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ENGINEERING EVALUATION / FACT SHEET

BACKGROUND INFORMATION

Application No.:	R13-3622
Plant ID No.:	059-00102
Applicant:	TransGas Development Systems, LLC
Facility Name:	Ammonia Production Facility
Location:	Wharncliffe, Mingo County
SIC/NAICS Code:	2873/325311
Application Type:	Construction
Received Date(s):	June 30, 2023 (Original) October 3, 2023 (Final)
Engineer Assigned:	Joe Kessler
Fee Amount:	$2,000
Dates Received:	July 5, 2023 ($1,000) August 7, 2023 ($1,000)
Complete Date:	November 1, 2023
Due Date:	January 30, 2024
Applicant's Ad Date:	October 11, 2023
Newspaper:	*The Williamson Daily News*
UTM's:	418.156 km Easting • 4,163.591 km Northing • Zone 17
Latitude/Longitude:	37.61577/-81.92736
Description:	Construction of six (6) identical 6,000 metric tons/day (MTPD) ammonia manufacturing plants on the site of the previously permitted (but not constructed) coal-to-gasoline facility (Permit Number R13-2791A).

On February 25, 2010, TransGas Development Systems, LLC (TransGas) was issued permit R13-2791 (later modified under R13-2791A issued on August 5, 2011) for the construction of a coal-to-gasoline facility located near Wharncliffe, Mingo County, WV. Minor construction on the facility was initiated in June 2011 before the work was discontinued and no further construction activities took place on the site. On June 30, 2023, TransGas submitted a permit application for an ammonia manufacturing facility on the same site as the previously permitted coal-to-gasoline facility. While the existing permit has never been revoked, it has been determined that this application, due to the completely different facility-type and length of time passed, will be reviewed and presented as a new construction and not a modification of the existing permit. However, if a final determination is made to issue the permit, it will revoke and supercede R13-2791A.

DESCRIPTION OF PROCESS

TransGas has applied for a permit to construct up to six (6) identical, self-contained, 6,000 metric tons/day (MTPD), 2,125,000 metric tons/year (MTPY), ammonia manufacturing plants on an area of reclaimed surface mining activity near Wharncliffe, Mingo County, WV. The basic process will be to take a feedstock of natural gas and, after removing impurities, "crack" the gas into its hydrogen and carbon components (syngas) using Topsoe's (the primary vendor - formerly "Haldor Topsoe") proprietary autothermal reforming (ATR) technology. After cracking, the hydrogen will be, in the presence of injected nitrogen, synthesized into ammonia (NH_3). The ammonia vapor is then chilled to produce liquid ammonia for storage and transport. The produced Ammonia is used by customers primarily as fertilizer, either directly as ammonia, or indirectly after synthesis, as urea or other ammonia-based materials. Ammonia is also used as a material in the manufacture of polymeric resins, explosives, nitric acid, and other products.

TransGas has announced plans to capture and sequester (store underground) carbon dioxide (CO_2) as part of the production process. It is important to note that, as the proposed facility is defined as a minor source, greenhouse gases (GHGs) - which includes CO_2 - are not a regulated pollutant under the minor source permitting rule (45CSR13). Therefore, no review of the viability of the carbon capture and sequestration (CCS) claim was conducted, or will any requirement be written into the draft permit mandating the use of CCS. For informational purposes, ammonia generated from natural gas without CCS is referred to as "grey" ammonia while ammonia generated with CCS is referred to as "blue" ammonia.

The following detailed process description is for one 6,000 MTPD plant but the process is exactly the same for each of the proposed six (6) identical units (emission unit numbers given in parentheses are listed with an "X," where each plant will use a 1 through 6 to identify the specific unit). As noted, natural gas (up to 194.5 mmscf/day/plant) is provided to the facility by a third party and first sent through a **Feed Purification** (1S-X) step (desulfurization and removal of other impurities). This step involves the use of a 14.3 mmBtu/hr hydrogen-fired **Pre-Heater** (9S-X) and a 1,332.7 mmBtu/hr hydrogen-fired **Super Heater** (10S-X). Each of these units will burn excess hydrogen created in the plant when the plant is in a steady-state operation and combust natural gas and process gas during plant startup. Emissions from these units shall be combined in a single stack and Selective Catalytic Reduction (SCR) will be used to control generated NO_x emissions (1C-X).

In the desulfurization section, any sulfur and other impurities are removed from the natural gas via a hydrogenation step where sulfur components are converted to saturated hydrocarbons and then hydrogen sulfide (H_2S) over a hydrogenation catalyst bed. The H_2S is absorbed in a sulfur absorber containing a sulfur absorption catalyst. This step also preheats the feedstock and provides steam to the reforming section and to the Steam Electric Generators that provide steady-state electricity to the plant.

After the purification of the feedstock, the desulfurized gas goes to the **Reformer Section** (2S-X), where the syngas is generated. The Reformer Section uses proprietary Topsoe ATR technology under the trademark of "SynCOR™." In the SynCOR Reformer, the purified natural gas is mixed with steam at the required steam/carbon ratio before being placed in the presence of a pre-reformer catalyst. In the pre-reformer, all higher hydrocarbons are converted into a mixture of hydrogen, carbon monoxide (CO), CO_2, and methane (CH_4) by the steam reforming and water gas shift reactions. The pre-reformed natural gas and steam, together with a mixture of steam and high purity oxygen, enters the Cool Tip Swirler (CTS) burner at the top of the **Autothermal (ATR) Section** (3S-1). Exothermic reactions occur within the combustion zone and catalytic zone whereby the overall hydrocarbon reforming occurs. This reforming (or "cracking") process occurs in the presence of catalysts and converts the methane into hydrogen, CO and CO_2.

After exiting the SynCOR Reformer, the syngas (made up primarily of CO, CO_2, and H_2) is sent to the **CO Conversion Section** (4S-X), where the syngas undergoes CO shift reactions to convert the CO into additional CO_2 and to increase the amount of hydrogen in the syngas. The shift reaction takes place in two adiabatic shift converters, both containing a "shift catalyst." The CO_2 is then removed in the **CO_2 Removal Section** (6S-X). This is done by CO_2 absorption in a hot potassium carbonate solution (HPC). After capturing the CO_2, the now K_2CO_3 solution is sent to a distillation column where the pure CO_2 is boiled off. At this point, if CCS is employed, the CO_2 may be pressurized and handled accordingly. If a grey ammonia process, the CO_2 is emitted into the ambient air.

