F:	359.04	ft3/lbmol	
1 hour:	60.00	min	
Gas Temperature	104.00	°F	
Gas Pressure	16.00	inwg	
Gas Pressure	1.04	atm, absolute	1 atm = 406.78 in H2O
Total Mass Flow	1,036,759	lb/hr	
CO2	210,734	lb/hr	
H2O	45,945	lb/hr	
O2	54,236	lb/hr	
Water Vapor Volumetric Flow before CCU	16829.40	acfm	
Dry Flue Gas Volumetric Flow before CCU	213,814.19	acfm, dry	
Wet Flue Gas Volumetric Flow before CCU	230,643.59	acfm, wet	
Wet Flue Gas Volumetric Flow before CCU	220,995.00	scfm, wet	
CO2 Removal Efficiency	95%		
Wet Flue Gas Flow after CCU	835,337.00	lb/hr	
MW of the Wet Flue Gas after CCU	27.38	lb/lbmol	
Wet Flue Gas Volumetric Flow after CCU	310,179.62	Nm3/hr	

Data:

Boiler Maximum Heat Input:	944	MMBtu/hr, HHV
Annual Operating Hours:	8760	hours/year
Startup Hours per Year:	55	hours/yr
Startup Hours + CCU Out of Service	823	hours/yr
CCU Hours Out of Service	768	hours/yr
Maximum Heat Input from NG during Startup:	180	MMBtu/hr
Average Heat Input from NG during Startup:	131.1	MMBtu/hr
Duration of NG Combustion during each Startup:	10	hours
Average Heat Input from NG + Biomass during Startup:	414.3	MMBtu/hr
No. of Startups:	5	
Duration per Startup:	11	hours/startup (before SCR / CO catalyst inlet temperature is achieved)

Total Boiler Operations Emissions with Startup + Normal Ops

Pollutant	Startup		Normal Ops w/ CCU		Total	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
NOx	90.91	2.50	20.20	87.92	20.20	90.42
CO	0.29	1.25	10.20	44.40	10.20	45.65
PM 2.5/10/FIL	3.51	0.10	7.99	34.78	7.99	34.87
Total PM	6.82	0.02	15.54	67.65	15.54	67.67
Total VOC	0.73	0.02	4.43	18.31	4.43	18.33
SO2	13.74	0.38	11.58	50.40	11.58	50.78
NH3	3.08	12.21	5.09	20.98	5.09	20.98
H2SO4	7.54	0.21	6.35	27.66	6.35	27.86
Pb	-	-	0.05	0.20	0.05	0.20
HCl	18.64	0.51	1.18	5.14	1.18	5.65
Hg	0.11	0.02	<0.01	0.01	<0.01	0.03
Organic HAPs [3]	0.73	<0.01	1.91	8.32	2.64	8.32
Metallic HAPs [4]	0.12	<0.01	0.27	1.20	0.39	1.20
HAPs from CCU[5]	-	-	2.06	8.17	2.06	8.17

Boiler Normal Operations (with CCU) 8705 hours

Pollutant	**Normal Operation Emission Factor**	**Normal Operation Emission Factor**	**Normal Operation (Hourly Maximum)**	**Normal Operation (Annual)**	**Note**
	ppmvd	lb/MMBtu	lb/hr	tpy	
NOx	13.55	0.021398	20.20	87.92	SCR Vendor's guarantee
CO	11.24	0.010805	10.20	44.40	CO Catalyst Vendor's guarantee
PM 2.5/10/FIL	-	0.008464	7.99	34.78	Vendor's Guarantee; Same emission factor with Pulse Jet Filter
Total PM	-	0.016464	15.54	67.65	See Note 1
VOC (CCU)	-	0.002695	2.54	10.10	See "Emissions from CCU"
VOC (Boiler Combustion)	-	0.002000	1.89	8.22	Vendor's Guarantee
SO2	5.58	0.012267	11.58	50.40	Wet DesulfurizationVendor's guarantee
NH3	3.65	0.002133	2.01	8.76	Vendor's guarantee
H2SO4	2.00	0.006731	6.35	27.66	63% removal efficiency by wet desulfurization
Pb	-	0.000048	0.05	0.20	Table 1.4-4 in AP-42
HCl	1.00	0.001251	1.18	5.14	Dry In-Duct Sorbent Injection
Hg	-	0.000004	<0.01	0.01	Table 1.4-4 AP-42
Organic HAPs [3]	-	0.002025	1.91	8.32	Adjusted AP-42 Chapter 1.6 Table 1.6-3
Metallic HAPs [4]	-	0.000291	0.27	1.20	See Note 4

Boiler Startup Emissions (without CCU) 55 hours

Pollutant:	**Startup Emission Factor**	**Startup Operation (Hourly Maximum)**	**Vendor Guaranteed Emissions Per Startup Annual**	**Startup Annual Total**	**Note**
	lb/MMBtu	lb/h	tpy	tpy	
NOx	-	90.91	0.5	2.5	Vendor's Guarantee
CO	-	45.45	0.25	1.25	Vendor's Guarantee
PM 2.5/10/FIL	0.0085	3.51	-	0.10	Vendor's Guarantee; Same emission factor with Pulse Jet Filter
Total PM	0.0165	6.82	-	0.19	Vendor's Guarantee for filterable PM + adjusted AP-42 emission factor for condensable PM. See Note 7
VOC (Boiler Combustion)	-	0.73	0.004	0.02	Vendor's Guarantee
SO2	0.0332	13.74	-	0.38	See Note 6
H2SO4	0.0182	7.54	-	0.21	63% removal efficiency by wet desulfurization.
Pb	0.00005	0.02	-	0.00	Table 1.4-2 in AP-42
HCl	0.045	18.64	-	0.51	97.22% removal efficiency by DSI
Hg	0.0003	0.11	-	0.00	Table 1.4-4 in AP-42
Organic HAPs [3]	-	0.73	0.004	0.02	Equal to VOC value
Metallic HAPs [4]	0.0003	0.12	-	0.003	See Note 4

1. Total particulate matter (PM) = filterable PM + condensable PM. Emission factor of 0.0085 lb/MMBtu for filterable PM, PM10, and PM2.5 is based on vendor's guarantee; Emission factor of 0.008 lb/MMBtu is based on a aggregation of test data collected from operating units. The flue gas from the proposed boiler will pass through the amine absorber and the wash water column. These steps will reduce the temperature of the flue gas to approximately 110 °F before it is discharged to the atmosphere. Therefore, the data entries for stokers using a wet scrubber as PM control and with complete test data records were used to derive the average emissions factor of condensable PM. The data are attached as supporting material at the end of the boiler emissions calculation.

2. Amine emissions from the CCU absorber stack are quantified based on engineering judgement and similar projects.

3. It is assumed that the amount of organic HAPs is the same as the amount of VOCs from fuel combustion. This assumption is supported by Table 1.6-3 in AP-42.

4. The emission factor for total metallic HAPs is based on Table 1.6-4 in AP-42. However, the emission factor for Manganese in AP-42 is adjusted after auditing AP-42 for outlier data. There is one FBC entry in the supporting database with an Manganese emission factor of 1.14E-05. The data used for this project is 10 times that value.

5. The vendor guaranteed VOC emission factor is 0.005 lb/MMBtu in the flue gas before the SCR/CO catalyst. Due to the presence of the CO catalyst, a VOC removal efficiency of 60% is applied to reduce the VOC emissions.

6. The emission factor for startup is the higher of the two emission factors of biomass combustion and natural gas combustion. For natural gas combustion during startup, the SO2 emissions are calculated as follows,

(131.1 MMBtu/hr * 1000000 Btu/MMBtu * 55 hrs for startup/yr)/(1051 Btu/Scf)/(379.48 Scf/lbmol) * (10 ppmv S/Scf) / 1000000 * 64 lb/lbmol = 11.57 lb/yr = 0.01 tpy

7. The amount of filterable PM/PM10/PM2.5 includes the particulates from the fresh sand storage silo and the sodium bicarbonate storage silo.

Emissions from CCU

Pollutant	Normal Operation Emission Factor	Normal Operation (Hourly Maximum)	Normal Operation (Annual)
	mg/Nm3	lb/hr	tpy
Solvent Amines	0.70	0.48	1.90
Ammonia	4.50	3.08	12.21
Nitrosamines [1]	0.01	0.01	0.03
Nitramines	0.01	0.01	0.03
Acetaldehyde [1]	2.85	1.95	7.73
Formaldehyde [1]	0.15	0.10	0.41
Total VOCs from CCU	3.72	2.54	10.10
Total HAPs from CCU	3.01	2.06	8.17

1. HAPs

HAP Emissions from Boiler Combustion

Reference: Table 1.6-3 of AP-42

Organic Compound	Average Emission Factor (lb/MMBtu)	CAS	HAP	HAP EF (lb/MMBtu)	Project HAP EF (lb/MMBtu) [3]	Emissions (tpy) [4]	Notes
Acenaphthene	9.10E-07	83-32-9	Yes	9.10E-07	1.08E-07	0.00	
Acenaphthylene	5.00E-06	208-96-8	Yes	5.00E-06	5.91E-07	0.00	
Acetaldehyde	8.30E-04	75-07-0	Yes	8.30E-04	9.81E-05	0.41	
Acetone	1.90E-04	67-64-1	No	0.00E+00	0.00E+00	0.00	Not a VOC or a HAP
Acetophenone	3.20E-09	98-86-2	Yes	3.20E-09	3.78E-10	0.00	
Acrolein	4.00E-03	107-02-8	Yes	4.00E-03	4.73E-04	1.95	
Anthracene	3.00E-06	120-12-7	Yes	3.00E-06	3.55E-07	0.00	
Benzaldehyde	<8.5E-07	100-52-7	No	0.00E+00	0.00E+00	0.00	
Benzene	4.20E-03	71-43-2	Yes	4.20E-03	4.96E-04	2.05	
Benzo(a)anthracene	6.50E-08	56-55-3	Yes	6.50E-08	7.68E-09	0.00	
Benzo(a)pyrene	2.60E-06	50-32-8	Yes	2.60E-06	3.07E-07	0.00	
Benzo(b)fluoranthene	1.00E-07	205-99-2	Yes	1.00E-07	1.18E-08	0.00	
Benzo(e)pyrene	2.60E-09	192-97-2	Yes	2.60E-09	3.07E-10	0.00	
Benzo(g,h,i)perylene	9.30E-08	191-24-2	Yes	9.30E-08	1.10E-08	0.00	
Benzo(j,k)fluoranthene	1.60E-07	205-82-3	Yes	1.60E-07	1.89E-08	0.00	
Benzo(k)fluoranthene	3.60E-08	207-08-9	Yes	3.60E-08	4.26E-09	0.00	
Benzoic acid	4.70E-08	65-85-0	No	0.00E+00	0.00E+00	0.00	
bis(2-Ethylhexyl)phthalate	4.70E-08	117-81-7	Yes	4.70E-08	5.56E-09	0.00	
Bromomethane	1.50E-05	74-83-9	Yes	1.50E-05	1.77E-06	0.01	
2-Butanone (MEK)	5.40E-06	78-93-3	Yes	5.40E-06	6.38E-07	0.00	
Carbazole	1.80E-06	86-74-8	Yes	1.80E-06	2.13E-07	0.00	
Carbon tetrachloride	4.50E-05	56-23-5	Yes	4.50E-05	5.32E-06	0.02	
Chlorine	7.90E-04	7782-50-5	Yes	7.90E-04			
Chlorobenzene	3.30E-05	108-90-7	Yes	3.30E-05	3.90E-06	0.02	
Chloroform	2.80E-05	67-66-3	Yes	2.80E-05	3.31E-06	0.01	
Chloromethane	2.30E-05	74-87-3	Yes	2.30E-05	2.72E-06	0.01	
2-Chloronaphthalene	2.40E-09	91-58-7	Yes	2.40E-09	2.84E-10	0.00	
2-Chlorophenol	2.40E-08	95-57-8	No	0.00E+00	0.00E+00	0.00	
Chrysene	3.80E-08	218-01-9	Yes	3.80E-08	4.49E-09	0.00	
Crotonaldehyde	9.90E-06	4170-30-3/123-73-9/15798-64-8	No	0.00E+00	0.00E+00	0.00	
Decachlorobiphenyl	2.70E-10	2051-24-3	Yes	2.70E-10	3.19E-11	0.00	
Dibenzo(a,h)anthracene	9.10E-09	53-70-3	Yes	9.10E-09	1.08E-09	0.00	
1,2-Dibromoethene	5.50E-05	540-49-8/590-12-5	No	0.00E+00	0.00E+00	0.00	
Dichlorobiphenyl	7.40E-10	34883-43-7	Yes	7.40E-10	8.75E-11	0.00	
1,2-Dichloroethane	2.90E-05	107-06-2	Yes	2.90E-05	3.43E-06	0.01	
Dichloromethane	2.90E-04	75-09-2	Yes	2.90E-04	3.43E-05	0.14	
1,2-Dichloropropane	3.30E-05	78-87-5	Yes	3.30E-05	3.90E-06	0.02	
2,4-Dinitrophenol	1.70E-07	51-28-5	Yes	1.70E-07	2.01E-08	0.00	
Ethylbenzene	3.10E-05	100-41-4	Yes	3.10E-05	3.66E-06	0.02	
Fluoranthene	1.60E-06	206-44-0	Yes	1.60E-06	1.89E-07	0.00	
Fluorene	3.40E-06	86-73-7	Yes	3.40E-06	4.02E-07	0.00	
Formaldehyde	4.40E-03	50-00-0	Yes	4.40E-03	5.20E-04	2.15	
Heptachlorobiphenyl	6.60E-11	28655-71-2	Yes	6.60E-11	7.80E-12	0.00	
Hexachlorobiphenyl	5.50E-10	Multiple	Yes	5.50E-10	6.50E-11	0.00	
Hexanal	7.00E-06	66-25-1	No	0.00E+00	0.00E+00	0.00	
Heptachlorodibenzo-p-dioxins	2.00E-09	Multiple	Yes	2.00E-09	2.36E-10	0.00	
Heptachlorodibenzo-p-furans	2.40E-10	Multiple	Yes	2.40E-10	2.84E-11	0.00	
Hexachlorodibenzo-p-dioxins	1.60E-06	Multiple	Yes	1.60E-06	1.89E-07	0.00	
Hexachlorodibenzo-p-furans	2.80E-10	Multiple	Yes	2.80E-10	3.31E-11	0.00	
Hydrogen chloride	1.90E-02	7647-01-0	Yes	1.90E-02			
Indeno(1,2,3,c,d)pyrene	8.70E-08	193-39-5	Yes	8.70E-08	1.03E-08	0.00	
Isobutyraldehyde	1.20E-05	78-84-2	No	0.00E+00	0.00E+00	0.00	
Methane	2.10E-02	74-82-8	No	0.00E+00	0.00E+00	0.00	
2-Methylnaphthalene	1.60E-07	91-57-6	Yes	1.60E-07	1.89E-08	0.00	
Monochlorobiphenyl	2.20E-10	27323-18-8	Yes	2.20E-10	2.60E-11	0.00	
Naphthalene	9.70E-05	91-20-3	Yes	9.70E-05	1.15E-05	0.05	