The remaining syngas, mostly containing just hydrogen at this point, is sent through a hydrogen purification step where inert gases are removed and some of the hydrogen is routed to the Pre-Heater and Super Heater and used as a fuel. The purified hydrogen gas stream is then sent through the **Nitrogen Wash Unit** (5S-X) before being processed in the **Ammonia Synthesis Loop** (7S-X). The syngas is introduced to a nitrogen wash in order to correct the H_2/N_2 ratio and to remove additional inert gases. A nitrogen wash replaces the more conventional steps of methanation, ammonia wash, and hydrogen recovery used in most ammonia facilities. The nitrogen wash removes both CO remaining after the shift reactions and trace amounts of methane remaining from the reforming section.

In the Ammonia Synthesis Loop, the now cleaned syngas with the correct ratio of nitrogen to hydrogen is synthesized in the presence of catalysts to produce ammonia. The synthesis gas is compressed and mixed with circulating synthesis gas from the ammonia loop recycle compressor, before being preheated and fed to the ammonia converter. The governing chemical reaction is: $N_2 + 3\ H_2 \Leftrightarrow 2\ NH_3$. The ammonia converter is a three-catalyst bed converter with radial flow through the catalyst beds. Between each of the catalyst beds, an interbed heat exchanger is installed and the interbed heat exchangers serve the purpose of removing the reaction heat prior to entering the next catalyst bed. The ammonia is created in vapor form and is then sent through a refrigeration step where the ammonia is purified and chilled into a liquid. The liquid ammonia is stored in a refrigerated tank with a capacity to hold approximately 22,500 lbs of ammonia product. From the storage tank, the liquid ammonia will be loaded onto trucks and transported off-site.

During startup of the above process, a 5.15 mmBtu/hr ammonia-fired **Startup Steam Generator** (8S-X) is used to generate heat and steam for the process prior to the plant's steady-state operation. Also during startups, syngas from the process will be routed to and controlled by a (maximum) 216,273 scf/min non-assisted **Process Flare** (2C-X). The Pre-Heater and Super-Heater will begin a startup cycle burning natural gas (for approximately 2 hours) before a transition to process gas to complete the startup process. Again, once the plant reaches steady-state, the heaters will then be fueled only by hydrogen. One startup cycle is estimated to last a maximum of about 15 hours, (the steam generator will only be needed for about 14 hours). NO_x emissions during startup as emitted from the steam generator and the heaters will be controlled by the SCR.

The facility will also include a Cummins Model C1000N6B 1,000 kW_e (1,082 kW_m), 1,451 horsepower (hp) natural gas-fired **Startup & Emergency Generator** (11S-X) to provide electrical power during startup and during times of power interruption. The plant will also include an Air Separation Unit (no regulated pollutants emitted) to provide nitrogen to the Ammonia Synthesis Loop. No substantive trucking emissions will occur at the site as the liquid ammonia will be piped off the hill to a railhead where it will be transported.

SITE INSPECTION

On April 8, 2009 and June 30, 2011, the writer conducted an inspection of the proposed location of TransGas's Ammonia Production Facility. These inspections were conducted as part of the review and compliance determination associated with R13-2791 and R13-2791A. As of the June 30, 2011 inspection, the site remained mostly untouched after reclamation of the mining activity and, based on satellite photos taken since that time, remains in that condition. For those reasons, an additional site inspection was not performed during the review of R13-3622. However, using the observations from those inspections and a review of the most recent satellite images, the following observations may be made:

- The proposed location of the TransGas facility is within the boundary of a former Cobra Run Natural Resources (CRNR) surface mine (Premium) in a remote location of Mingo County. No adjacent surface mining activity appears to be ongoing at the broader site (active mining was on-going during the review of R13-2791). The site is relatively isolated from any communities as it lies on the surface mined (and reclaimed) hills above Gilbert Creek that lies to the southeast;

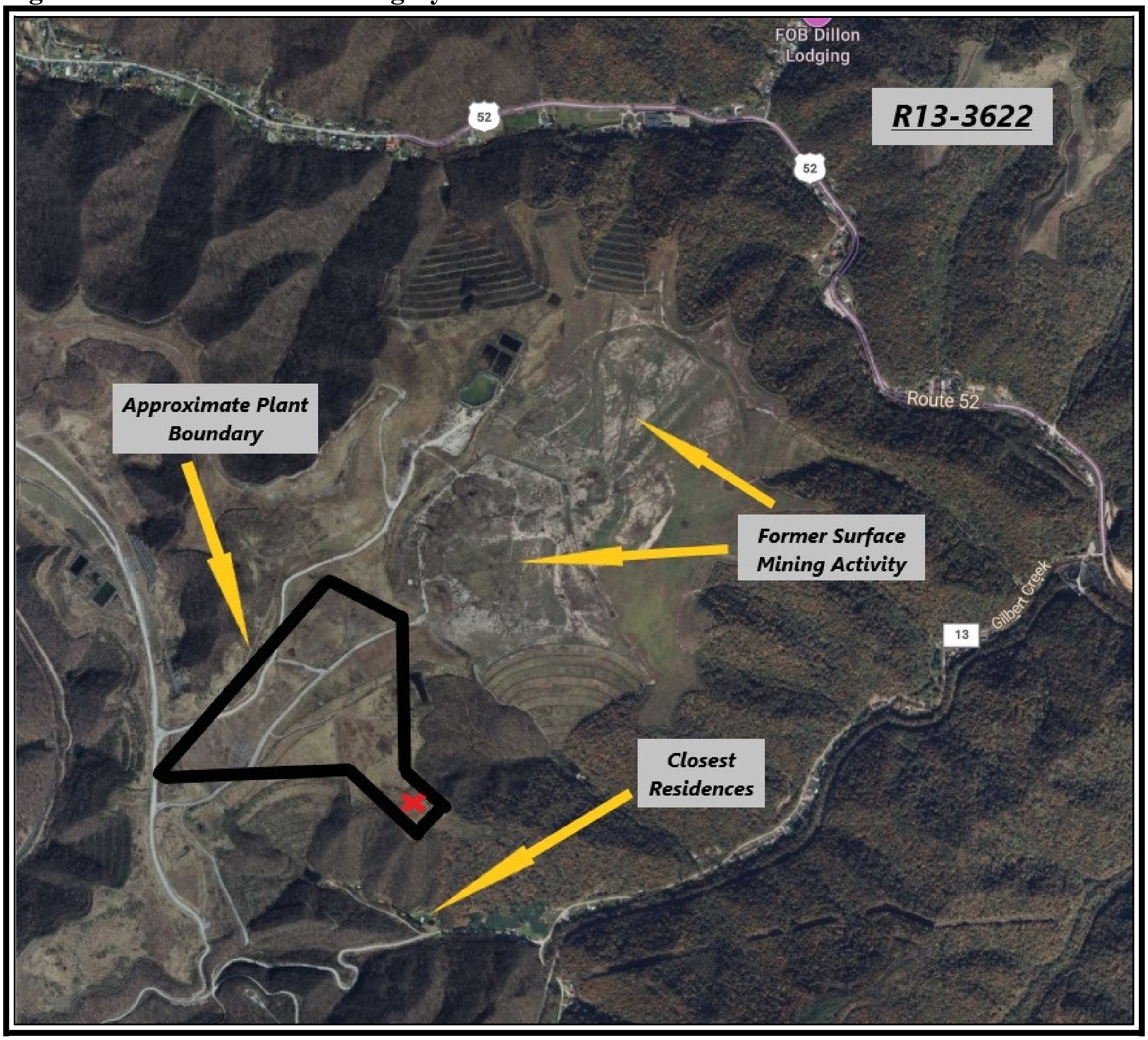
- The topography of the area surrounding the propose location is hilly, with deep cuts formed by various creeks and streams in the area. This region of southern West Virginia has seen heavy mining activity, both on the surface and underground and many areas of surface disturbance are located near the proposed site; and

- The closest occupied residences to the proposed location appear to be located approximately 0.70 miles southeast of the site along County Route 10 (Right Fork Ben's Creek Road). Notably, the community of Gilbert is located approximately 3.35 miles to the east and the Twisted Gun Golf Course lies approximately 1.75 miles to the southwest; and

Directions: [Latitude: 37.61577, Longitude: -81.92736] From the WV State Route 44 and U.S Highway 52 intersection, travel on 52S for approximately 7.3 miles until turning right on Gilbert Creek Road (County Road 13) and proceeding for approximately 1.9 miles. When reaching Right Fork Ben's Creek Road (County Route 10), turn right and go approximately 1.1 miles until the entrance of the old CRNR Premium Surface Mine is reached on the right. The proposed facility will be located approximately a mile up the hill inside CRNR property.

The following is labeled satellite imagery (taken from BingMaps - date unknown but 2018+) of the proposed site of the Ammonia Production Facility (the red "X" on the map represents the location where the picture of the site was taken as shown in Figure 2):

Figure 1: Labeled Satellite Imagery



The following is a picture taken from a location on the southeast of the site at the location of the red "X" on the map above:

Figure 2: View of Site from Southeast Corner

AIR EMISSIONS AND CALCULATION METHODOLOGIES

TransGas included in Attachment N of the permit application air emissions calculations for the proposed Ammonia Production Facility. The following will summarize the calculation methodologies used by TransGas to calculate the potential-to-emit (PTE) of the proposed facility.

Startup/Shutdown Emissions

The proposed Ammonia Product Plant will have distinct and separate emission profiles during plant startup, plant shutdown, and during steady-state operation of the plant. Most significantly, during startup/shutdown, the facility will burn off the syngas in the process flare until the plant components reach a point of proper temperatures and pressures to process the syngas into ammonia (startup) or until all the plant components are safely brought offline (shutdown). The following will detail the emissions that only occur during startup/shutdown of the plant. It is important to note that TransGas has only included in the facility-wide potential-to-emit (PTE) the emissions associated with six (6) startups and six (6) shutdowns per year. This estimate is based on a maximum of one (1) startup and shutdown per plant per year. However, if only one of the plants is in operation, that plant could undergo all six startup/shutdown cycles (and distributed as necessary as more plants are added) and the emissions would be accounted for.

Startup Steam Generators

As noted in the process description, a 5.15 mmBtu/hr ammonia-fired Startup Steam Generator (1E-X) is used in each plant to generate heat and steam for the process prior to the plant's steady-state operation. The unit is fired only on ammonia (NH_3) and, therefore, only produces emissions of ammonia slip (ammonia not combusted and emitted), N_2O, and NO_x. The emissions produced are sent to the SCR system to remove the NO_x prior to release into the air. The uncontrolled emissions of NO_x are based on the amount of ammonia combusted per hour during the startup cycle (the unit is estimated to operate for a maximum of 14 hours in the startup cycle). The highest amount consumed in any hour is 13,448 pounds, and the total for the whole cycle is 155,327 pounds (with a total heat input based on 382.8 Btu/lb-ammonia of 59.46 mmBtu/start-up cycle). Using this data and a calculated uncontrolled NO_x emission rate of 2.82 lb-NO_x/mmBtu, the uncontrolled emissions were calculated to be a maximum of 14.50 lbs/hr and full startup event total of 167.45 lbs of NO_x. The controlled emissions from the units are then reduced by 99% in the SCR, for a maximum hourly rate of 0.15 lbs/hr and 1.67 lbs/startup cycle. The ammonia feed rate was provided by the vendor and based on the simulated needs of the startup cycle. This unit then goes offline and does not operate during steady-state operations of the plant or during a plant shutdown.

Pre-Heater/Super-Heater - Startup

The 14.3 mmBtu/hr Pre-Heater (1E-X) and 1,332.7 mmBtu/hr Super Heater (1E-X) begin the startup cycle combusting natural gas (this phase lasts approximately 2 hours). After this period, the plant components begin to produce process gas that is then used to first supplement and then replace the natural gas in the heaters. The heaters then combust process gas until the transition late in the startup cycle of the fuel to hydrogen. As noted above, once the plant achieves steady-state operation, the heaters will combust only excess hydrogen produced in the process. The emissions of CO, NO_x and SO_2 during startup are based on process simulations/modeling provided by the vendor. Emissions of particulate matter, VOCs, and HAPs during this startup cycle are conservatively based on the amount of gas combusted and emission factors taken from AP-42, Section 1.4 - "Natural Gas Combustion" (AP-42 is a database of emission factors maintained by EPA) and are based on the heat content of the specific process gas streams. As during steady-state, emissions from the heaters are sent to the SCRs for control of NO_x (a 99% control rate). The heaters do not have a separate emissions profile during the shutdown phase.