Organic Compound	Average Emission Factor (lb/MMBtu)	CAS	HAP	HAP EF (lb/MMBtu)	Project HAP EF (lb/MMBtu) [3]	Emissions (tpy) [4]	Notes
2-Nitrophenol	2.40E-07	88-75-5	No	0.00E+00	0.00E+00	0.00	
4-Nitrophenol	1.10E-07	100-02-7	Yes	1.10E-07	1.30E-08	0.00	
Octachlorodibenzo-p-dioxins	6.60E-08	3268-87-9	Yes	6.60E-08	7.80E-09	0.00	
Octachlorodibenzo-p-furans	8.80E-11		Yes	8.80E-11	1.04E-11	0.00	
Pentachlorodibenzo-p-dioxins	1.50E-09		Yes	1.50E-09	1.77E-10	0.00	
Pentachlorodibenzo-p-furans	4.20E-10		Yes	4.20E-10	4.96E-11	0.00	
Pentachlorobiphenyl	1.20E-09		Yes	1.20E-09	1.42E-10	0.00	
Pentachlorophenol	5.10E-08	87-86-5	Yes	5.10E-08	6.03E-09	0.00	
Perylene	5.20E-10	198-55-0	Yes	5.20E-10	6.15E-11	0.00	
Phenanthrene	7.00E-06	85-01-8	Yes	7.00E-06	8.27E-07	0.00	
Phenol	5.10E-05	108-95-2	Yes	5.10E-05	6.03E-06	0.02	
Propanal (propionaldehyde)	3.20E-05	123-38-6	Yes	3.20E-05	3.78E-06	0.02	
Pyrene	3.70E-06	129-00-0	No	0.00E+00	0.00E+00	0.00	
Styrene	1.90E-03	100-42-5	Yes	1.90E-03	2.25E-04	0.93	
2,3,7,8-Tetrachlorodibenzo-p-dioxins	8.60E-12	1746-01-6	Yes	8.60E-12	1.02E-12	0.00	
Tetrachlorodibenzo-p-dioxins	4.70E-10		Yes	4.70E-10	5.56E-11	0.00	
2,3,7,8-Tetrachlorodibenzo-p-furans	9.00E-11		Yes	9.00E-11	1.06E-11	0.00	
Tetrachlorodibenzo-p-furans	7.50E-10		Yes	7.50E-10	8.86E-11	0.00	
Tetrachlorobiphenyl	2.50E-09	35693-99-3	No	0.00E+00	0.00E+00	0.00	
Tetrachloroethene	3.80E-05	127-18-4	Yes	3.80E-05	4.49E-06	0.02	Not a VOC
o-Tolualdehyde	7.20E-06	529-20-4	No	0.00E+00	0.00E+00	0.00	
p-Tolualdehyde	1.10E-05	104-87-0	No	0.00E+00	0.00E+00	0.00	
Toluene	9.20E-04	108-88-3	Yes	9.20E-04	1.09E-04	0.45	
Trichlorobiphenyl	2.60E-09	7012-37-5	Yes	2.60E-09	3.07E-10	0.00	
1,1,1-Trichloroethane	3.10E-05	71-55-6	Yes	3.10E-05	3.66E-06	0.02	Not a VOC
Trichloroethene	3.00E-05	79-01-6	Yes	3.00E-05	3.55E-06	0.01	
Trichlorofluoromethane	4.10E-05	75-69-4	No	0.00E+00	0.00E+00	0.00	
2,4,6-Trichlorophenol	<2.2E-08	88-06-2	Yes	<2.2E-08	2.60E-09	0.00	
Vinyl Chloride	1.80E-05	85-01-4	Yes	1.80E-05	2.13E-06	0.01	
o-Xylene	2.50E-05	95-47-6	Yes	2.50E-05	2.95E-06	0.01	
Total organic compounds (TOC) [1]	0.039						
Volatile organic compounds (VOC) [2]	0.017						
Nitrous Oxide (N2O)	0.013	10024-97-2	No	0.00E+00	0.00E+00		
Carbon Dioxide (CO2)	195	124-38-9	No	0.00E+00	0.00E+00		
VOC Total	1.69E-02						
HAPs Total (Organic + Inorganic)				**0.036923**			
Organic HAPs				**1.71E-02**	**2.03E-03**	8.37	

1. Per note *ai* in AP-42 Section 1.6, factor for TOC is the sum of all factors in table except nitrous oxide and carbon dioxide.
2. Per note *aj* in AP-42 Section 1.6, factor for VOC is the sum of all factors in table except hydrogen chloride, chlorine, formaldehyde, tetrachloroethene, 1,1,1,-trichloroethane, dichloromethane, acetone, nitrous oxide, methane, and carbon dioxide.
3. Project HAP EFs are proportionally adjusted to match the project VOC EFs.
4. The annual emissions are conservatively estimated using the maximum heat input capacity of the boiler and 8760 hours per year.

Reference: Table 1.6-4 of AP-42

Trace Element	Average Emission Factor (lb/MMBtu)	HAP	HAP EF (lb/MMBtu)
Antimony	7.90E-06	Yes	0.0000079
Arsenic	2.20E-05	Yes	0.000022
Barium	1.70E-04	No	0
Beryllium	1.10E-06	Yes	0.0000011
Cadmium	4.10E-06	Yes	0.0000041
Chromium, total	2.10E-05	Yes	0.000021
Chromium, hexavalent	3.50E-06	Yes	0.0000035
Cobalt	6.50E-06	Yes	0.0000065
Copper	4.90E-05	No	0
Iron	9.90E-04	No	0
Lead	4.80E-05	Yes	0.000048
Manganese [1]	1.14E-04	Yes	**0.000114**
Mercury	3.50E-06	Yes	0.0000035
Molybdenum	2.10E-06	No	0
Nickel	3.30E-05	Yes	0.000033
Phosphorus	2.70E-05	Yes	0.000027
Potassium	3.90E-02	No	0
Selenium	2.80E-06	Yes	0.0000028
Silver	1.70E-03	No	0
Sodium	3.60E-04	No	0
Strontium	1.00E-05	No	0
Tin	2.30E-05	No	0
Titanium	2.00E-05	No	0
Vanadium	9.80E-07	No	0
Yttrium	3.00E-07	No	0
Zinc	4.20E-04	No	0
Hazardous Trace Elements Total			**0.0002909**

1. For Manganese, the emission factors is an adjusted emission factor after auditing AP-42 for outlier data. There is one FBC entry in the supporting database with an Manganese emission factor of 1.14E-05. The data used for this project is 10 times that value.

Table N-2 Wood Chips Receiving Hoppers
MGS CNP 1, LLC

Source Name:	Biomass Unloading Baghouse	**EPN:**	121-PKG-1001	
Proposed MAERT Limits		**Date:**	5/6/2025	
FIN	**EPN**	**Air Contaminant**	**lbs/hr**	**TPY**
121-LS-1001 121-LS-1002	121-PKG-1001	PM	1.08	4.72
		PM10	1.08	4.72
		PM2.5	1.08	4.72

Process Description:

Wood fuel is delivered to the site by trucks. Trucks unload wood fuel into two receiving hoppers (121-LS-1001 and 121-LS-1002). Dust control is provided by a slight negative pressure in the dumping area. The extracted dust laden air will be directed through a bag house (121-PKG-1001) before discharge to atmosphere.
The bag house will reduce the particulate matter emissions to reach a PM loading of 0.01 grains/cf.

To represent worst case emissions, maximum hourly emissions for 121-LS-1001 and 121-LS-1002 are both based on the total amount of wood fuel to be delivered to the site, rather than splitting the emissions in half. This scenario is conservative, as if one of the truck unloaders fails, fuel can be delivered via the other unloader and all the wood chips would be delivered to one hopper. The annual emissions of 121-LS-1001 and 121-LS-1002 are permitted under a cap quantified based on the maximum amount of wood chips delivered each year.

Bases and Factors:

Particulate Matter (PM) emissions from truck unloading are estimated using the following design information:

Baghouse volumetric exhaust flow rate: 12566 ft3/min

The bag house will reduce the particulate matter emissions to a PM loading of 0.01 grains/cf.

Hourly emission rates are determined as follows:

Hourly Emissions (lb/hr) = exhaust flow (ft3/min) x 60 min/hr x PM loading in exhaust (0.01 grains/cf)
Annual emission rates are determined as follows:
Annual Emissions (tpy) = [hourly emissions (lb/hr) * annnual operating hours (hr)] / 2,000 (lb/ton)

Table N-2 Wood Chips Receiving Hoppers
MGS CNP 1, LLC

Data:

	Fuel Delivered Per Year	Exhaust Flow	PM Loading in Exhaust	Controlled Max Hourly Emissions	Annual Operating Hours	Controlled Annual Emissions
Pollutant	tons/yr	ft3/min	gr/cf	lb/hr	hr/year	tpy
PM	929146.92	12566	0.01	**1.08**	8760	**4.72**
PM10	929146.92	12566	0.01	**1.08**	8760	**4.72**
PM2.5	929146.92	12566	0.01	**1.08**	8760	**4.72**

Emission Factors for Biomass Handling Process:
Emissions are based on AP-42 emission factors for Aggregate Handling and Storage Piles (AP-42 V5, Section 13.2.4.3, November 2006)

Average Wind Speed is obtained from US EPA AP-42 Table 7.1-7 for Huntington, West Virginia (closest data collection point)

Data:

Source Parameters				
Pollutant	**Particle Size (µm)**	**# of Drops in Transfer Process**	**Average Moisture % (M)** [1]	**k**(2)
PM/TSP	**< 30**	**1**	**4.8**	**0.74**
PM_{10}	**< 10**	**1**	**4.8**	**0.35**
$PM_{2.5}$	**< 2.5**	**1**	**4.8**	**0.053**

[1] 0.25% -4.8% maintains the quality rating level A of the equation. The moisture content of the wood chips is 45%. 4.8% is used in the calculations to get conservative results.

Hours of Operation	**8,760**	hours/year (24 hours/day X 7 days/week X 52 weeks/year)	
Annual Average Wind Speed of Area (U)=	**5.6**	mph	annual average and highest monthly average wind speed for Huntington, WV taken from US EPA AP-42 Table 7.1-7.
Highest Monthly Average Wind Speed of Area (U)=	**6.9**	mph	

Calculations:
AP-42 (section 13.2.4.3) lb/ton of material

$$Emission\ factor\,(lb/ton) = k*(0.0032)*\frac{\left(\frac{U}{5}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}$$

Where: k = particle size multiplier from AP-42 Section 13.2.4.3
M = material moisture content (%)
U = mean wind speed

TSP/PM hourly emission factor:			**TSP/PM annual emission factor:**		
= (0.74) x (0.0032) x [(6.9/5)^1.3/(4.8/2)^1.4]			= (0.74) x (0.0032) x [(5.6/5)^1.3/(4.8/2)^1.4]		
=	***0.0011***	lbs/ton	=	***0.0008***	lbs/ton

PM_{10} hourly emission factor:			**PM_{10} annual emission factor:**		
= (0.35) x (0.0032) x [(6.9/5)^1.3/(4.8/2)^1.4]			= (0.35) x (0.0032) x [(5.6/5)^1.3/(4.8/2)^1.4]		
=	***0.0005***	lbs/ton	=	***0.0004***	lbs/ton

$PM_{2.5}$ hourly average emission factor:			**$PM_{2.5}$ annual average emission factor:**		
= (0.053) x (0.0032) x [(6.9/5)^1.3/(4.8/2)^1.4]			= (0.053) x (0.0032) x [(5.6/5)^1.3/(4.8/2)^1.4]		
=	***0.0001***	lbs/ton	=	***0.0001***	lbs/ton

Table N-4 Biomass Handling Process
MGS CNP 1, LLC

Emission Unit	Emission Point	Description
121-CV-1001	**121-CV-1001**	Conveyor #1 from Biomass Receiving Hopper 1001 to Storage Pile
121-CV-1002	**121-CV-1002**	Conveyor #2 from Biomass Receiving Hopper 1002 to Storage Pile
CHIP-1	**CHIP-1**	Biomass Storage Pile Loading Fugitives
121-S-1001	**121-S-1001**	Biomass Feed Hopper
121-CV-1003	**121-CV-1003**	Conveyor from Feed Hopper to 121-CV-2001 A/B
121-CV-2001 A	**121-CV-2001 A**	Screw Conveyor from 121-CV-1003 to Biomass Fuel Metering Bin 121-S-2001 A
121-CV-2001 B	**121-CV-2001 B**	Screw Conveyor from 121-CV-1003 to Biomass Fuel Metering Bin 121-S-2001 B
121-S-2001 A	**121-S-2001 A**	Biomass Fuel Metering Bin A
121-S-2001 B	**121-S-2001 B**	Biomass Fuel Metering Bin B

Process Description:

From the receiving hoppers, biomass is conveyed via covered conveyors (121-CV-1001 and 121-CV-1002) to an uncovered chip pile **(CHIP-1)**.
The biomass is loaded from the chip pile into a biomass feed hopper (121-S-1001) using front end loaders.
The biomass is conveyed from the biomass feed hopper (121-S-1001) to the fuel metering bins (121-S-2001 A/B) through a covered transfer conveyor (121-CV-1003) and two covered screw conveyors (121-CV-2001 A/B).
The above description indicates that the faiclity will be equipped with two identical biomass transfer processes from the receiving hopper to the BFB (except there will be just one biomass feed hopper and one conveyor from the feed hopper to the screw conveyors). For each transfer process, there will be 6 drop points from the receiving hoppers to
To represent worst case emissions, the maximum hourly emissions for each drop point are based on the total amount of wood fuel to be delivered to the site, rather than splitting the emissions in half. The annual emissions for both drop points at each step are permitted under a cap.

Bases and Factors:

Emission factors are based on AP-42 emission factors for Aggregate Handling and Storage Piles (AP-42 V5, Section 13.2.4.3, November 2006). Please refer to Table N-3 for emission factor calculations.

Hourly emission rates are determined as follows:
Hourly Emissions (lb/hr) = annual emissions (tpy) / annual operating hours (hr) x 2,000 lb/ton

Annual emission rates are determined as follows:
Annual Emissions (tpy) = [wood conveyed (tpy) * emission factor (lb emissions per ton of wood conveyed per drop point) * number of drop points] / 2,000 (lb/ton)

Total Emissions:

Pollutant	Wood Chips Conveyed at Each Transfer Step TPY	Emission Factor lb PM/ ton of wood/ drop point	Number of Drop Points	Annual Emissions TPY	Annual Operating Hours	Hourly Emission lb/hr
PM	929,147	0.0011	6	**2.95**	8,760	**0.67**
PM10	929,147	0.0005	6	**1.39**	8,760	**0.32**
PM2.5	929,147	0.0001	6	**0.21**	8,760	**0.05**

Note: Because the amount of biomass transferred are not split in half, the hourly emissions calculated above represent the maximum hourly emission rate at each of the 8 drop points in the two transfer processes. The annual emissions calculated above represent the cap for the two drop points at each transfer step.