Flaring- Startup

As noted, during startup and during shutdowns, syngas from the process will be routed to and controlled by a (maximum) 216,273 scf/min non-assisted Process Flare (2E-X). During startup, several areas of the plant will evacuate process gas to the flare until steady-state conditions are achieved. At that time, the flaring will no longer need to occur and the process gas shall be routed through the areas of the plant. The flow rates of the gas sent to the flare during startup are given in Attachment N of the permit application.

Some of the process gas produced in the startup phase is also combusted in the Pre-Heater/Super-Heater (as discussed above). The components of the gas and the amounts are based on process simulations/modeling provided by the vendor. The complete startup cycle (the amount of time the flare is in operation is approximately 40 hours. The emissions of CO and NO_x from the flaring are based on vendor provided post-flaring concentrations (given in ppm_v). The emissions of SO_2 are also calculated as a mass balance considering any sulfur remaining in the process gas. The emissions of particulate matter, VOCs, and HAPs are very conservatively based on emission factors are also taken from AP-42, Section 1.4 - "Natural Gas Combustion" and are based on the heat content of the specific process gas streams. It is important to note that the startup phase produces relatively high short-term pollutant emissions but, as the startup phase is short and the amount of startup is calculated at only one (1) per year per plant, the annual emissions from flaring are low.

Flaring- Shutdown

Flaring also occurs during a shutdown of the plant as plant components are brought down off pressure and the remaining process gases are evacuated to the Process Flare. The emissions from the shutdown phase are based on emission factors provided by the vendor. The shutdown cycle is estimated to last approximately 1 hour. As with the startup emissions profile, it is important to note that the shutdown phase produces relatively high short-term pollutant emissions but, as the shutdown phase is short and the amount of shutdowns is calculated at only one (1) per year per plant, the annual emissions from flaring during shutdown are low.

Steady-State Emissions

When the plant is fully at temperature and pressure and is producing ammonia, it is operating in a steady-state mode. The only emission sources during this mode are the combustion exhaust emissions from the Pre-Heater (1E-X) and Super Heater (1E-X) and the leaks from the piping components at the plant.

Pre-Heater/Super-Heater - Steady-State

As noted elsewhere, during steady state the 14.3 mmBtu/hr Pre-Heater (9S-X) and the 1,332.7 mmBtu/hr Super Heater (10S-X) are fired by excess hydrogen produced in the Reformer. As the units only combust purified hydrogen, the only pollutant produced in the combustion process is "thermal" NO_x - this is NO_x created by the oxidation of the nitrogen in ambient air within the combustion process. These NO_x emissions (uncontrolled) were calculated based on the size of the heaters and the expected amount of hydrogen feed to the units. The controlled emissions were then based on utilization of the SCR for NO_x control, at an efficiency of 99%. The annual emissions are based conservatively on the units operating 8,760 hours/yr.

In addition to the creation of thermal NOx when combusting hydrogen, TransGas also calculated the nominal amount of combustion exhaust created from the use of natural gas as a flame detection method. As hydrogen burns clear, trace amounts of natural gas are introduced into the burner so the flame is visible for monitoring purposes. The amount introduced was estimated to be a maximum aggregate of only 16.7 scf/hr for both units. The emissions produced from this trace natural gas were based on AP-42, Section 1.4 - "Natural Gas Combustion" and are based on the nominal low-heating value of the natural gas of 979.98 Btu/scf. Annual emissions are based on the use of the flame detection gas for 8,760 hours/yr.

Component Leaks

TransGas based their VOC/HAP fugitive equipment leak calculations on emission factors taken from the document EPA-453/R-95-017 - "Protocol for Equipment Leak Emission Estimates" Table 2-1. Aggregate component counts were based on engineering estimates for the specific sections of the proposed plant. No control efficiencies were used. No VOCs were estimated as emitted from component leaks as only methane emissions occur, which is not defined as a VOC. Emissions of CO are the only regulated pollutant emitted from component leaks and are based on the following mole percentage for process lines 2015, 2012, 2160, 3745, and 7170: CO - 7.2%, and for process line 3745 - 0.01%. Based on this methodology, the fugitive emissions of CO from each individual ammonia plant will be 1.47 tons/year with an aggregate facility-wide total of 8.79 tons/year.

Emergency Engine

Potential emissions from the proposed 2-Stroke Lean Burn (2SLB) Cummins Model C1000N6B 1,000 kW_e (1,082 kW_m), 1,451 horsepower (hp) natural gas-fired Startup & Emergency Generators (4E-X) are each based, where applicable, on either information provided by the vendor or on AP-42, Section 3.2 - "Natural Gas-fired Reciprocating Engines." A heat input of 9.85 mmBtu/hr was used in the calculations (as based on a heat ratio of 147.3 hp/mmBtu). The emissions from the units are given in the following table:

Table 1: Per-Emergency Generator PTE

Pollutant	Emission Factor		Source	Hourly (lb/hr)	Annual (ton/yr)
	Value	Units			
CO	1.60	g/hp-hr	Vendor	5.11	0.26
NO_X	1.00	g/hp-hr	Vendor	3.20	0.16
$PM_{2.5}/PM_{10}/PM$(2)	4.83e-02	lb/mmBtu	AP-42, Table 3.4-1	0.48	0.03
SO_2	5.88e-04(1)	lb/mmBtu	AP-42, Table 3.2-1	5.79e-03	0.01
VOCs	0.120	lb/mmBtu	AP-42, Table 3.2-1	1.18	0.06
Total HAPs	7.95e-02	lb/mmBtu	AP-42, Table 3.2-1	0.78	0.04

(1) Based on a fuel sulfur content of 2,000 gr/10^6 scf.

Emissions Summary

Based on the above estimation methodology as submitted in Attachment N of the permit application, the facility-wide annual PTE (based on all six identical plants in operation) of the proposed Ammonia Production Facility is given in the following table.

Table 2: Facility-Wide Annual PTE

Pollutant	Startup/ Shutdown(1)	Steady-State	Electric Generators	Fugitives	Facility-Wide
CO	2.92	0.12	1.56	8.79	13.39
NO_x	11.42	40.14	0.96	0.00	52.52
$PM_{2.5}$(2)	0.10	0.12	0.18	0.00	0.40
PM_{10}(2)	0.10	0.12	0.18	0.00	0.40
PM(2)	0.10	0.12	0.18	0.00	0.40
SO_2	<0.01	0.12	0.06	0.00	0.18
VOC	0.07	0.12	0.36	0.00	0.55
Total HAPs	0.03	0.00	0.24	0.00	0.27

(1) Includes Startup Steam Generator, Heaters, and Flaring during startup and shutdown.
(2) Includes Condensables.

REGULATORY APPLICABILITY

The proposed Ammonia Production Facility is subject to substantive requirements in the following state and federal air quality rules and regulations:

Table 3: Applicable State and Federal Air Quality Rules and Regulations

State Air Quality Rules	
Emissions Standards	
45CSR2	To Prevent and Control Particulate Air Pollution from Combustion of Fuel in Indirect Heat Exchangers
45CSR6	To Prevent and Control Particulate Air Pollution from Combustion of Refuse
45CSR10	To Prevent and Control Air Pollution from the Emission of Sulfur Oxides
Permitting Programs and Administrative Rules	
45CSR13	Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants, Notification Requirements, Administrative Updates, Temporary Permits, General Permits, and Procedures for Evaluation
45CSR22	Air Quality Management Fee Program

Federal Air Quality Regulations	
New Source Performance Standards (NSPS) - 40 CFR 60	
Subpart JJJJ	Standards of Performance for Stationary Compression Ignition Internal Combustion Engines
Maximum Achievable Control Technology (MACT) - 40 CFR 63[(1)]	
Suboart ZZZZ	National Emission Standard for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines

(1) As the facility-wide PTE does not exceed 10 TPY of any individual HAP or 25 TPY of aggregate HAPs, the proposed TransGas facility is defined as a non-major "area source" for the purposes of 40 CFR 63 applicability. Therefore, only certain MACTs that apply to area sources have potential applicability to the proposed source.

Each applicable rule (and any rule that warrants a discussion of non-applicability) and TransGas's proposed compliance therewith will be summarized below.

WV State Air Quality Rules

45CSR2: To Prevent and Control Particulate Air Pollution from Combustion of Fuel in Indirect Heat Exchangers - (Not Applicable)

45CSR2 "*establishes emission limitations for smoke and particulate matter which are discharged from fuel burning units.*" A fuel burning unit is defined under 45CSR2 as any "*furnace, boiler apparatus, device, mechanism, stack or structure used in the process of burning fuel or other combustible material for the primary purpose of producing heat or power by indirect heat transfer.*" Additionally, the definition of "indirect heat exchanger" specifically excludes process heaters, which are defined as "*a device that is primarily used to heat a material to initiate or promote a chemical reaction in which the material participates as a reactant or catalyst.*" Based on the definition and exclusion of process heaters, the 14.3 mmBtu/hr Pre-Heater and the 1,332.7 mmBtu/hr Super Heater are not subject to 45CSR2. The 5.15 mmBtu/hr ammonia-fired Startup Steam Generator is below the 45CSR2 heat input exclusion given under §45-2-11.1 and, as it does not produce any particulate matter emissions, is not subject to the opacity limits under §45-2-3.

45CSR6: To Prevent and Control Particulate Air Pollution from Combustion of Refuse

TransGas has proposed the use of identical Process Flares (2C-X) for control of various waste gas streams produced during plant startup/shutdown (see description above). Each identical unit meets the definition of an "incinerator" under 45CSR6 and is, therefore, subject to the requirements therein. The substantive requirements applicable to the Process Flares are discussed below.

45CSR6 Emission Standards for Incinerators - Section 4.1

Section 4.1 limits PM emissions from incinerators to a value determined by the following formula:

Emissions (lb/hr) = F x Incinerator Capacity (tons/hr)

Where, the factor, F, is as indicated in Table I below:

Table I: Factor, F, for Determining Maximum Allowable Particulate Emissions

Incinerator Capacity	Factor F
A. Less than 15,000 lbs/hr	5.43
B. 15,000 lbs/hr or greater	2.72

Based on information in the permit application, each Process Flare will have a maximum capacity of 12,976,386 scf/hr. Using methane as a surrogate for the process gases sent to the flares, we can estimate the maximum capacity of the flare. Based on the maximum capacity of the proposed units of 12,976,386 ft^3/hr, and using the density of methane (0.0422 lb/scf), the capacity of the units in lbs/hr would be approximately 547,603 lbs/hour (273 tons/hr). Using this value in the above equation produces a particulate matter emission limit of 743 lb/hr. Based on information provided by TransGas, the worst case particulate matter emissions from each unit were estimated to be only 7.54 lbs/hr. This emission rate will easily meet the individual 45CSR6 limit.

45CSR6 Opacity Limits for - Section 4.3, 4.4

Pursuant to Section 4.3, and subject to the exemptions under 4.4, the RTOs each will have a 20% limit on opacity during operation. Proper design and operation of the units should prevent any substantive opacity from the units.

45CSR7: To Prevent and Control Particulate Air Pollution from Manufacturing Process Operations - (Not Applicable)

45CSR7 has requirements to prevent and control particulate matter air pollution from manufacturing processes and associated operations. Pursuant to §45-7-2.20, a "manufacturing process" means "*any action, operation or treatment, embracing chemical, industrial or manufacturing efforts . . . that may emit smoke, particulate matter or gaseous matter.*" However, for the purposes of 45CSR7, a source of particulate matter emissions that is solely the result of the combustion of gaseous fuels is not considered a "source operation" as defined under §45-7-2.38. This is based on the definition that states a source operation is one that "*result in the separation of air contaminants from the process materials or in the conversion of the process materials into air contaminants.*" Gaseous fuels do not meet the reasonable definition of a "process material." Additionally, the particulate matter limits given under 45CSR7 only address filterable particulate matter, which are only about 25% of total natural gas particulate matter emissions (and similarly with other gaseous fules). This determination excludes all gaseous combustion sources from 45CSR7 applicability.

The proposed Ammonia Production Facility will only have particulate matter emissions associated with either gaseous fuel combustion (Pre-Heater/Super-Heater), the Electric Generator, and the Process Flare. 45CSR7 does not apply to the Electric Generator as it is also a combustion device and is subject to the particulate matter standards under 40 CFR 60, Subpart JJJJ, or the Process Flare as that unit is subject to the particulate matter standards under 45CSR6.

45CSR10: To Prevent and Control Air Pollution from the Emission of Sulfur Oxides - (Not Applicable)

The purpose of 45CSR10 is to "*prevent and control air pollution from the emission of sulfur oxides.*" 45CSR10 has requirements (Section 3) limiting SO_2 emissions from "fuel burning units," limiting in-stack SO_2 concentrations (Section 4) of "manufacturing process source operations," and limiting H_2S concentrations(Section 5) in "process gas" streams that are combusted. Sections 3 and 4 are potentially applicable to operations at the proposed TransGas Facility. Concerning Section 3, based on the same applicability definitions as discussed above under 45CSR2 (process heater and heat input exclusions), the 14.3 mmBtu/hr Pre-Heater, the 1,333.27 mmBtu/hr Super Heater, and the 5.15 mmBtu/hr ammonia-fired Startup Steam Generator are not subject to 45CSR10, Section 3.