Emissions at each individual piece of equipment:

Source	Transfer Rate		Emission Factor (lb/ton)						Emissions						Protection from Wind	Efficiency [1]
			Hourly			Annual			Short-term Emissions (lb/hr)			Annual Emissions (tpy)				
	(tons/hr)	(tons/yr)	PM	PM10	PM2.5	PM	PM10	PM2.5	PM	PM10	PM2.5	PM	PM10	PM2.5		
121-CV-1001	106.07	929146.92	0.0011	0.0005	0.0001	0.0008	0.0004	0.0001	0.056	0.027	0.004	0.187	0.088	0.013	Yes	50%
121-CV-1002	106.07		0.0011	0.0005	0.0001	0.0008	0.0004	0.0001	0.056	0.027	0.004				Yes	50%
CHIP-1	106.07	929146.92	0.0011	0.0005	0.0001	0.0008	0.0004	0.0001	0.112	0.053	0.008	0.374	0.177	0.027	No	0%
121-S-1001	106.07	929146.92	0.0011	0.0005	0.0001	0.0008	0.0004	0.0001	0.112	0.053	0.008	0.374	0.177	0.027	No	0%
121-CV-1003	106.07	929146.92	0.0011	0.0005	0.0001	0.0008	0.0004	0.0001	0.056	0.027	0.004	0.187	0.088	0.013	Yes	50%
121-CV-2001 A	106.07	929146.92	0.0011	0.0005	0.0001	0.0008	0.0004	0.0001	0.056	0.027	0.004	0.187	0.088	0.013	Yes	50%
121-CV-2001 B	106.07		0.0011	0.0005	0.0001	0.0008	0.0004	0.0001	0.056	0.027	0.004				Yes	50%
121-S-2001 A [2]	106.07	929146.92	0.0011	0.0005	0.0001	0.0008	0.0004	0.0001	0.056	0.027	0.004	0.187	0.088	0.013	Yes	50%
121-S-2001 B [2]	106.07		0.0011	0.0005	0.0001	0.0008	0.0004	0.0001	0.056	0.027	0.004				Yes	50%
								TOTAL	-	-	-	1.50	0.71	0.11		

[1] Design is still in progress. Because there will be covers on the conveyors to reduce wind speed, an emission control efficiency of 50% is used in the calculations.
[2] Both biomass metering bins adopt gooseneck opening.

PM PM10 PM2.5 PM PM10 PM2.5

Table N-5 Storage Pile Wind Erosion
MGS CNP 1, LLC

Source Name:	Wood Chips Storage Pile Wind Erosion	**EPN:**	CHIP-2	
Proposed MAERT Limits		**Date:**	5/6/2025	
FIN	**EPN**	**Air Contaminant**	**lbs/hr**	**TPY**
CHIP-2	CHIP-2	PM	--	0.21
		PM10	--	0.11
		PM2.5	--	0.02

Process Description:

Wood chips are stored outside in one storage pile.

Bases and Factors:

Emissions from wood chip storage wind erosion are estimated using the AP-42, Section 13.2.5, Industrial Wind Erosion, November 2006 - Equation (2).

Monthly fastest mile is obtained for Mason County, West Virginia (closest data collection point).
Meassured wind gust speed plus additional 10 mph to account for yearly fluctuations.
Storage piles will be sprayed with water as necessary to control particulate emissions.

Data:

Calculations:

AP-42 (section 13.2.5, Industrial Wind Erosion, November 2006 - Equation (2)) lb/ton of material

$$\text{Emission factor} = k \sum_{i=1}^{N} P_i \quad (2)$$

Where: EF = emission factor ($g/m^2/yr$)
k = particle size multiplier from AP-42 Section 13.2.5
N = number of disturbances per year
P_i = erosion potential corresponding to the observed (or probable) fastest mile of wind for the ith period between disturbances, g/m^2
$P = 58 (u^* - u_t^*)^2 + 25 (u^* - u_t^*)$ (equation 3)
$p = 0$ for $u^* < u_t^*$
u^* = friction velocity = 0.053 X the fastest mile (m/s) (equation 4)
u_t^* = threshold friction velocity (m/s) = 1.02 m/s for overburden from AP-42 Table 13.2.5-2
The fastest mile is defined as the fastest observed mile of wind from Huntington, WV for the years 1980 - 2010.

Input

Aerodynamic Particle Size Multipliers for Equation 2		
Pollutant	**Particle Size (µm)**	**k**
PM/TSP	**< 30**	**1.0**
PM_{10}	**< 10**	**0.5**
$PM_{2.5}$	**< 2.5**	**0.075**

Threshold friction velocity (u_t*)	1.02	m/s
Frequency of disturbance	35040	per year
Average frequency of wind events resulting in wind erosion	125	per month

Erosion Potential Emission Factors

Month	Fastest Mile		u*	($u^* - u_t^*$)	$(u^* - u_t^*)^2$	P_{PM}	P_{PM10}	$P_{PM2.5}$
	(mph)	(m/s)	(m/s)			(g/m^2)	(g/m^2)	(g/m^2)
Jan	40	17.88	0.95	-0.07	0.01	0	0	0
Feb	53	23.69	1.26	0.24	0.06	9.12	4.56	0.68
Mar	48	21.46	1.14	0.12	0.01	3.73	1.86	0.28
Apr	49	21.90	1.16	0.14	0.02	4.68	2.34	0.35
May	38	16.99	0.90	-0.12	0.01	0.00	0.00	0.00
Jun	46	20.56	1.09	0.07	0.00	2.03	1.02	0.15
Jul	43	19.22	1.02	0.00	0.00	0.00	0.00	0.00
Aug	33	14.75	0.78	-0.24	0.06	0.00	0.00	0.00
Sep	35	15.65	0.83	-0.19	0.04	0.00	0.00	0.00
Oct	33	14.75	0.78	-0.24	0.06	0.00	0.00	0.00
Nov	42	18.78	1.00	-0.02	0.00	0.00	0.00	0.00
Dec	46	20.56	1.09	0.07	0.00	2.03	1.02	0.15
					Maximum Erosion Potential	9.12	4.56	0.68
					Annualized Erosion Factor (g/m^2-yr)	91.90	45.97	6.85

Wind Erosion Emissions

Emission Source	**Total Area**	**Disturbed Area**		**Control Efficiency**	**PM**	**PM10**	**PM2.5**
	(m^2)	(%)	(m^2)	(%)	(tpy)	(tpy)	(tpy)
Chip Storage	21,000	10	2100	0	0.21	0.11	0.02

Emission Unit	Emission Point	Description	Hourly Rate (tons/hr)	Annual Rate (tons/yr)	Control	Note
121-CV-4001 A	121-CV-4001 A	PJFF Ash Collection Drag Chain Conveyor A (From boiler hopper to surge bin A)	4.5	39420	Covered	
121-CV-4001 B	121-CV-4001 B	PJFF Ash Collection Drag Chain Conveyor B (from boiler hopper to surge bin B)	4.5		Covered	
121-S-4002 A	121-S-4002 A	PJFF Ash Collection Surge Bin A	4.5	39420	NA	Hoppers are not open to the atmosphere. According to information provided by the boiler supplier, Babcock & Wilcox (B&W), the hopper does not produce any emissions.
121-S-4002 B	121-S-4002 B	PJFF Ash Collection Suge Bin B	4.5		NA	
121-CV-4002	121-CV-4002	PJFF Ash Transport Drag Chain Conveyor (From Surge Bins #1 and #2 to PJFF Ash Transfer Drag Chain Conveyor)	4.5	39420	Covered	
121-CV-4003	121-CV-4003	PJFF Ash Transfer Drag Chain Conveyor (to Ash Bucket Elevator)	4.5	39420	Covered	
121-CV-4004	121-CV-4004	Ash Bucket Elevator	4.5	39420	Covered	
121-CV-4005	121-CV-4005	Ash Distrubution Drag Chain Conveyor (From Ash Bucket Elevator to Fly Ash Storage Silos)	4.5	39420	Covered	
121-CV-4006 A	121-CV-4006 A	Economizer Hopper Ash Drag Chain Conveyor A (From Economizer Hopper to Economizer Hopper Ash Surge Bin A)	3.3	28908	Covered	
121-CV-4006 B	121-CV-4006 B	Economizer Hopper Ash Drag Chain Conveyor B (From Economizer Hopper to Economizer Hopper Ash Surge Bin B)	3.3		Covered	
121-S-4003 A	121-S-4002 A	Economizer Hopper Ash Surge Bin A	3.3	28908	NA	Hoppers are not open to the atmosphere. According to information provided by the

Table N-6 Fly Ash Handling Process
MGS CNP 1, LLC

Emission Unit	Emission Point	Description	Hourly Rate (tons/hr)	Annual Rate (tons/yr)	Control	Note
121-S-4003 B	121-S-4002 B	Economizer Hopper Ash Surge Bin B	3.3	28908	NA	boiler supplier, B&W, the hoppers will not produce any emissions.

Table N-6 Fly Ash Handling Process
MGS CNP 1, LLC

Emission Unit	Emission Point	Description	Hourly Rate (tons/hr)	Annual Rate (tons/yr)	Control	Note
121-CV-4007 A	121-CV-4007 A	Economizer Ash Transport Conveyor A (From Economizer Ash Surge Bin A to Fly Ash Silo A)	3.3	28908	Covered	
121-CV-4007 B	121-CV-4007 B	Economizer Ash Transport Conveyor B (From Economizer Ash Surge Bin B to Fly Ash Silo B)	3.3		Covered	
121-S-4001 A	121-S-4001 A	Fly Ash Storage Silo A	7.8	68328	Pulse Jet Filter 121-F-4001 A	
121-S-4001 B	121-S-4001 B	Fly Ash Storage Silo B	7.8		Pulse Jet Filter 121-F-4001 B	
121-MX-4001 A	121-MX-4001 A	Pugmill A	7.8	68328	NA	There will be no emissions per B&W.
121-MX-4001 B	121-MX-4001 B	Pugmill B	7.8		NA	
121-TL-0001	121-TL-0001	Fly Ash Truck Loading	8.6	75336	Wet fly ash, with a moisture content of at least 10%	

Table N-6 Fly Ash Handling Process
MGS CNP 1, LLC

Fugitive emissions can be expected from conveying and transferring of fly ash due to wind and conveyor vibration.

Source	No. of Transfer	Transfer Rate		Emission Factors (lb/ton)						Emissions						Protection from Wind	Efficiency [1]
				Hourly			Annual			Short-term Emissions (lb/hr)			Annual Emissions (tpy)				
		(tons/hr)	(tons/yr)	PM	PM10	PM2.5	PM	PM10	PM2.5	PM	PM10	PM2.5	PM	PM10	PM2.5		
121-CV-4001 A	1	4.5	39420	0.2386	0.1129	0.0171	0.1819	0.0860	0.0130	0.537	0.254	0.038	1.793	0.848	0.128	Yes	50%
121-CV-4001 B	1	4.5		0.2386	0.1129	0.0171	0.1819	0.0860	0.0130	0.537	0.254	0.038				Yes	50%
121-CV-4002	1	4.5	39420	0.2386	0.1129	0.0171	0.1819	0.0860	0.0130	0.537	0.254	0.038	1.793	0.848	0.128	Yes	50%
121-CV-4003	1	4.5	39420	0.2386	0.1129	0.0171	0.1819	0.0860	0.0130	0.537	0.254	0.038	1.793	0.848	0.128	Yes	50%
121-CV-4004	1	4.5	39420	0.2386	0.1129	0.0171	0.1819	0.0860	0.0130	0.537	0.254	0.038	1.793	0.848	0.128	Yes	50%
121-CV-4005	1	4.5	39420	0.2386	0.1129	0.0171	0.1819	0.0860	0.0130	0.537	0.254	0.038	1.793	0.848	0.128	Yes	50%
121-CV-4006 A	1	3.3	28908	0.2386	0.1129	0.0171	0.1819	0.0860	0.0130	0.394	0.186	0.028	1.315	0.622	0.094	Yes	50%
121-CV-4006 B	1	3.3		0.2386	0.1129	0.0171	0.1819	0.0860	0.0130	0.394	0.186	0.028				Yes	50%
121-CV-4007 A	1	3.3	28908	0.2386	0.1129	0.0171	0.1819	0.0860	0.0130	0.394	0.186	0.028	1.315	0.622	0.094	Yes	50%
121-CV-4007 B	1	3.3		0.2386	0.1129	0.0171	0.1819	0.0860	0.0130	0.394	0.186	0.028				Yes	50%
121-S-4001 A	1	7.8	68328	0.2386	0.1129	0.0171	0.1819	0.0860	0.0130	Refer to emission calculations for fly ash storage silos							
121-S-4001 B	1	7.8		0.2386	0.1129	0.0171	0.1819	0.0860	0.0130								
121-TL-0001	1	8.6	75336	-	-	-	-	-	-	Refer to emission calculations for fly ash truck loading							
						TOTAL				4.796	2.268	0.343	11.592	5.483	0.830		

[1] Design is still in progress. Because there will be covers on the conveyors to reduce wind speed, an emission control efficiency of 50% is used in the calculations.

Emission Factors for Dry Fly Ash Handling Process:

Emissions are based on AP-42 emission factors for Aggregate Handling and Storage Piles (AP-42 V5, Section 13.2.4.3, Equation (1), November 2006)

Average Wind Speed is obtained from US EPA AP-42 Table 7.1-7 for Huntington, West Virginia (closest data collection point)

Data:

Source Parameters				
Pollutant	**Particle Size (µm)**	**# of Drops in Transfer Process**	**Average Moisture % (M) [1]**	**k[2]**
PM/TSP	**< 30**	**1**	**0.10**	**0.74**
PM_{10}	**< 10**	**1**	**0.10**	**0.35**
$PM_{2.5}$	**< 2.5**	**1**	**0.10**	**0.053**

[1] 0.25% -4.8% maintains the quality rating level A of the equation. The moisture content of the dry fly ash is conservatively assumed to be 0.1%.