Concerning Section 4, §45-10-4.1 states that "*[n]o person shall cause, suffer, allow or permit the emission into the open air from any source operation an in-stack sulfur dioxide concentration exceeding 2,000 parts per million by volume from existing source operations . . .*" TransGas has estimated small amounts of SO_2 emissions from the heaters during startup (combustion of process gases) and during steady-state (from combustion of trace amounts of natural gas for flame detection). However, pursuant to §45-10-4.1(e), "*a manufacturing process source operation(s) which has the potential to emit less than 500 pounds per year of sulfur oxides.*" The facility-wide PTE of SO_2 is 0.18 tons/yr (or 360 pounds/yr) and Section 4.1 does not apply.

Concerning Section 5, §45-10-5.1 states that "*[n]o person shall cause, suffer, allow or permit the combustion of any refinery process gas stream or any other process gas stream that contains hydrogen sulfide* [H_2S] *in a concentration greater than 50 grains per 100 cubic feet of gas . . .*" TransGas has conservatively estimated a trace amount of sulfur (100 ppb) left in the process gas as it is either combusted in the heaters or the process flare. However, this trace amount of sulfur is a conservative estimate only, and it is expected that the actual sulfur content after the natural gas desulfurization step will be undetectable. For this reason, it is clear that the process gas will easily be in compliance with the H_2S limit under §45-10-5.1.

45CSR13: Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants, Notification Requirements, Administrative Updates, Temporary Permits, General Permits, and Procedures for Evaluation

The proposed construction of the Ammonia Production Facility has the potential to emit a regulated pollutant in excess of six (6) lbs/hour and ten (10) TPY and, therefore, pursuant to §45-13-2.24, the proposed facility is defined as a "stationary source" under 45CSR13. Pursuant to §45-13-5.1, "*[n]o person shall cause, suffer, allow or permit the construction . . . and operation of any stationary source to be commenced without . . . obtaining a permit to construct.*" Therefore, TransGas is required to obtain a permit under 45CSR13 for the construction and operation of the proposed facility.

As required under §45-13-8.3 ("Notice Level A"), TransGas placed a Class I legal advertisement in a "newspaper of *general circulation* in the area where the source is . . . located." The ad ran on October 11, 2023 in *The Williamson Daily News* and the affidavit of publication for this legal advertisement was submitted on October 26, 2023.

45CSR14: Permits for Construction and Major Modification of Major Stationary Sources of Air Pollution for the Prevention of Significant Deterioration - (Not Applicable)

45CSR14 establishes and adopts a preconstruction permit program for the construction and major modification of major stationary sources in areas of attainment with the National Ambient Air Quality Standards (NAAQS). Mingo County is currently classified as in attainment with the NAAQS and, therefore, a proposed new "major stationary source" in Mingo County would be subject to the provisions of 45CSR14. The proposed Ammonia Production Facility is defined as a source listed under §45-14-2.43(a) - "Chemical Process Plant" - and, therefore, pursuant to 2.4(b), would be defined as a "major stationary source" if any regulated pollutant has a PTE in excess of 100 TPY. The proposed facility, however, does not have a potential-to-emit of any regulated pollutant in excess of 100 TPY (see Table 2 above) and is, therefore, not defined as a major stationary source and is not subject to the provisions of 45CSR14.

45CSR22: Air Quality Management Fee Program

45CSR22 establishes a program to collect fees for certificates to operate (CTO) and for permits to construct, modify or relocate sources of air pollution. The proposed Ammonia Production Facility is defined as a minor source and is not subject to 45CSR30 (see below). TransGas is, therefore, required to pay the appropriate annual fees and keep their CTO current under the program outline under 45CSR22. The proposed facility will be classified under 45CSR22 and assessed fees based on Fee Class 5A which is defined as "Chemical Production ≥ 3 Units."

45CSR30: Requirements for Operating Permits

45CSR30 provides for the establishment of a comprehensive air quality permitting system consistent with the requirements of Title V of the Clean Air Act. The proposed Ammonia Production Facility does not meet the definition of a "major source under §112 of the Clean Air Act" as outlined under §45-30-2.26 and clarified (fugitive policy) under 45CSR30b. The proposed facility-wide PTE (see Table X above) of any regulated pollutant does not exceed 100 TPY. Additionally, the facility-wide PTE does not exceed 10 TPY of any individual HAP or 25 TPY of aggregate HAPs. However, as the proposed facility is subject to a New Source Performance Standard (NSPS) - 40 CFR 60, Subpart JJJJ, and a National Emission Standard for Hazardous Air Pollutants (NESHAP) rule (40 CFR 63, Subpart ZZZZ), the facility would, in most cases, be subject to Title V as a "deferred source." However, pursuant to §60.4230(c) and §63.6585(d), respectively, as a non-major source, TransGas is not required to obtain a new Title V permit for the facility and is not considered a deferred source. Therefore, the facility is not subject to 45CSR30 and is subject to 45CSR22 as noted above.

<u>**Federal Air Quality Regulations**</u>

40 CFR 60, Subpart Db: Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units - (Not Applicable)

40 CFR 60 Subpart Dc is the New Source Performance Standard (NSPS) for industrial-commercial-institutional steam generating units for which construction, modification, or

reconstruction is commenced after June 19, 1984 and that have a maximum design heat input capacity greater than 100 mmBtu/hr. The definition of "steam generating unit," however, specifically exempts "process heaters." The definition of process heaters means "*a device that is primarily used to heat a material to initiate or promote a chemical reaction in which the material participates as a reactant or catalyst.*" The 1,332.7 mmBtu/hr Super-Heater meets this definition of a process heater and is, therefore, not subject to Subpart Db.

40 CFR Part 60, Subpart Dc: Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units - (Not Applicable)

Subpart Dc of 40 CFR 60 is the federal NSPS for small industrial-commercial-institutional "steam generating units" that have an MDHI of less than 100 mmBtu/hr and greater than 10 mmBtu/hr and that were constructed, modified, or reconstructed after June 9, 1989. Subpart Dc contains within it emission standards, compliance methods, monitoring requirements, and reporting and record-keeping procedures for affected facilities applicable to the rule. The definition of "steam generating unit," however, specifically exempts "process heaters." The definition of process heaters means "*a device that is primarily used to heat a material to initiate or promote a chemical reaction in which the material participates as a reactant or catalyst.*" The 14.30 mmBtu/hr Pre-Heater meets this definition of a process heater and is, therefore, not subject to Subpart Dc.

40 CFR 60 Subpart JJJJ: Standards of Performance for Stationary Spark Ignition Internal Combustion Engines

TransGas has proposed the use of identical 2-Stroke Lean Burn (2SLB) Cummins Model C1000N6B 1,000 kW_e (1,082 kW_m), 1,451 horsepower (hp) natural gas-fired Startup & Emergency Generators at each of the individual ammonia production plants. Each unit is defined under 40 CFR 60, Subpart JJJJ as a stationary spark-ignition internal combustion engine (SI ICE) and is, pursuant to §60.4230(a)(4)(i), subject to the applicable provisions of the rule. Pursuant to §60.4233(e): "*Owners and operators of stationary SI ICE with a maximum engine power greater than or equal to 75 KW (100 HP) (except gasoline and rich burn engines that use LPG) must comply with the emission standards in Table 1 to this subpart for their stationary SI ICE.*" Therefore, as an engine that is greater than 100 hp, each engine must comply with the emission standards under Table 1 of Subpart JJJJ as given in the following table:

Table 4: Subpart JJJJ Compliance

Pollutant	Standard (g/HP-hr)	Uncontrolled Emissions (g/bhp)(1)	Control Percentage(2)	Controlled Emissions (g/bhp)	JJJJ Compliant?
NO_x	1.0	Unknown	Unknown	1.00(1)	Yes
CO	2.0	Unknown	Unknown	1.60(1)	Yes
VOC	0.7	Unknown	Unknown	0.37(2)	Yes

(1) Emission rates are based on the specification sheet provided by vendor and are noted as post-control.
(2) Based on (1.18 lbs/hr * 453.59 g/lb)/1,451 hp.

Based on the emissions presented for the generators in Attachment N of the permit application, the electric generators will be in compliance with the Subpart JJJJ standards.

40 CFR 63, Subpart ZZZZ: National Emission Standard for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines

40 CFR 63, Subpart ZZZZ is a federal MACT that establishes national emission limitations and operating limitations for HAPs emitted from stationary reciprocating internal combustion engines (RICE) located at major and area sources of HAP emissions. As the proposed Ammonia Production Facility is defined as an area source of HAPs (see Table X), the facility is subject to applicable requirements of Subpart ZZZZ. Pursuant to §63.6590(c):

> An affected source that meets any of the criteria in paragraphs (c)(1) through (7) of this section must meet the requirements of this part by meeting the requirements of 40 CFR part 60 subpart IIII, for compression ignition engines or 40 CFR part 60 subpart JJJJ, for spark ignition engines. No further requirements apply for such engines under this part.

§63.6590(c)(1) specifies that "[a] *new or reconstructed stationary RICE located at an area source*" is defined as a RICE that shows compliance with the requirements of Subpart ZZZZ by "*meeting the requirements of . . . 40 CFR part 60 subpart IIII, for compression ignition engines.*" Pursuant to §63.6590(a)(2)(iii), a "[a] *stationary RICE located at an area source of HAP emissions is new if you commenced construction of the stationary RICE on or after June 12, 2006.*" The 1,500 1,500 kW_e diesel-fired Emergency Engine (5S-1) proposed for the Ammonia Production Facility is defined as a new stationary RICE and, therefore, compliance is shown with Subpart ZZZZ by meeting the requirements of 40 CFR 60, Subpart JJJJ. Compliance with Subpart JJJJ is discussed above.

<u>ANALYSIS OF NON-CRITERIA REGULATED POLLUTANTS</u>

This section provides information on those regulated pollutants that may be emitted from the proposed Ammonia Production Facility and that are not classified as "criteria pollutants." Criteria pollutants are defined as Carbon Monoxide (CO), Lead (Pb), Oxides of Nitrogen (NO_x), Ozone (inclusive of VOCs), Particulate Matter (PM_{10} and $PM_{2.5}$), and Sulfur Dioxide (SO_2). These pollutants have National Ambient Air Quality Standards (NAAQS) set for each that are designed to protect the public health and welfare. Other pollutants of concern, although designated as non-criteria *and without national concentration standards*, are regulated through various state and federal programs designed to limit their emissions and public exposure. These programs include federal source-specific HAP regulations promulgated under 40 CFR 61 and 40 CFR 63 (NESHAPS/MACT), and WV Legislative Rule 45CSR27 that regulates certain HAPs defined as Toxic Air Pollutants (TAPs). Any potential applicability to these programs were discussed above under REGULATORY APPLICABILITY.

The majority of non-criteria regulated pollutants fall under the definition of HAPs which are compounds identified under Section 112(b) of the Clean Air Act (CAA) as pollutants or groups of pollutants that EPA knows or suspects *may* cause cancer or other serious human health effects. These adverse health affects, however, may be associated with a wide range of ambient concentrations and exposure times and are influenced by source-specific characteristics such as emission rates and local meteorological conditions. Health impacts are also dependent on multiple factors that affect variability in humans such as genetics, age, health status (e.g., the presence of preexisting disease) and lifestyle. As stated previously, *there are no applicable federal or state ambient air quality standards for these specific chemicals*. For a complete discussion of the potential health effects of each compound listed in this section, refer to the IRIS database located at www.epa.gov/iris. It is important to note that the USEPA does not divide the various HAPs into further classifications based on toxicity or if the compound is a suspected carcinogen.

TransGas has estimated only trace amounts of HAPs emitted from the proposed facility and all are associated with HAPs created during the combustion of natural gas and process gas (during startup/shutdown). The primary contributor of HAP emissions are the six (6) Startup & Emergency Generators. However, as these units each are limited to operate only 100 hours/year, the annual emission rates of HAPs are low. The following table lists each HAP currently identified by MGM as potentially emitted in an amount greater than 10 lbs/year from the proposed engine. Additionally, information concerning the pollutant, and the associated carcinogenic risk (as based on analysis provided in the Integrated Risk Information System (IRIS)), and any potentially applicable MACT is provided.