Table N-6 Fly Ash Handling Process
MGS CNP 1, LLC

Hours of Operation	**8,760**	hours/year (24 hours/day X 7 days/week X 52 weeks/year)	
Annual Average Wind Speed of Area (U)=	**5.6**	mph	annual average and highest monthly average wind speeds for Huntington, WV taken from US EPA AP-42 Table 7.1-7.
Highest Monthly Average Wind Speed of Area (U)=	**6.9**	mph	

Calculations:

AP-42 (section 13.2.4.3) lb/ton of material

$$Emission\ factor\,(lb/ton) = k*(0.0032)*\frac{\left(\frac{U}{5}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}$$

Where: k = particle size multiplier from AP-42 Section 13.2.4.3
M = material moisture content (%)
U = mean wind speed

TSP/PM hourly emission factor:		
= (0.74) x (0.0032) x [(6.9/5)^1.3/(0.1/2)^1.4]		
=	***0.2386***	lbs/ton

TSP/PM annual average emission factor:		
= (0.74) x (0.0032) x [(5.6/5)^1.3/(0.1/2)^1.4]		
=	***0.1819***	lbs/ton

$PM_{10\ hourly}$ emission factor:		
= (0.35) x (0.0032) x [(6.9/5)^1.3/(0.1/2)^1.4]		
=	***0.1129***	lbs/ton

$PM_{10\ annual}$ average emission factor:		
= (0.35) x (0.0032) x [(5.6/5)^1.3/(0.1/2)^1.4]		
=	***0.0860***	lbs/ton

$PM_{2.5\ hourly}$ emission factor:		
= (0.053) x (0.0032) x [(6.9/5)^1.3/(0.1/2)^1.4]		
=	***0.0171***	lbs/ton

$PM_{2.5\ annual}$ average emission factor:		
= (0.053) x (0.0032) x [(5.6/5)^1.3/(0.1/2)^1.4]		
=	***0.0130***	lbs/ton

Table N-6 Fly Ash Handling Process
MGS CNP 1, LLC

Source Name:	Fly Ash Storage Silos A & B	EPN:	121-F-4001 A / 121-F-4001 B	
Proposed MAERT Limits		**Date:**	5/6/2025	
FIN	**EPN**	**Air Contaminant**	**lbs/hr**	**TPY**
121-S-4001 A 121-S-4001 B	121-F-4001 A / 121-F-4001 B	PM	0.02	0.06
		PM10	0.01	0.03
		PM2.5	0.00	0.00

Process Description:

Generated fly ash will be transferred to two ash storage silos via an enclosed conveyor. When a sufficient volume has been collected, the fly ash will be mixed with utility water before removed from site for disposal by trucks.

The emissions from the fly ash silos were conservatively estimated using emission factors for Aggregate Handling and Storage Piles (AP-42 V5, Section 13.2.4.3, Equation (1), November 2006).

The two fly ash silos will be used alternately. Therefore, the annual emissions from the two silos will be permitted under a cap.

Bases and Factors:

The emission factors used to estimate the uncontrolled PM, PM10 and PM2.5 emissions were presented in Table N-6 Fly Ash Handling (2). A filter will be installed on each silo and run continuously, reducing particulate emissions by 99%.

Data:

Filter control efficiency: 99%

Pollutant	Emission Factor (lb/ton)		Feed Rate per Hour	Feed Rate per Year	Uncontrolled		Controlled	
					Hourly Emissions	Annual Emissions	Hourly Emissions	Annual Emissions
	Hourly	Annual	Tons/hr	Tons/yr	lb/hr	TPY	lb/hr	TPY
PM	0.2386	0.1819	7.8	68328.00	**1.86**	**6.21**	**0.02**	**0.06**
PM10	0.1129	0.0860	7.8	68328.00	**0.88**	**2.94**	**0.01**	**0.03**
PM2.5	0.0171	0.0130	7.8	68328.00	**0.13**	**0.45**	**0.00**	**0.0045**

Source Name:	Fly Ash Truck Loading	EPN:	121-TL-0001	
Proposed MAERT Limits		**Date:**	5/6/2025	
FIN	**EPN**	**Air Contaminant**	**lbs/hr**	**TPY**
121-TL-0001	121-TL-0001	PM	0.00	0.01
		PM10	0.00	0.01
		PM2.5	0.00	0.00

Process Description:

Generated fly ash will be transferred to the ash storage silos via a conveying system. When a sufficient volume has been collected, the fly ash will be mixed with utility water before removed from site for disposal by trucks. The fly ash will have a minimum moisture content of 10% when loaded into trucks.

The particulate matter emissions will be controlled by keeping high moisture content of the fly ash.

Fly Ash Loading into Trucks

Data:

Pollutant	Emission Factor	Ash Produced per Hour	Ash Produced per Year	Hourly Emissions	Annual Emissions
	lb/Ton	Tons/hr	Tons/yr	lb/hr	TPY
PM	0.0004	8.6	75336	0.0033	0.01
PM10	0.0002	8.6	75336	0.0015	0.01
PM2.5	0.0000	8.6	75336	0.0002	0.001

Emission Factors for Dry Fly Ash Handling Process:

Emissions are based on AP-42 emission factors for Aggregate Handling and Storage Piles (AP-42 V5, Section 13.2.4.3, Equation (1), November 2006)

Average Wind Speed is obtained from US EPA AP-42 Table 7.1-7 for Huntington, West Virginia (closest data collection point)

Data:

Source Parameters				
Pollutant	**Particle Size (µm)**	**# of Drops in Transfer Process**	**Average Moisture % (M)** [1]	**k** (2)
PM/TSP	**< 30**	**1**	**10**	**0.74**
PM_{10}	**< 10**	**1**	**10**	**0.35**
$PM_{2.5}$	**< 2.5**	**1**	**10**	**0.053**

[1] 0.25% -4.8% maintains the quality rating level A of the equation. The minimum moisture content of the wet fly ash is 10%.

Hours of Operation	**8,760**	hours/year (24 hours/day X 7 days/week X 52 weeks/year)	
Annual Average Wind Speed of Area (U)=	**5.6**	mph	annual average and highest monthly average wind speeds for Huntington, WV taken from US EPA AP-42 Table 7.1-7.
Highest Monthly Average Wind Speed of Area (U)=	**6.9**	mph	

Calculations:

AP-42 (section 13.2.4.3) lb/ton of material

$$Emission\ factor\ (lb/ton) = k * (0.0032) * \frac{\left(\frac{U}{5}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}$$

Where: k = particle size multiplier from AP-42 Section 13.2.4.3
M = material moisture content (%)
U = mean wind speed

TSP/PM average emission factor:		
= (0.74) x (0.0032) x [(6.9/5)^1.3/(10/2)^1.4]		
=	***0.0004***	lbs/ton

PM_{10} average emission factor:		
= (0.35) x (0.0032) x [(6.9/5)^1.3/(10/2)^1.4]		
=	***0.0002***	lbs/ton

$PM_{2.5}$ average emission factor:		
= (0.053) x (0.0032) x [(6.9/5)^1.3/(10/2)^1.4]		
=	***0.00003***	lbs/ton

Table N-7 Sand Handling Process
MGS CNP 1, LLC

Bottom Ash and Sand Handling Process

Emission Unit ID	Emission Point ID	Description	Hourly Rate lb/hr	Annual Rate tpy	Control	Note
121-CV-5001 A	121-CV-5001 A	Metering Conveyor A (Bed Ash Screw A)	2250	9855	Covered	
121-CV-5001 B	121-CV-5001 B	Metering Conveyor B (Bed Ash Screw B)	2250		Covered	
121-CV-5002A	121-CV-5002A	Vibrating Screener A (to separate bottom ash and sand)	2250	9855	Trough hood (Partial enclosure)	
121-CV-5002B	121-CV-5002B	Vibrating Screener B (to separate bottom ash and sand)	2250		Trough hood (Partial enclosure)	
121-S-6001 A	121-S-6001 A	Bottom Ash Storage Bin A	2000	8760	NA	No emissions are expected due to the size of the material.
121-S-6001 B	121-S-6001 B	Bottom Ash Storage Bin B	2000		NA	
121-S-1002	121-S-1002	Sand Receiving Hopper	100000	1752	NA	
121-CV-1004	121-CV-1004	Inclined Sand Hopper Conveyor	100000	1752	Covered	
121-S-5001	121-S-5001	Makeup Sand Silo	100000	1752	Vent piping to the BFB	
NA	NA	Chute (From Makeup Sand Silo to Sand Bucket Elevator)	400	1752	Full enclosure (Pipe)	
121-CV-5003 A	121-CV-5003 A	Transfer Conveyor A (Recycled Sand) (From Vibrating Screener A to Sand Bucket Elevator A)	250	1095	Cover assembly (partial enclosure)	
121-CV-5003 B	121-CV-5003 B	Transfer Conveyor B (Recycled Sand) (From Vibrating Screener B to Sand Bucket Elevator B)	250		Cover assembly (partial enclosure)	
121-CV-5004 A	121-CV-5004 A	Sand Bucket Elevator A (Recycled Sand + Fresh Sand)	650	2847	Covered	250 lbs/hr of reclaimed sand + 400 lbs/hr of makeup sand
121-CV-5004 B	121-CV-5004 B	Sand Bucket Elevator B (Recycled Sand + Fresh Sand)	650		Covered	251 lbs/hr of reclaimed sand + 400 lbs/hr of makeup sand
NA	NA	Recycle Sand Chute A (From Sand Bucket Elevator A Discharge to Boiler)	6000 lbs/24 hours		Full enclosure (Pipe)	No emissions
NA	NA	Recycle Sand Chute B (From Sand Bucket Elevator B Discharge to Boiler)	6000 lbs/24 hours		Full enclosure (Pipe)	No emissions

Fugitive emissions can be expected from conveying and transferring of sand due to wind and conveyor vibration.

Basis:
Particulate emissions from the sand handling process are conservatively estimated using uncontrolled emission factors in AP-42 Table 11.12-2 for aggregate transfer.

							Emissions							
							Short-term Emissions			Annual Emissions				
Source	**No. of Transfer Points**	**Transfer Rate**		**Emission Factor (lb/ton)**			**(lb/hr)**			**(tpy)**			**Protection from Wind**	**Efficiency [1]**
		(tons/hr)	**(tons/yr)**	**PM**	**PM10**	**PM2.5**	**PM**	**PM10**	**PM2.5**	**PM**	**PM10**	**PM2.5**		
121-CV-5001 A	1	1.125	9855	0.0069	0.0033	0.0033	0.004	0.002	0.002	0.017	0.008	0.008	Yes	50%
121-CV-5001 B	1	1.125		0.0069	0.0033	0.0033	0.004	0.002	0.002				Yes	50%
121-CV-5002A	1	1.125	9855	0.0069	0.0033	0.0033	0.004	0.002	0.002	0.017	0.008	0.008	Yes	50%
121-CV-5002B	1	1.125		0.0069	0.0033	0.0033	0.004	0.002	0.002				Yes	50%
121-S-1002	1	50	1752	0.0069	0.0033	0.0033	0.345	0.165	0.165	0.006	0.003	0.003	No	0%
121-CV-1004	1	50	1752	0.0069	0.0033	0.0033	0.173	0.083	0.083	0.003	0.001	0.001	Yes	50%
121-CV-5003 A	1	0.125	1095	0.0069	0.0033	0.0033	0.000	0.000	0.000	0.002	0.001	0.001	Yes	50%
121-CV-5003 B	1	0.125		0.0069	0.0033	0.0033	0.000	0.000	0.000				Yes	50%
121-CV-5004 A	1	0.325	2847	0.0069	0.0033	0.0033	0.001	0.001	0.001	0.005	0.002	0.002	Yes	50%
121-CV-5004 B	1	0.325		0.0069	0.0033	0.0033	0.001	0.001	0.001				Yes	50%
						TOTAL	0.536	0.256	0.256	0.050	0.024	0.024		

[1] Design is still in progress. Because there will be covers on the conveyors to reduce wind speed, an emission control efficiency of 50% is used in the calculations.

Table N-8 Sodium Bicarbonate Handling Process
MGS CNP 1, LLC

Emission Unit	Emission Point	Description	Hourly Rate lb/hr	Annual Rate tpy	Control	Note
121-S-9901	121-PKG-3001; 122-T-1001	Sodium Bicarbonate Storage Silo	13000	438	Vent routed to boiler and controlled by the boiler PJFF	Batch operation; NaHCO3 will be pneumatically transferred to the silo.
121-S-9902 A	121-F-9902 A	Sodium Bicarbonate Vent Hopper A	100	438	Pulse Jet Filter 121-F-9902 A	
121-S-9902 B	121-F-9902 B	Sodium Bicarbonate Vent Hopper B	100		Pulse Jet Filter 121-F-9902 B	

Table N-8 Sodium Bicarbonate Handling Process
MGS CNP 1, LLC

Source Name:	Sodium Bicarbonate Vent Hoppers	**EPN:**	121-F-9902 A; 121-F-9902 B	
Proposed MAERT Limits		**Date:**	5/6/2025	
FIN	**EPN**	**Air Contaminant**	**lbs/hr**	**TPY**
121-F-9902 A; 121-F-9902 B	121-F-9902A; 121-F-9902 B	PM	1.95E-04	8.54E-04
		PM10	7.50E-05	3.29E-04
		PM2.5	7.50E-05	3.29E-04

Process Description:

From the NaHCO3 Silo, NaHCO3 will be gravity fed to the vent hoppers.
The emissions from the vent hoppers are estimated using emission factors from Table 11.19.2-2 in Section 11.19.2 of AP-42.

Bases and Factors:

0.039 lb/ton and 0.015 lb/ton are used to estimate the uncontrolled PM and PM10/PM2.5 emissions.
Each vent hopper will be equipped with one filter and will reduce particulate emissions by 90%.

To represent worst case emissions, the maximum hourly emissions for each vent hopper are based on the total amount of NaHCO3 to flow through the vent hoppers, rather than splitting the emissions in half. The annual emissions for both vent hoppers are permitted under a cap.

Data:

Filter control efficiency: 90%

				Uncontrolled		Controlled	
Pollutant	**Emission Factor**	**Feed Rate per Hour**	**Feed Rate per Year**	**Hourly Emissions**	**Annual Emissions**	**Hourly Emissions**	**Annual Emissions**
	lb/ton	**Tons/hr**	**Tons/yr**	**lb/hr**	**TPY**	**lb/hr**	**TPY**
PM	0.039	0.05	438.00	0.00195	0.0085	0.0002	0.0009
PM10	0.015	0.05	438.00	0.00075	0.0033	0.0001	0.0003
PM2.5	0.015	0.05	438.00	0.00075	0.0033	0.0001	0.0003

Cooling Tower

One open recirculating, induced draft and counterflow cooling tower will be installed to support the facility's operation. The cooling tower will have 6 cells.