Table 5: Non-Criteria Regulated Pollutant Information

Pollutant	CAS #	Type	PTE (lbs/yr)	Known/Suspected Carcinogen	Classification	MACT(1)
Acetaldehyde	75-07-0	VOC	45.90	Yes	B2 - Probable Human Carcinogen(2)	None
Acrolein	107-02-8	VOC	46.00	No	Inadequate Data(3)	None
Formaldehyde	50-00-0	VOC	324.00	Yes	B1 - Probable Human Carcinogen(4)	None
Methanol	67-56-1	VOC	14.70	No	Not Assessed(5)	None

(1) Does a MACT apply to this specific HAP for any emission unit at the facility? See "Regulatory Applicability" section for discussion.

(2) [**Acetaldehyde**] From IRIS: "*Based on increased incidence of nasal tumors in male and female rats and laryngeal tumors in male and female hamsters after inhalation exposure.*"

(3) [**Acrolein**] From IRIS: "*Under the Draft Revised Guidelines for Carcinogen Risk Assessment (U.S. EPA, 1999), the potential carcinogenicity of acrolein cannot be determined because the existing data are inadequate for an assessment of human carcinogenic potential for either the oral or inhalation route of exposure. There are no adequate human studies of the carcinogenic potential of acrolein. Collectively, experimental studies provide inadequate evidence that acrolein causes cancer in laboratory animals.*"

(4) [**Formaldehyde**] From IRIS: "*Based on limited evidence in humans, and sufficient evidence in animals. Human data include nine studies that show statistically significant associations between site-specific respiratory neoplasms and exposure to formaldehyde or formaldehyde-containing products. An increased incidence of nasal squamous cell carcinomas was observed in long-term inhalation studies in rats and in mice. The classification is supported by in vitro genotoxicity data and formaldehyde's structural relationships to other carcinogenic aldehydes such as acetaldehyde.*"

(5) [**Methanol**] From IRIS: "*Not assessed under the IRIS Program.*"

AIR QUALITY IMPACT ANALYSIS

The estimated maximum emissions of the proposed facility are less than applicability thresholds that would define the proposed facility as "major" under 45CSR14 and, therefore, no air quality impacts modeling analysis was performed.

MONITORING, COMPLIANCE DEMONSTRATIONS, REPORTING, AND RECORDING OF OPERATIONS

Monitoring and Compliance Demonstrations

The primary purpose of emissions monitoring is to determine continuous compliance with emission limits and operating restrictions in the permit over a determined averaging period. Emissions monitoring may include any or all of the following:

- Real-time continuous emissions monitoring to sample and record pollutant emissions (CEMS, COMS);
- Monitoring of plant-wide variables to limit the scope of the plant as applied for;
- Parametric monitoring of variables pre-determined to be proportional (at a known ratio) to emissions (recording of material throughput, fuel usage, production, etc.);
- Real-time tracking of materials and pollutant percentages used in processes where evaporation emissions are expected;
- Monitoring of control device performance indicators (pressure drops, liquid flow rates, oxidizer temperatures, etc.) to guarantee efficacy of pollution control equipment; and
- Visual stack observations to monitor opacity.

It is the permittee's responsibility to record, certify, and report the monitoring results so as to verify compliance with the emission limits. Where emissions are based on the maximum rated short and long-term capacity of units, generally no continuous emissions or parametric monitoring is required as compliance with the emission limits is based on the specific limited capacity of the units.

For the proposed TransGas facility, a mix of the above methods are used to give a reasonable assurance that continuous compliance with emission limits is being maintained. Specifically, some examples include:

- Monitoring of the usage and throughput of a number of different feedstock materials, operational data, and the final product [Table 4.2.3];
- Control device monitoring on the Process Flares [4.2.4]; and
- Visible emissions monitoring on the Process Flares [4.2.5].

In addition to site-specific monitoring and compliance demonstrations, TransGas is required to meet all applicable statutory requirements including those given under 40 CFR 60 Subpart JJJJ. Refer to Section 4.2 of the draft permit for all the unit-specific monitoring, compliance demonstration, reporting, and record-keeping requirements (MRR).

Record-Keeping

TransGas will be required to follow the standard record-keeping boilerplate language as given under Section 4.4 of the draft permit. This will require TransGas to maintain records of all data monitored in the permit and keep the information for a minimum of five years. All collected data will be available to the Director upon request. TransGas will also be required to follow all the record-keeping requirements as applicable under the variously applicable state and federal rules and regulations.

Reporting

Beyond the requirement to follow all reporting requirements as applicable under the variously applicable state and federal rules and regulations, TransGas will be required to submit the following substantive reports:

- The results of stack testing within sixty (60) days of completion of the test. The test report shall provide the information necessary to document the objectives of the test and to determine whether proper procedures were used to accomplish these objectives [3.3.1(d)];

- When necessary, any deviation of the allowable visible emission requirement for any emission source discovered during observation using 40 CFR Part 60, Appendix A, Method 9 must be reported in writing to the Director of the DAQ as soon as practicable, but within ten (10) calendar days, of the occurrence and shall include, at a minimum, the following information: the results of the visible determination of opacity of emissions, the cause or suspected cause of the violation(s), and any corrective measures taken or planned [4.2.5(d)];

- A report detailing all required monitoring on or before September 15 for the reporting period January 1 to June 30 and March 15 for the reporting period July 1 to December 31. All instances of deviation from permit requirements must be clearly identified in such reports [4.5.1(a)]; and

- On or before March 15, a certification of compliance with all requirements of the draft permit for the previous calendar year ending on December 31 [4.5.1(b)].

PERFORMANCE TESTING OF OPERATIONS

Performance testing is required to verify, where reasonable and appropriate, the emissions or emission factors used to determine emission units' potential-to-emit and to show initial or periodic compliance with permitted emission limits. Performance testing must be conducted in accordance with accepted test methods and according to a protocol approved by the Director prior to testing (as outlined under 3.3 of the draft permit). The draft permit outlines specific initial and periodic performance testing for the sources venting to the SCR under Section 4.3.2 and 4.3.3 of the draft permit. Refer to Section 4.3 of the draft permit for all performance testing requirements.

<u>RECOMMENDATION TO DIRECTOR</u>

The information provided in permit application R13-3622 indicates that compliance with all applicable state and federal air quality regulations will be achieved. Therefore, I recommend to the Director that the DAQ go to public notice with a preliminary determination to issue Permit Number R13-3622 to TransGas Development Systems, LLC for the construction of their Ammonia Production Facility located near Wharncliffe, Mingo County, WV.

Joseph Kessler

Digitally signed by: Joseph Kessler
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Date: 2023.12.20 18:59:15 -05'00'

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