		Cooling Tower	Notes
	Emission Unit ID	129-CT-9301	
	EPN	129-CT-9301	
Input	Recirculation Rate (gpm)	80,762	Rated capacity, Design Info
	Drift (%)[2]	0.001	Design Info
	Maximum TDS (ppm)	5000	
	Annual Average TDS (ppm)	1700	
	Annual operating hours	8760	
Calculated Emissions	Avg. PM (lb/hr)	0.69	
	Max. PM (lb/hr)	2.02	
	PM (tpy)	3.01	
	Avg. PM10 (lb/hr)	0.57	
	Max. PM10 (lb/hr)	1.48	
	PM10 (tpy)	2.52	
	Avg. PM2.5 (lb/hr)	0.29	
	Max. PM2.5 (lb/hr)	0.67	
	PM2.5 (tpy)	1.26	

Cooling Tower Water Info:

concentration ratio:	5		Design Info
TDS (average) make up water:	340	ppmw	Design Info
TDS (maximum) make up water:	1,000	ppmw	
Maximum TDS:	5,000	ppmw	
Annual Average TDS:	1700	ppmw	

Recirculation Rate:	18,386	m3/hr
Water density:	8.34	lb/gal
	997	kg/m3
1 lb =	453.59	grams
1 hr =	60	min
1 kg =	1000	grams

Equation: PM = Recirculation Rate, gpm * Drift% * 8.34 lb/gal * 60 min/hr * TDS ppm/1000000 — Reference (1)

Particle Size Calculation (Hourly Max.)[3]

Cooling Tower Droplet Size			**Particle Size**		
Droplet (Dd, microns)	**Mean (Dd, microns)**	**Distribution (% Mass Smaller Than)**	**(Dp, microns)**	**PM 10 %Mass**	**PM2.5 %Mass**
< 15	7.5	20.00	0.983		33.23
15 - 35	25	40.00	3.277		
35 - 65	50	60.00	6.554	73.14	
65 - 115	90	80.00	11.797		
115 - 170	142.5	90.00	18.679		
170 - 230	200	95.00	26.216		
230 - 275	252.5	99.00	33.098		
275 - 525	400	99.80	52.432		
> 525	525	100.00	68.817		

Particle Size Calculation (Annual Emis.)[3]

Cooling Tower Droplet Size			Particle Size		
Droplet (Dd, microns)	Mean (Dd, microns)	Distribution (% Mass Smaller Than)	(Dp, microns)	PM 10 %Mass	PM2.5 %Mass
< 15	7.5	20.00	0.686		
15 - 35	25	40.00	2.287		41.86
35 - 65	50	60.00	4.574		
65 - 115	90	80.00	8.234	83.68	
115 - 170	142.5	90.00	13.037		
170 - 230	200	95.00	18.298		
230 - 275	252.5	99.00	23.101		
275 - 525	400	99.80	36.595		
> 525	525	100.00	48.031		

Dp = Dd * [(pd/pp) * (TDS) / 1,000,000)] ^ 1/3

where: Density of Water (pd)= 1
Density of TDS (pp) = 2.22

TDS is assumed to be sodium chloride.

Equations and Example Calculations:

Max. PM Hourly Emissions (lb/hr) = Cooling Water Circulation Rate (gpm) * Drift (%) * 60 * 8.34 * Max. TDS in Circulating Water (ppm)/1000000

= 80,762 gal / min | 0.0010% | 60 min / hr | 8.34 lb / gal | 5000 parts / 1000000 parts = 2.02 lb / hr

PM Annual Emissions (tpy) = Average PM Emissions (lb/hr) * Maximum Hours of Operation * Conversion (1 ton/2000 lb)

= 0.69 lb / hr | 8760 hrs / yr | 1 ton / 2000 lbs = 3.01 tons / yr

Max. PM10 Hourly Emissions (lb/hr) = Max. PM Hourly Emissions (lb/hr) * Mass of drift with PM10 (%)

= 2.02 lb / hr | 73.14% = 1.48 lbs / hr

PM10 Annual Emissions (tpy) = Average PM10 Hourly Emissions (lb/hr) *Maximum Hours of Operation (hr/yr) * (1 ton/2000 lb)

= 0.57 lb / hr | 8760 hrs / yr | 1 ton / 2000 lbs = 2.52 tons / yr

Max. PM2.5 Hourly Emissions (lb/hr) = Max. PM Hourly Emissions (lb/hr) * Mass of drift with PM2.5 (%)

= 2.02 lb / hr | 33.23% = 0.67 lbs / hr

PM2.5Annual Emissions (tpy) = Average PM2.5 Hourly Emissions (lb/hr) *Maximum Hours of Operation (hr/yr) * (1 ton/2000 lb)

= 0.29 lb / hr | 8760 hrs / yr | 1 ton / 2000 lbs = 1.26 tons / yr

References

1. AP-42 Chapter 13.4 Cooling Towers.
2. 0.001% Drift is based on design.
3. Calculation Methodology is based on "Calculating Realistic PM10 Emissions from Cooling Towers", Joel Reisman and Gordon Frisbie, Greystone Environmental Consultants, Sacramento, CA.

Table N-10a Fugitive Road - Annual
MGS CNP 1, LLC

Annual Emission Rate

Unit EPN	Vehicles Per Day	Hours of Vehicle Traffic (hrs/day)	Road Length (miles)	Vehicle Mile Travelled Hourly (VMT/hr)
PM-PlantRd	107	24	0.63	2.81

Constituents	Emission Factor		Average Hourly Emissions (lb/hr)	Annual Emissions (ton/yr)
Criteria Pollutants	Factor	Units		
PM	0.7626	lb/VMT	2.14	9.38
PM 2.5	0.0374	lb/VMT	0.11	0.46
PM 10	0.1525	lb/VMT	0.43	1.88

Assumptions:

All roads paved

Maximum annual emission rate assumes 107 vehicle/24 hr day.

Mix of vehicles	Average Vehicle Weight	Min Vehicle Weight	Max Vehicle Weight	Unit
4.90%	25.5	24	27	ton
5.88%	30	20	40	ton
94.12%	31.5	18	42	ton
Average weight	32.7	-	-	ton

Maximum inside plant speed (posted speed limit) 20 mph.

Number of days with rainfall greater than 0.01 inch is 140 days.

Constants:

k for PM	0.011	lb/VMT, Particle size multiplier for particle size range.
k for PM2.5	0.00054	lb/VMT, Particle size multiplier for particle size range.
k for PM10	0.0022	lb/VMT, Particle size multiplier for particle size range.
sL	2.4	g/m^2, Road surface silt loading
W	32.7	ton, Average weight of the vehicles travelling the road.
P	157	days, Number of "wet" days with at least 0.254 mm (0.01 in) of precipitation during the averaging period based on Figure 13.2.1-2 in AP-42.
N	365	days, Number of days in the averaging period.
	8760	hrs, Annual operation

Equations and Example Calculations:

(1) PM Emission Factor (lb/VMT) = $EF = [k * (sL)^{0.91} * (W)^{1.02}](1-P/4N)$

= $0.011\ lb/VMT * (2.4\ g/m^2)^{0.91} * (32.7\ ton)^{1.02} * (1-140/(4*365))$

0.7626 lb/VMT

(2) PM Average Hourly Emission (lb/hr) = (VMT Hourly) * (EF for PM)

(2.79 VMT/hr) * (0.7725 lb/VMT)

2.14 lb/hr

(3) PM Annual Emission (ton/yr) = (PM Hourly Emission * Annual Operation) / 2000 lb/ton

(2.17 lb/hr * 8760 yrs) / 2000 lb/ton

9.38 ton/yr

References:

(1) AP-42, 13.2.1 Paved Roads
(2) Particle size multiplier, k, from Table 13.2.1-1
(3) Road surface silt loading constant, sL, estimated based on low traffic travel in Table 13.2.1-2 with application of identified controls:
•Paving of all in-plant haul roads
•Post and limit the maximum travelling speed to 20 mph

Max Hourly Rate

Unit EPN	Vehicles Per Day	Hours of Vehicle Traffic (hrs/day)	Road Length (miles)	Vehicle Mile Travelled Hourly (VMT/hr)
PM-PlantRd	203	10	0.63	12.79

Constituents	Emission Factor		Max Hourly Emissions (lb/hr)
Criteria Pollutants	Factor	Units	
PM	0.8395	lb/VMT	10.74
PM 2.5	0.0412	lb/VMT	0.527
PM 10	0.1679	lb/VMT	2.15

Assumptions:

All roads paved

Maximum hourly emission rate assumes 198 vehicle/10 hr day.

Mix of vehicles	Average Vehicle Weight	Min Vehicle Weight	Max Vehicle Weight	Units
2.53%	25.5	24	27	ton
3.03%	30	20	40	ton
96.97%	31.5	18	45	ton
Average weight	32.1	-	-	ton

Maximum inside plant speed (posted speed limit) 20 mph.

Number of hours with rainfall greater than 0.01 inch is 0 days.

Constants:

k for PM	0.011	lb/VMT, Particle size multiplier for particle size range.
k for PM2.5	0.00054	lb/VMT, Particle size multiplier for particle size range.
k for PM10	0.0022	lb/VMT, Particle size multiplier for particle size range.
sL	2.4	g/m^2, Road surface silt loading
W	32.1	ton, Average weight of the vehicles travelling the road.
P	0	days, Number of "wet" days with at least 0.254 mm (0.01 in) of precipitation during the averaging period.
N	1	days, Number of days in the averaging period.

Equations and Example Calculations:

(1) PM Emission Factor (lb/VMT) = $EF = k * (sL)^{0.91} * (W)^{1.02}$

= $0.011 \text{ lb/VMT} * (2.4 \text{ g/m}^2)^{0.91} * (32.1 \text{ ton})^{1.02} * (1-0/4*1)$

0.8395 lb/VMT

(2) PM Hourly Emission (lb/hr) = (VMT Hourly) * (EF for PM)

(12.79 VMT/hr) * (0.8395 lb/VMT)

10.74 lb/hr

References:

(1) AP-42, 13.2.1 Paved Roads

(2) Particle size multiplier, k, from Table 13.2.1-1

(3) Road surface silt loading constant, sL, estimated based on low traffic travel in Table 13.2.1-2 with application of identified controls:

•Paving of all in-plant haul roads

•Post and limit the maximum travelling speed to 20 mph

Table N-11 Fixed Roof Tanks Emissions
MGS CNP 1, LLC

Fixed roof tank emissions:
Breathing and working losses from fixed roof tanks were estimated using equations and methodology from AP-42 Chapter 7.
Emissions are based on the anticipated annual throughput for each tank along with the material composition to be stored.

Equipment ID	Description	Tank Type	Throughput	Maximum Filling Rate	Working Volume		Shell Height/Length	Max. Liquid Height	Diameter	Heated/Insulated		Control
			(bbl/yr)	(bbl/hr)	(bbl)	(gal)	(ft)	(ft)	(ft)	(Y/N)	°F	
128-V-9001	Ammonia Storage Tank	Vertical	11,140.00	154.70	196	8,225	17.5	14	10	N	NA	to atmosphere
122-TK-9901	Lean Amine Tank	Vertical	7,670.63	1,167.00	7,162	300,789	40	32	40	Y	50	to atmosphere
TOTAL	**2**											

Company Name				**MGS CNP 1, LLC**	
Site Name				**BECCS Plant**	
Emission Unit ID				**122-TK-9902**	**122-TK-9901**
Description				**Amine Makeup Tank**	**Lean Amine Tank**
INPUT DATA					
Tank Data					
Tank Type (Vertical or Horizontal)				Vertical Fixed Roof	Vertical Fixed Roof
Diameter, D	**D**	**ft**		10.00	40
Height, H (or length for horizontal tanks)	H_S	ft		15.00	40
Roof Type				Cone	Cone
Cone Roof Slope (cone roof only), S_R	S_R	dimensionless, default 0.0625		0.0625	0.0625
Shell Paint Color				White	White
Shell Paint Condition				Good	Good
Roof Paint Color				White	White
Roof Paint Condition				Good	Good
Breather Vent Pressure Setting, P_{BP}	P_{BP}	psig (default is 0.03)		0.03	0.03
Breather Vent Vacuum Setting, P_{BV}	**P_{BV}**	psig (default is - 0.03)		-0.03	-0.03
Pressure of Vapor Space at Normal Conditions, P_I	P_I	psig (default is 0)		0	0
Maximum Liquid Height, H_{LX}	**H_{LX}**	**ft**		12.00	32.00
Minimum Liquid Height, H_{LN}	**H_{LN}**	**ft**		1	2
Average Liquid Height, H_{LA}	H_{LA}	ft	$H_{LX}/2$	6.00	16.00
Maximum Hourly Throughput, Q_{MAX}	**Q_{MAX}**	**bbl/hr**		167.85	1167.00
Annual Throughput, Q_{ANN}	Q_{ANN}	bbl/yr		509.00	7670.63
Control Type				NA	NA
Control Efficiency				NA	NA
Tank insulated?				Yes	Yes
	T_{LA}, T_B, T_{LX}, T_{LN}	°R		509.67	509.67
Tank Maximum Liquid Volume, V_{LX}	V_{LX}	Gal		6462.71	282008.96
Meteorological Data					
Daily Min. Ambient Temp, T_{AN}	T_{AN}	°F		46.2	46.2
Daily Max. Ambient Temp, T_{AX}	T_{AX}	°F		65.3	65.3
Daily Total Solar Insolation, I	I	Btu/(ft^2-day)		1250	1250
Atmospheric Pressure, P_A	P_A	psia (default is 14.7)		14.26	14.26

Material Data

Working Loss Product Factor, K_P	K_P	dimensionless (0.75 for crude oils, 1.0 for all other organic		1	1

Total Losses, L_T (Eq. 1-1)	**L_T**	**tpy**	**$L_T = L_S + L_W$**	0.001	0.010
Total Losses, L_T (Eq. 1-1)	**L_T**	**lb/yr**	**$L_T = L_S + L_W$**	1.35	20.34
Standing Storage Losses, L_S (Eq. 1-4)	**Ls**	lb/yr	**$L_S = 365V_VW_VK_EK_S$**	0.00	0.00
Tank Vapor Space Volume, V_V (Eq. 1-3)	V_V	ft^3	**$V_V = ((\pi/4)D_E^2)H_{VO}$**	715.04	30682.89
Vapor Space Outage, H_{VO} (Eq. 1-16)	H_{VO}	ft	**$H_{VO} = H_S - H_L + H_{RO}$ (vertical tanks)**	9.10	24.42
Cone Roof Outage, H_{RO} (Eq. 1-17)	H_{RO}	ft	**$H_{RO} = H_R/3$ (cone roof)**	0.10	0.42
Cone Tank Roof Height, H_R (Eq. 1-18)	H_R	ft	**$H_R = S_RR_S$ (cone roof)**	0.31	1.25
Vapor Space Expansion Factor, K_E (Eq. 1-5)	K_E	dimensionless	**$K_E = \Delta T_V/T_{LA} + (\Delta P_V - \Delta P_B)/(P_A - P_{VA})$**	0.00	0.00
Vapor Space Expansion Factor, K_E (Eq. 1-12)	K_E	dimensionless	$K_E = 0.0018\Delta T_V$	0.00	0.00
Average Daily Vapor Temperature Range, ΔT_V (Eq. 1-6)	ΔT_V	°R	**$\Delta T_V = (1-0.8/(2.2*(Hs/D)+1.9))\Delta T_A + (0.042\alpha_R I+0.026(Hs/D)\alpha_S I)/(2.2(Hs/D)+1.9)$**	0.00	0.00
Average Daily Vapor Temperature Range, ΔT_V (Eq. 1-7)	ΔT_V	°R	**$\Delta T_V = 0.7\Delta T_A + 0.02\alpha I$**	0.00	0.00
Paint Solar Absorptance, α (Table 7.1-6)		dimensionless		0.17	0.17
Average Daily Ambient Temperature Range, ΔT_A (Eq. 1-11)	ΔT_A	°R	**$\Delta T_A = T_{AX} - T_{AN}$**	19.10	19.10
Average daily liquid Surface Temperature, T_{LA} (Eq. 1-27)	T_{LA}	°R	**$T_{LA} = (0.5-0.8/(4.4(Hs/D)+3.8))T_{AA} + (0.5 + 0.8/(4.4(Hs/D)+3.8))T_B + (0.021\alpha_R I + 0.013 (Hs/D)\alpha_s I)/(4.4(Hs/D)+3.8))$**	509.67	509.67
		°F		50.00	50.00
		°C		10.00	10.00
		K		283.15	283.15
Average daily Liquid Surface Temperature, T_{LA} (Eq. 1-28)	T_{LA}	°R	**$T_{LA} = 0.4T_{AA} + 0.6T_B+0.005\alpha I$**	509.67	509.67
		°F		50.00	50.00
		°C		10.00	10.00
		K		283.15	283.15
Liquid Bulk Temperature, T_B (Eq. 1-31)	T_B	°R	**$T_B = T_{AA} + 0.003\alpha I$**	509.67	509.67
		°F		50.00	50.00
Average Daily Ambient Temperature, T_{AA} (Eq. 1-30)	T_{AA}	°R	**$T_{AA} = (T_{AX} + T_{AN})/2$**	515.42	515.42
Average Daily Minimum Liquid Surface Temperature, T_{LN} (Fig 7.1-17)	T_{LN}	°R	**$T_{LN} = T_{LA} - 0.25\Delta T_V$**	509.67	509.67
		°F		50.00	50.00
		°C		10.00	10.00
		K		283.15	283.15
		°R	**$T_{LX} = T_{LA} + 0.25\Delta T_V$**	509.67	509.67

Average Daily Maximum Liquid Surface Temperature, T_{LX} (Fig. 7.1-17)	T_{LX}	°F		50.00	50.00
		°C		10.00	10.00
		K		283.15	283.15
Daily Vapor Pressure Range, ΔP_V (Eq. 1-9)	ΔP_V	psia	**$\Delta P_V = P_{VX} - P_{VN}$**	0.000	0.000
Is the fixed roof tank of bolted or riveted construction?				No	No

Breather Vent Pressure Setting Range, ΔP_B (Eq. 1-10)	ΔP_B	psig	**$\Delta P_B = P_{BP} - P_{BV}$**	0.06	0.06
Vented Vapor Saturation Factor, K_S (Eq. 1-21)	K_S	dimensionless	**$K_S = 1/(1 + 0.053P_{VA}H_{VO})$**	0.93	0.84
Vapor Pressure at the Average Daily Liquid Surface Temp., P_{VA} (Eq. 1-24)	P_{VA}	psia		0.1451	0.1451
Stock Vapor Density, W_V (Eq. 1-22)	W_V	lb/ft^3	**$W_V = (M_V P_{VA})/(RTv)$**	4.73E-04	4.73E-04
Vapor Molecular Weight, M_V (Eq. 1-23)	M_V	lb/lb-mol		18.06	18.06
Average Vapor Temperature, T_V (Eq. 1-32)	T_V	°R	**$T_V = ((2.2(Hs/D)+1.1)T_{AA} + 0.8T_B+0.021\alpha_R I + 0.013(Hs/D)\alpha_s I)/(2.2(Hs/D)+1.9)$**	516.19	516.06
Average Vapor Temperature, T_V (Eq. 1-33)	T_V	°R	$T_V = 0.7T_{AA} + 0.3T_B + 0.009\alpha I$	509.67	509.67
Working Loss, L_W (Eq. 1-29)	**L_W**	lb/yr	**$L_W = V_Q K_N K_P W_V K_B$**	1.35	20.34
Number of Turnovers per Year, N (Eq. 1-30)	N	dimensionless	**$N = 5.614Q/V_{LX}$**	3.31	1.14
Working Loss Turnover (saturation) factor, K_N	K_N	dimensionless		1.00	1.00
Working Loss Product Factor, K_P	K_P	dimensionless		1	1
Tank Maximum Liquid Volume, V_{LX} (Eq. 1-31)	V_{LX}	ft^3	**$V_{LX} = (\pi/4)D^2(H_{LX}-H_{LN})$)**	863.94	37699.11
Vent Setting Correction Factor Test (Eq. 1-40)			**$K_N(P_{BP} + P_A)/(P_I + P_A) > 1.0$**	1.002	1.002
Vent Setting Correction Factor, K_B (Eq. 1-41)	K_B	dimensionless		0.998	0.998
Vent Setting Correction Factor, K_B	K_B	dimensionless	**$K_B =(((P_I + P_A)/K_N) - P_{VA})/(P_{BP} + P_A - P_{VA})$**	0.998	0.998

MAXIMUM HOURLY EMISSIONS (TCEQ GUIDANCE DOCUMENT "ESTIMATING SHORT TERM EMISSION RATES FROM FIXED ROOF TANKS", 02/20)

Maximum Short-Term Emission Rate, L_{MAX} (Eq. 1)	L_{MAX}	lb/hr	**$L_{MAX} = (M_V \times P_{VA} \times FR_M)/(R \times T)$**	0.45	3.14
Vapor Molecular Weight of the Compound, M_V		lb/lbmol		18.06	18.06
Maximum Filling Rate, FR_M		gal/hr		7049.73	49014.00
Ideal Gas Constant, R	R	[(psia × gal)/(lbmol × ° R)]		80.27	80.27
Worst Case Liquid Surface Temperature, T	T_{LX} + 10	°R	input or 95 as max. ambient	509.67	509.67
Vapor Pressure of the Tank Contents at T_{MAX}	P_{VA}	psia		0.15	0.15

Speciated Emissions (122-TK-9901)

					122-TK-9901	
	Vapor Phase @ T_{LA}	Vapor Phase @ T_{LX}	Vapor Phase @ T_{LN}	Vapor Phase @ T_{max}	Uncontrolled Emissions	
Components	wt%	wt%	wt%	wt%	(lb/hr)	(tpy)
MEA	0.27	0.27	0.27	0.27	1.20E-03	1.79E-06
MDEA	0.05	0.05	0.05	0.05	2.40E-04	3.59E-07
Water	99.68	99.68	99.68	99.68	0.4502	0.0007

Speciated Emissions (122-TK-2001)

					122-TK-2201	
	Vapor Phase @ T_{LA}	Vapor Phase @ T_{LX}	Vapor Phase @ T_{LN}	Vapor Phase @ T_{max}	Uncontrolled Emissions	
Components	wt%	wt%	wt%	wt%	(lb/hr)	(tpy)
MEA	0.27	0.27	0.27	0.27	8.33E-03	2.70E-05

MDEA	0.05	0.05	0.05	0.05	1.67E-03	5.41E-06
Water	99.68	99.68	99.68	99.68	3.1299	0.0101

Vapor Pressure Calculations for Tanks 122-TK-9901 and 122-TK-9902

				a	b	c	P_{VAi}	P_{VXi}	P_{VNi}	P_{max}	Vapor Phase @ T_{LA}	Vapor Phase @ T_{LX}	Vapor Phase @ T_{LN}	Vapor Phase @ T_{max}	Vapor Phase @ T_{LA}	Vapor Phase @ T_{LX}	Vapor Phase @ T_{LN}	Vapor Phase @ T_{max}
Components	MW	Wt.%	mol%	dimensionless	(°K)	(°K)	psia	psia	psia	psia	mol%	mol%	mol%	mol%	wt%	wt%	wt%	wt%
MEA [1]	61.08	23.00	10.85	4.29252	1408.87	-116.093	0.0010484	0.0010484	0.0010484	0.0010484	0.0785	0.0785	0.0785	0.0785	0.2653	0.2653	0.2653	0.2653
MDEA [2]	119.163	25.00	6.04				0.0001934	0.0001934	0.0001934	0.0001934	0.008	0.008	0.008	0.008	0.05	0.05	0.05	0.05
Water [3]	18.02	52.00	83.11	4.6543	1435.264	-64.848	0.17	0.17	0.17	0.17	99.913	99.913	99.913	99.913	99.68	99.68	99.68	99.68
							0.14	0.14	0.14	0.14								
	MW of Liquid Product						Vapor Pressures				MW of Vapor							
	MW	28.80				TOTAL	0.15	0.15	0.15	0.15	18.06	18.06	18.06	18.06				

[1] Pressure equation for MEA is P_{VA} in bar and T in °K. P = 10^(A-B/(C+T)). (https://webbook.nist.gov/cgi/cbook.cgi?ID=C141435&Mask=4&Type=ANTOINE&Plot=on).
P_{VA} in bar is converted to psia by multiplying 14.50377. Temperature range [338.6 to 444.1] K.

[2] MDEA has a vapor pressure less than 0.01 mm Hg at 20 °C. The amine tank is kept at 10 °C. 0.01 mmHg was used in the calculation to obtain conservative results.

[3] Pressure equation for water is P_{VA} in bar and T in °K. P = 10^(A-B/(C+T)). (https://webbook.nist.gov/cgi/cbook.cgi?ID=C7732185&Mask=4&Type=ANTOINE&Plot=on).
P_{VA} in bar is converted to psia by multiplying 14.50377. Temperature range [255.9 - 373] K.

There will be one diesel-fired fire water pump, with rating @ 600 hp.
Sulfur content of fuel used in engines will be 15 ppm sulfur or less.
Annual non-emergency operating hours will be limited to 100 hr/yr.
Engines will be new (model year 2024 or later).

FIN: **129-P-9402** **EPN:** **129-P-9402**

Fuel Type:	**Diesel**	
Year	2024	
Total Engines:	1	
Fuel Consumption per Engine:	35.90	gal/hr
Diesel Density [1]	7.001	lb/gal
Fuel Consumption per Engine:	251.34	lbs/hr
Diesel Fuel Heat Content (HHV): [1]	19,300	Btu/lb
Heat Input (HHV) per Engine:	4.85	MMBtu/hr
Engine Horsepower Output:	600	hp
Engine Output:	447	kW
Annual Operation:	50	hr/yr
Engine Load:	100%	
Displacement per Cylinder	< 30 L per cylinder	
Brake Specific Fuel Consumptions: [2]	8084.64	Btu/hp-hr

Notes:
[1] 19,300 Btu/lb is the average heating value of diesel and 7.001 lb/gal is the density of diesel as provided by vendor.
[2] Brake specific fuel consumption per hour = (Heat Input (HHV)) / (Engine Horsepower Output (hp)).

Water Pump Diesel Engine Emission Rates

Pollutant	**Emission Factor** [1,2,3]		**Emissions Rates (Per Engine)**		
			Max. Hourly	**Annual Average**[4]	**Annual**
			lb/hr	**lb/hr**	**tpy**
NOX [1]	4.0	g/kw-hr	3.95	0.02	0.10
CO [1]	3.5	g/kw-hr	3.45	0.02	0.09
PM10 [1,3]	0.2	g/kw-hr	0.20	0.001	0.00
PM2.5 [1,3]	0.2	g/kw-hr	0.20	0.0011	0.00
VOC [1]	4.0	g/kw-hr	3.95	0.02	0.10
SO2 [2]	1.26E-05	lb/hp-hr	0.01	0.00	0.000

Notes:
1. NOX, CO, PM, and VOC emission factors are from 40 CFR 60.4205(c) for engines with rated power greater than or equal to 600 hp (450 kW) but less than or equal to 750 hp (560 kW). NSPS Subpart IIII specifies to use emission factors from Table 4 to 40 CFR Subpart IIII.
2. Emission factors for SO2 based on 15 ppmw ULSD.
3. All PM is assumed to be less than 1.0 µm in diameter. Therefore, the PM emission factor is used to estimate emissions of PM10 and PM2.5.
4. Annual average hourly emission rates are (annual emissions in tpy)*2000 lb/ton*1 year/8760 hours.

Example Calculation:

Hourly NO_X = (4.0 g / kW-hr) × (447.43 kW) × (1 lb / 453.59 g) = 3.95 lb / hr

Annual NO_X = (3.95 lb / hr) × (50 hrs / yr) × (1 ton / 2000 lbs) = 0.10 ton / yr

HAP Emissions from Engines

HAP Emission Estimation

Max Input = 4.85 MMBtu/hr each engine
Annual Hours @ Max Rating = 50.0 hrs/yr
Hourly Emissions = (Max Heat Input - MMBtu/hr) x (1 SCF/1,020 Btu) x (EF - lb/MMSCF)
Annual Emissions = (Max Heat Input - MMBtu/hr) x (1 SCF/1,020 Btu) x (EF - lb/MMSCF) x (Annual Operating Hours) / (2,000 lb/Ton)

Pollutant	EF [1] (lb/MMBtu)	Source	§112 HAP? [2]	Max. Hourly Emission [3] (lb/hr)	Annual Emission (lb/yr) [4]	Annual Emissions (tpy) [5]
Benzene	9.33E-04	AP42; Table 3.3-2; 10/96.	YES	4.53E-03	2.26E-01	1.13E-04
Toluene	4.09E-04	AP42; Table 3.3-2; 10/96.	YES	1.98E-03	9.92E-02	4.96E-05
Xylenes	2.85E-04	AP42; Table 3.3-2; 10/96.	YES	1.38E-03	6.91E-02	3.46E-05
Propylene	2.58E-03	AP42; Table 3.3-2; 10/96.	NO	1.25E-02	6.26E-01	3.13E-04
1,3-Butadiene	<3.91E-05	AP42; Table 3.3-2; 10/96.	YES	1.90E-04	9.48E-03	4.74E-06
Formaldehyde	1.18E-03	AP42; Table 3.3-2; 10/96.	YES	5.72E-03	2.86E-01	1.43E-04
Acetaldehyde	7.67E-04	AP42; Table 3.3-2; 10/96.	YES	3.72E-03	1.86E-01	9.30E-05
Acrolein	<9.25E-05	AP42; Table 3.3-2; 10/96.	YES	4.49E-04	2.24E-02	1.12E-05
Total PAH	<1.68E-04	AP42; Table 3.3-2; 10/96.	YES	8.15E-04	4.07E-02	2.04E-05
Naphthalene	8.48E-05	AP42; Table 3.3-2; 10/96.	YES	4.11E-04	2.06E-02	1.03E-05
Acenaphthylene	<5.06E-06	AP42; Table 3.3-2; 10/96.	YES	2.45E-05	1.23E-03	6.14E-07
Acenaphthene	<1.42E-06	AP42; Table 3.3-2; 10/96.	YES	6.89E-06	3.44E-04	1.72E-07
Fluorene	2.92E-05	AP42; Table 3.3-2; 10/96.	YES	1.42E-04	7.08E-03	3.54E-06
Phenanthrene	2.94E-05	AP42; Table 3.3-2; 10/96.	YES	1.43E-04	7.13E-03	3.57E-06
Anthracene	1.87E-06	AP42; Table 3.3-2; 10/96.	YES	9.07E-06	4.54E-04	2.27E-07
Fluoranthene	7.61E-06	AP42; Table 3.3-2; 10/96.	YES	3.69E-05	1.85E-03	9.23E-07
Pyrene	4.78E-06	AP42; Table 3.3-2; 10/96.	YES	2.32E-05	1.16E-03	5.80E-07
Benzo(a)anthracene	1.68E-06	AP42; Table 3.3-2; 10/96.	YES	8.15E-06	4.07E-04	2.04E-07
Chrysene	3.53E-07	AP42; Table 3.3-2; 10/96.	YES	1.71E-06	8.56E-05	4.28E-08
Benzo(b)fluoranthene	<9.91E-08	AP42; Table 3.3-2; 10/96.	YES	4.81E-07	2.40E-05	1.20E-08
Benzo(k)fluoranthene	<1.55E-07	AP42; Table 3.3-2; 10/96.	YES	7.52E-07	3.76E-05	1.88E-08
Benzo(a)pyrene	<1.88E-07	AP42; Table 3.3-2; 10/96.	YES	9.12E-07	4.56E-05	2.28E-08
Indeno(1,2,3-cd)pyrene	<3.75E-07	AP42; Table 3.3-2; 10/96.	YES	1.82E-06	9.10E-05	4.55E-08
Dibenzo(a,h)anthracene	<5.83E-07	AP42; Table 3.3-2; 10/96.	YES	2.83E-06	1.41E-04	7.07E-08
Benzo(g,h,l)perylene	<4.89E-07	AP42; Table 3.3-2; 10/96.	YES	2.37E-06	1.19E-04	5.93E-08
Total §112 HAP =	3.87E-03			1.88E-02	9.39E-01	4.70E-04

[1] Emission factors obtained from US EPA AP-42 Section 3.3 Gasoline and Diesel Engines (10/96), Table 3.3-2.
[2] Listed US EPA Hazardous Air Pollutants.
[3] Max. Hourly Emissions = Emission Factor (lb/MMBtu) *Max Heat Input Capacity per Engine (MMBtu/hr)
[4] Maximum Annual Emission Rate (lb/yr) = Hourly Emissions (lb/hr) * Annual Operating Hours (hr/yr)
[4] Maximum Annual Emission Rate (lb/yr) = Hourly Emissions (lb/hr) * Annual Operating Hours (hr/yr)
[5] Maximum Potential Annual Emission Rate (tpy) = Hourly Emissions (lb/hr) * Annual Hours (hr/yr) ((1 ton/2000 lb).

There will be one NG-fired startup generator, with power rating @ 2237 kW
Sulfur content of fuel used in engine will be 10 ppmv sulfur or less.
Annual operating hours will be limited to 100 hr/yr.
Engines will be new (model year 2024 or later).

FIN: **129-PKG-0001** **EPN:** **129-PKG-0001**
Engine Type 4-stroke, lean burn engine

Fuel Type:	**Natural Gas**	
Year	2024	
Total Engines:	1	
Fuel Consumption:	18808	Scf/hr
NG HHV	1051.00	Btu/Scf
Heat Input (HHV):	19.77	MMBtu/hr
Engine Horsepower Output:	3000	hp
Engine Output:	2237	kW
Annual Operation:	50	hr/yr
Engine Load:	100%	
Brake Specific Fuel Consumptions: [1]	8836.00	Btu/kW-hr

1 hp = 2544 Btu/hr
1 kW = 1.341 hp

Standard Temperature:	60	°F	15.56	°C
Standard Pressure:	1	atm		
Standard Volume:	379.48	ft3/lbmol		

Notes:
[1] Vendor supplied data - 8836 Btu/kW-hr

Generator Gas Engine Emission Rates

Pollutant	**Emission Factor** [1,2,3,4]		**Emissions Rates**		
			Max. Hourly	**Annual Average**[5]	**Annual**
			Max lb/hr	**annual avg lb/hr**	**tpy**
NOX [1]	1.0	g/hp-hr	6.61	0.04	0.17
CO [1]	2.0	g/hp-hr	13.23	0.08	0.33
PM [2,4]	0.0099871	lb/MMBtu	0.20	0.0011	0.00
PM10 [2,4]	0.0099871	lb/MMBtu	0.20	0.0011	0.00
PM2.5 [2,4]	0.0099871	lb/MMBtu	0.20	0.0011	0.00
VOC_{JJJJ} [1]	0.7	g/hp-hr	4.63	0.03	0.12
VOC [6]	-	-	5.67	0.03	0.14
SO2 [3]	1.06E-05	lb/hp-hr	0.03	0.00	0.001

Notes:
1. NOX, CO, and VOC_{JJJJ} emission factors are Table 1 to 40 CFR 60 Subpart JJJJ for engines with rated power greater than or equal to 500 hp and manufactured after 7/1/2010.
40 CFR 60.4233(e) specifies to use emission factors from Table 1 to 40 CFR 60 Subpart JJJJ.
2. PM/PM10/PM2.5 emission factors come from Table 3.2-2 in AP-42.
3. Emission factors for SO2 based on 10 ppmv sulfur in NG.
4. All PM is assumed to be less than 1.0 µm in diameter. Therefore, the PM emission factor is used to estimate emissions of PM10 and PM2.5.
5. Annual average hourly emission rates are (annual emissions in tpy)*2000 lb/ton*1 year/8760 hours.
6. As indicated in 4*0 CFR 60 Subpart JJJJ, Table 1, Note d,* , VOC_{JJJJ} does not include formaldehyde. Total VOC = VOC_{JJJJ} + Formaldehyde. Formaldehyde is quantified using emission factor in Section 3.2 of AP-42.

Example Calculation:

$$\text{Hourly } NO_X = \frac{1.00\text{ g}}{\text{hp-hr}} \left| \frac{3000.00\text{ hp}}{} \right| \frac{1\text{ lb}}{453.59\text{ g}} = \frac{6.61\text{ lb}}{\text{hr}}$$

$$\text{Annual } NO_X = \frac{6.61\text{ lb}}{\text{hr}} \left| \frac{50\text{ hrs}}{\text{yr}} \right| \frac{1\text{ ton}}{2000\text{ lbs}} = \frac{0.17\text{ ton}}{\text{yr}}$$

HAP Emissions from NG Engine

HAP Emission Estimation

Max Input = 19.77 MMBtu/hr each engine
Annual Hours @ Max Rating = 50.0 hrs/yr
Hourly Emissions = (Max Heat Input - MMBtu/hr) x (EF - lb/MMBtu)
Annual Emissions = (Max Heat Input - MMBtu/hr) x (EF - lb/MMBtu) x (Annual Operating Hours) / (2,000 lb/Ton)

4-Stroke, Lean Burn Engine (37 HAPs)

Pollutant	**HAPs [2]**	**Emission Factor [1]**	**Emission Factor Rating**	**HAPs Emission Factor**	**Max Hourly Emission [3]**	**Annual Emission**	**Annual Emissions**
		lb/MMBtu(fuel input)		lb/MMBtu(fuel input)	**(lb/hr)**	**(lb/yr) [4]**	**(tpy) [5]**
1,1,2,2-Tetrachloroethanek	Yes	0.00004	E	0.00004	7.91E-04	3.95E-02	1.98E-05
1,1,2-Trichloroethanek	Yes	0.0000318	E	0.0000318	6.29E-04	3.14E-02	1.57E-05
1,1-Dichloroethane	No	0.0000236	E	0	0.00E+00	0.00E+00	0.00E+00
1,2,3-Trimethylbenzene	No	2.30E-05	D	0	0.00E+00	0.00E+00	0.00E+00
1,2,4-Trimethylbenzene	No	1.43E-05	C	0	0.00E+00	0.00E+00	0.00E+00
1,2-Dichloroethane	No	0.0000236	E	0	0.00E+00	0.00E+00	0.00E+00
1,2-Dichloropropane	No	0.0000269	E	0	0.00E+00	0.00E+00	0.00E+00
1,3,5-Trimethylbenzene	No	3.38E-05	D	0	0.00E+00	0.00E+00	0.00E+00
1,3-Butadienek	Yes	2.67E-04	D	2.67E-04	5.28E-03	2.64E-01	1.32E-04
1,3-Dichloropropenek	Yes	0.0000264	E	0.0000264	5.22E-04	2.61E-02	1.30E-05
2-Methylnaphthalenek	Yes	3.32E-05	C	3.32E-05	6.56E-04	3.28E-02	1.64E-05
2,2,4-Trimethylpentanek	Yes	2.50E-04	C	2.50E-04	4.94E-03	2.47E-01	1.24E-04
Acenaphthenek	Yes	1.25E-06	C	1.25E-06	2.47E-05	1.24E-03	6.18E-07
Acenaphthylenek	Yes	5.53E-06	C	5.53E-06	1.09E-04	5.47E-03	2.73E-06
Acetaldehydek,l	Yes	8.36E-03	A	8.36E-03	1.65E-01	8.26E+00	4.13E-03
Acroleink,l	Yes	5.14E-03	A	5.14E-03	1.02E-01	5.08E+00	2.54E-03
Benzenek	Yes	4.40E-04	A	4.40E-04	8.70E-03	4.35E-01	2.17E-04
Benzo(b)fluoranthenek	Yes	1.66E-07	D	1.66E-07	3.28E-06	1.64E-04	8.20E-08
Benzo(e)pyrenek	Yes	4.15E-07	D	4.15E-07	8.20E-06	4.10E-04	2.05E-07
Benzo(g,h,i)perylenek	Yes	4.14E-07	D	4.14E-07	8.18E-06	4.09E-04	2.05E-07

Table N-13 NG Startup Generator
MGS CNP 1, LLC

Pollutant	HAPs [2]	Emission Factor [1]	Emission Factor Rating	HAPs Emission Factor	Max Hourly Emission [3]	Annual Emission	Annual Emissions
		lb/MMBtu(fuel input)		lb/MMBtu(fuel input)	(lb/hr)	(lb/yr) [4]	(tpy) [5]
Biphenylk	Yes	2.12E-04	D	2.12E-04	4.19E-03	2.10E-01	1.05E-04
Butane	No	5.41E-04	D	0	0.00E+00	0.00E+00	0.00E+00
Butyr/Isobutyraldehyde	No	1.01E-04	C	0	0.00E+00	0.00E+00	0.00E+00
Carbon Tetrachloridek	Yes	0.0000367	E	0.0000367	7.25E-04	3.63E-02	1.81E-05
Chlorobenzenek	Yes	0.0000304	E	0.0000304	6.01E-04	3.00E-02	1.50E-05
Chloroethane	No	1.87E-06	D	0	0.00E+00	0.00E+00	0.00E+00
Chloroformk	Yes	0.0000285	E	0.0000285	5.63E-04	2.82E-02	1.41E-05
Chrysenek	Yes	6.93E-07	C	6.93E-07	1.37E-05	6.85E-04	3.42E-07
Cyclopentane	No	2.27E-04	C	0	0.00E+00	0.00E+00	0.00E+00
Ethane	No	1.05E-01	C	0	0.00E+00	0.00E+00	0.00E+00
Ethylbenzenek	Yes	3.97E-05	B	3.97E-05	7.85E-04	3.92E-02	1.96E-05
Ethylene Dibromidek	Yes	0.0000443	E	0.0000443	8.76E-04	4.38E-02	2.19E-05
Fluoranthenek	Yes	1.11E-06	C	1.11E-06	2.19E-05	1.10E-03	5.49E-07
Fluorenek	Yes	5.67E-06	C	5.67E-06	1.12E-04	5.60E-03	2.80E-06
Formaldehydek,l	Yes	5.28E-02	A	5.28E-02	1.04E+00	5.22E+01	2.61E-02
Methanolk	Yes	2.50E-03	B	2.50E-03	4.94E-02	2.47E+00	1.24E-03
Methylcyclohexane	No	1.23E-03	C	0	0.00E+00	0.00E+00	0.00E+00
Methylene Chloridek	Yes	2.00E-05	C	2.00E-05	3.95E-04	1.98E-02	9.88E-06
n-Hexanek	Yes	1.11E-03	C	1.11E-03	2.19E-02	1.10E+00	5.49E-04
n-Nonane	No	1.10E-04	C	0	0.00E+00	0.00E+00	0.00E+00
n-Octane	No	3.51E-04	C	0	0.00E+00	0.00E+00	0.00E+00
n-Pentane	No	2.60E-03	C	0	0.00E+00	0.00E+00	0.00E+00
Naphthalenek	Yes	7.44E-05	C	7.44E-05	1.47E-03	7.35E-02	3.68E-05
PAHk	Yes	2.69E-05	D	2.69E-05	5.32E-04	2.66E-02	1.33E-05
Phenanthrenek	Yes	1.04E-05	D	1.04E-05	2.06E-04	1.03E-02	5.14E-06
Phenolk	Yes	2.40E-05	D	2.40E-05	4.74E-04	2.37E-02	1.19E-05
Propane	No	4.19E-02	C	0	0.00E+00	0.00E+00	0.00E+00
Pyrenek	Yes	1.36E-06	C	1.36E-06	2.69E-05	1.34E-03	6.72E-07
Styrenek	Yes	0.0000236	E	0.0000236	4.67E-04	2.33E-02	1.17E-05
Tetrachloroethanek	Yes	2.48E-06	D	2.48E-06	4.90E-05	2.45E-03	1.23E-06
Toluenek	Yes	4.08E-04	B	4.08E-04	8.07E-03	4.03E-01	2.02E-04
Vinyl Chloridek	Yes	1.49E-05	C	1.49E-05	2.95E-04	1.47E-02	7.36E-06
Xylenek	Yes	1.84E-04	B	1.84E-04	3.64E-03	1.82E-01	9.09E-05
			Total HAPs	0.0002617	1.43	71.36	0.04

[1] Emission factors obtained from US EPA AP-42 Section 3.4 Large Stationary Diesel and All Stationary Dual-fuel Engines (10/96), Tables 3.4-3 and 3.4-4.
[2] Listed US EPA Hazardous Air Pollutants.
[3] Max. Hourly Emissions = Emission Factor (lb/MMBtu) *Max Heat Input Capacity per Engine (MMBtu/hr)
[4] Maximum Annual Emission Rate (lb/yr) = Hourly Emissions (lb/hr) * Annual Operating Hours (hr/yr)
[5] Maximum Potential Annual Emission Rate (tpy) = Hourly Emissions (lb/hr) * Annual Hours (hr/yr) ((1 ton/2000 lb).

Company:	MGS CNP 1, LLC
Emission Point ID:	BECCS-FUG BECCS Plant Equipment Leaks
HOURS OF OPERATION:	8,760

Emission Summary

Pollutant	Hourly Emission Rate lb/hr	Annual Emission Rate tpy
VOC	8.32	36.46
NH_3	0.60	2.64

Emission Calculation

Component	Product (Service)	Component Count[1]	TOC Emission Factor[2] kg/comp-hr	Stream Composition, wt%		Hourly Emissions, lb/hr	
				VOC	NH_3	VOC	NH_3
Valves	Rich Amine (Heavy Liquid)	58	0.00023	44%	0.0001%	0.01	2.93E-08
Pump Seals		2	0.00862			0.02	3.79E-08
Compressor Seals		0	-			-	-
Pressure Relief Valves (Gas Service)		5	0.104			0.50	1.14E-06
Flanges		200	0.00183			0.36	8.05E-07
Open-ended Lines [3]		15	0			0.00	0.00E+00
Valves	Lean Amine (Heavy Liquid)	410	0.00023	47%	-	0.10	-
Pump Seals		10	0.00862			0.09	-
Compressor Seals		0	-			-	-
Pressure Relief Valves (Gas Service)		37	0.104			3.96	-
Flanges		1362	0.00183			2.57	-
Open-ended Lines [3]		104	0			0.00	-
Valves	Natural Gas (Gas)	6	0.00597	12%	-	0.01	-
Pump Seals		0	-			-	-
Compressor Seals		0	0.228			0.00	-
Pressure Relief Valves		0	0.104			0.00	-
Flanges		22	0.00183			0.01	-
Open-ended Lines [3]		1	0			0.00	-

Table N-14 Equipment Leaks
MGS CNP 1, LLC

Component	Product (Service)	Component Count[1]	TOC Emission Factor[2] kg/comp-hr	Stream Composition, wt%		Hourly Emissions, lb/hr	
				VOC	NH_3	VOC	NH_3
Valves	Diesel (Heavy Liquid)	29	0.00023	100%	-	0.01	-
Pump Seals		1	0.00862			0.02	-
Compressor Seals		0	-			-	-
Pressure Relief Valves (Gas Service)		1	0.104			0.23	-
Flanges		109	0.00183			0.44	-
Open-ended Lines [3]		6	0			0.00	-
Valves	Aqueous Ammonia (Light Liquid)	61	0.00403	-	25%	-	1.35E-01
Pump Seals		2	0.0199			-	2.19E-02
Compressor Seals		0	-			-	-
Pressure Relief Valves (Gas Service)		4	0.104			-	2.29E-01
Flanges		216	0.00183			-	2.17E-01
Open-ended Lines [3]		14	0			-	0.00E+00
Total Hourly Emissions, lb/hr						8.32	0.60

[1] *Component Count is estimated based on similar projects.*

[2] *TOC emission factor is obtained from protocol for equipment leak emission estimates, EPA-453/R-95-017, November 1995, Table 2-1. SOCMI Average Emission Factors*

[3] *Open-ended Lines will be equipped with a cap, blind flange, plug, or a second valve; therefore a 100% control credit is taken.*

[4] *Sampling connections will be closed-purge connections; therefore a 100% control credit is taken.*

Truck Loadout of Degraded Amine
Overview:
Degraded amine removed from the reclaiming system will be loaded offsite by trucks. Maximum permit calculations are based on 2000 barrels per year. For hourly maximum, the loading rate is 105 GPM (150 barrels per hour). MEA is used to represent the amine.

Emissions Methodology:
AP-42, Section 5.2 : Transport and Marketing of Petroleum Liquids
Formula for calculating loading losses:

$$L_L = 12.46\,\frac{S * P * M}{T}$$

AP-42, Section 5.2 6/08, Equation 1

where:
L_L = Loading loss, pounds per 1000 gallons (lb/10^3 gal) of liquid loaded
S = A saturation factor (based on type and service of loaded vessel)
P = True vapor pressure of liquid loaded, pounds per square inch absolute
M = molecular weight of vapors, pounds per pound-mole (lb/lb-mole)
T = temperature of bulk liquid loaded, °R 524.97 °R

Physical and Chemical Properties:

Emission Unit ID	True Vapor Pressure [1] (psia)	MW of Vapors [1] (lb / lb-mole)	Loading Loss (lb / 10^3 gal)	Notes
VOC - Amine -LOAD	0.0027	61.08	0.002	Submerged Loading: dedicated normal service, Uncontrolled

Throughput and Emissions:

Emission Unit ID	Max Hourly Mgal/hr	Annual Mgal/yr	Max Hourly Vapor Released (lb / hr)	Maximum Annual Vapor Released (lb/yr)	Notes
VOC - Amine -LOAD	6.3	84	0.015	0.20	Submerged Loading: dedicated normal service, Uncontrolled

Degraded Amine loading vapors - Uncontrolled

Emissions	Average lb / hr	Maximum lb / hr	Maximum tons /yr
VOC - Amine -LOAD	0.000022	0.015	0.00010

Calculation of MEA vapor pressure

Components	MW	Wt.%	mol%	a	b	c
				dimensionless	(°K)	(°K)
MEA [1]	61.08	100.00	100.00	4.29252	1408.87	-116.093

P_{VA}	0.0026844	psia

[1] Pressure equation for MEA is P_{VA} in bar and T in °K. P = 10^(A-B/(C+T)). (https://webbook.nist.gov/cgi/cbook.cgi?ID=C141435&Mask=4&Type=ANTOINE&Plot=on).
P_{VA} in bar is converted to psia by multiplying 14.50377. Temperature range [338.6 to 444.1] K.

Source Name:	Wastewater Treatment Plant	**EPN:**	127-PKG-0001	
Proposed Limits		**Date:**	5/6/2025	
FIN	**EPN**	**Air Contaminant**[3]	**lbs/hr** [1]	**tpy**
127-PKG-0001	127-PKG-0001	NH3	0.51	2.10
		H2SO4	0.64	2.79
		HCl[2]	0.12	0.57

[1] Hourly emission rate is the emission rate under normal operating conditions.

[2] Hazardous Air Pollutant

[3] VOC and HAPs were excluded from this calculation

Process Description:

The wastewater treatment plant will receive water from the direct contact cooler/polishing scrubber system. The scrubbing liquid will have direct contact with the flue gas exhaust from the boiler. The scrubber solution will adsorb ammonia, sulfuric acid and hydrochloric acid that could be present in the flue gas. The scrubbing solution will be sent to the Wastewater Treatment Plant for further processing before it is discharged to the outfall. It is conservatively assumed that 10% of the ammonia, sulfuric acid and hydrochloric acid in the flue gas could be emitted from the Wastewater Treatment plant. The wastewater treatment plant will also receive water from the demineralized water system, raw water treatment, flush pond water, cooling tower water and boiler blowdown water. These streams are not expected to contribute emissions from the wastewater treatment plant.

Emission Unit ID	Emission Point ID	Proposed Emission Point ID	Emission Unit Description	Year Installed	Design Capacity	Control Device
BFB Boiler						
121-H-2001	121-PKG-3001 or 122-T-1001	121-PKG-3001 - EP or 122-T-1001 - EP	Wood Chip Fired Fluidized Bed Boiler	2026	944 MMBtu/hr	H2001-1C - Pulse Jet Fabric Filter H2001-2C - SCR H2001-3C - CO Oxidation Catalyst H2001-4C - Wet Flue Gas Desulfurization H2001-5C - Dry Sorbent Injection
121-S-5001			Makeup Sand Silo	2026	50 Tons/hr	
121-S-9901			Sodium Bicarbonate Storage Silo	2026	100 lbs/hr	
Biomass Handling Process						
121-LS-1001	121-PKG-1001	121-PKG-1001 - EP	Biomass Receiving Hopper 1001	2026	212 tons/hr	Baghouse 121-PKG-1001
121-LS-1002			Biomass Receiving Hopper 1002	2026	212 tons/hr	
121-CV-1001	121-CV-1001	121-CV-1001 - EP	Conveyor #1 from Biomass Receiving Hopper 1001 to Storage Pile	2026	106.07 tons/hr	Covered
121-CV-1002	121-CV-1002	121-CV-1002 - EP	Conveyor #2 from Biomass Receiving Hopper 1002 to Storage Pile	2026	106.07 tons/hr	Covered
CHIP-1	CHIP-1	CHIP-1 - EP	Biomass Storage Pile Loading Fugitives	2026	106.07 tons/hr	NA
121-S-1001	121-S-1001	121-S-1001 - EP	Biomass Feed Hopper	2026	106.07 tons/hr	NA
121-CV-1003	121-CV-1003	121-CV-1003 - EP	Conveyor from Feed Hopper to 121-CV-2001 A/B	2026	106.07 tons/hr	Covered
121-CV-2001 A	121-CV-2001 A	121-CV-2001 A - EP	Screw Conveyor from Biomass Feed Hopper A to Biomass Fuel Metering Bin 121-S-2001 A	2026	106.07 tons/hr	Covered
121-CV-2001B	121-CV-2001B	121-CV-2001B - EP	Screw Conveyor from Biomass Feed Hopper B to Biomass Fuel Metering Bin 121-S-2001 B	2026	106.07 tons/hr	Covered
121-S-2001 A	121-S-2001 A	121-S-2001 A - EP	Biomass Fuel Metering Bin A	2026	106.07 tons/hr	NA
121-S-2001 B	121-S-2001 B	121-S-2001 B - EP	Biomass Fuel Metering Bin B	2026	106.07 tons/hr	NA
CHIP-2	CHIP-2	CHIP-2 - EP	Wood Chips Storage Pile	2026	-	NA

Fly Ash / Economizer Ash Handling Process						
121-CV-4001 A	121-CV-4001 A	121-CV-4001 A - EP	PJFF Ash Collection Drag Chain Conveyor A (From boiler hopper to surge bin A)	2026	4.5 tons/hr	Covered
121-CV-4001 B	121-CV-4001 B	121-CV-4001 B - EP	PJFF Ash Collection Drag Chain Conveyor B (from boiler to surge bin B)	2026	4.5 tons/hr	Covered
121-CV-4002	121-CV-4002	121-CV-4002 - EP	PJFF Ash Transport Drag Chain Conveyor (From Surge Bins #1 and #2 to PJFF Ash Transfer Drag Chain Conveyor)	2026	4.5 tons/hr	Covered
121-CV-4003	121-CV-4003	121-CV-4003 - EP	PJFF Ash Transfer Drag Chain Conveyor (to Ash Bucket Elevator)	2026	4.5 tons/hr	Covered
121-CV-4004	121-CV-4004	121-CV-4004 - EP	Ash Bucket Elevator	2026	4.5 tons/hr	Covered
121-CV-4005	121-CV-4005	121-CV-4005 - EP	Ash Distribution Drag Chain Conveyor (From Ash Bucket Elevator to Fly Ash Storage Silos)	2026	4.5 tons/hr	Covered
121-CV-4006 A	121-CV-4006 A	121-CV-4006 A - EP	Economizer Hopper Ash Drag Chain Conveyor A (From Economizer Hopper to Economizer Hopper Ash Surge Bin A)	2026	3.3 tons/hr	Covered
121-CV-4006 B	121-CV-4006 B	121-CV-4006 B - EP	Economizer Hopper Ash Drag Chain Conveyor B (From Economizer Hopper to Economizer Hopper Ash Surge Bin B)	2026	3.3 tons/hr	Covered
121-CV-4007 A	121-CV-4007 A	121-CV-4007 A - EP	Economizer Ash Transport Conveyor A (From Economizer Ash Surge Bin A to Fly Ash Silo A)	2026	3.3 tons/hr	Covered
121-CV-4007 B	121-CV-4007 B	121-CV-4007 B - EP	Economizer Ash Transport Conveyor B (From Economizer Ash Surge Bin B to Fly Ash Silo B)	2026	3.3 tons/hr	Covered
121-S-4001 A	121-F-4001 A	121-F-4001 A - EP	Fly Ash Storage Silo A	2026	7.8 tons/hr	PJF 121-F-4001 A
121-S-4001 B	121-F-4001 B	121-F-4001 B - EP	Fly Ash Storage Silo B	2026	7.8 tons/hr	PJF 121-F-4001 B
121-TL-0001	121-TL-0001	121-TL-0001 - EP	Fly Ash Truck Loading	2026	8.6 tons/hr	N/A

Bottom Ash and Sand Handling Process						
121-CV-5001 A	121-CV-5001 A	121-CV-5001 A - EP	Metering Conveyor A (Bed Ash Screw A)	2026	2250 lbs/hr	Covered
121-CV-5001 B	121-CV-5001 B	121-CV-5001 B - EP	Metering Conveyor B (Bed Ash Screw B)	2026	2250 lbs/hr	Covered
121-CV-5002A	121-CV-5002A	121-CV-5002A - EP	Vibrating Screener A (to separate bottom ash and sand)	2026	2250 lbs/hr	Partial Enclosure
121-CV-5002B	121-CV-5002B	121-CV-5002B - EP	Vibrating Screener B (to separate bottom ash and sand)	2026	2250 lbs/hr	Trough hood (Partial enclosure)
121-S-1002	121-PKG-3001 or 122-T-1001	121-PKG-3001 or 122-T-1001 - EP	Sand Receiving Hopper	2026	50 tons/hr	NA Covered Vent piping to the BFB
121-CV-1004	121-CV-1004	121-CV-1004 - EP	Inclined Sand Hopper Conveyor	2026	50 tons/hr	
121-S-5001	121-PKG-3001; 122-T-1001	121-PKG-3001; - EP	Makeup Sand Silo	2026	50 tons/hr 1752 tons/yr	
121-CV-5003 A	121-CV-5003 A	121-CV-5003 A - EP	Transfer Conveyor A (Recycled Sand) (From Vibrating Screener A to Sand Bucket Elevator A)	2026	6000 lbs/24 hours	Partial Enclosure)
121-CV-5003 B	121-CV-5003 B	121-CV-5003 B - EP	Transfer Conveyor B (Recycled Sand) (From Vibrating Screener B to Sand Bucket Elevator B)	2026	6000 lbs/24 hours	Partial Enclosure)
121-CV-5004 A	121-CV-5004 A	121-CV-5004 A - EP	Sand Bucket Elevator A (Recycled Sand + Fresh Sand)	2026	650	Covered
121-CV-5004 B	121-CV-5004 B	121-CV-5004 B - EP	Sand Bucket Elevator B (Recycled Sand + Fresh Sand)	2026	650	Covered

NaHCO3 Handling Process						
121-S-9901	121-PKG-3001; 122-T-1001	121-PKG-3001; - EP122-T-1001 - EP	Sodium Bicarbonate Storage Silo	2026	1400 scfm gas flow (intermittent, 86 hrs/yr)	Vent routed to PJFF
121-S-9902 A	121-F-9902 A	121-F-9902 A - EP	Sodium Bicarbonate Vent Hopper A	2026	126 lbs/hr	PFJ 121-F-9902 A
121-S-9902 B	121-F-9902 B	121-F-9902 B - EP	Sodium Bicarbonate Vent Hopper B	2026	126 lbs/hr	PJF 121-F-9902 B
Others Point Sources						
129-CT-9301	129-CT-9301	129-CT-9301 - EP	Cooling Tower	2026	80,762 gpm	NA
PM-PlantRd	PM-PlantRd	PM-PlantRd - EP	Truck Road Fugitive Particulate Emissions	2026	Max 203 vehicles per day; On average 107 vehicles per day	NA
122-TK-9902	122-TK-9901	122-TK-9901 - EP	Amine Makeup Tank	2026	8812 gal (max)	NA
122-TK-9901	122-TK-9901	122-TK-9901 - EP	Lean Amine Tank	2026	375,986 gal (max)	NA
129-P-9402	129-P-9402	129-P-9402 - EP	Fire Water Pump	2026	600 HP	NA
129-PKG-0001	129-PKG-0001	129-PKG-0001 - EP	NG Startup Generator	2026	3000 HP	NA
VOC-Amine-LOAD	VOC-Amine-LOAD	VOC-Amine-LOAD - EP	Truck Loadout of Degraded Amine	2026	6.3 Mgal/hr	NA
127-PKG-0001	127-PKG-001	127-PKG-001 - EP	Wastewater Treatment Plant	2026	0.17 Mgal/yr 1,517.49 Mgal/yr	NA
Tanks						
129-TK-9402	129-TK-9402	129-TK-9402 - EP	Diesel Tank	2026	1616 gal (max)	NA
122-PKG-2001	122-PKG-2001	122-PKG-2001 - EP	Biodegraded Amine Tank	2026	4,488 gal (max)	NA