GROUP AGAINST SMOG & POLLUTION
Wightman School Community Building
5135 Penn Avenue
Pittsburgh, PA 15224
412-924-0604
gasp-pgh.org

January 17, 2012

Via email and first class mail
Joyce E. Epps
Director
Bureau of Air Quality
Pennsylvania Department of Environmental Protection
Rachel Carson State Office Building
P.O. Box 8468
Harrisburg, PA 17105-8468
jeepps@state.pa.us

Dear Ms. Epps,

The Group Against Smog and Pollution (GASP) commends the Pennsylvania Department of Environmental Protection for requesting emissions inventory information from companies engaged in unconventional natural gas production in Pennsylvania. This industry is a significant and fast-growing source of emissions of ozone-forming oxides of nitrogen (NOx) and volatile organic compounds (VOCs). An accurate inventory of NOx and VOC emissions is critical to PADEP's efforts to develop an effective, economical strategy to bring the Commonwealth into compliance with federal health-based ambient air quality standards.

The inventory would have benefitted from earlier and more robust opportunities for outside input. While GASP has not had the opportunity to review the emissions reporting spreadsheet and any associated instructions or guidance to operators, based on the presentation and discussion of the emissions inventory effort at the January 12, 2012 Air Quality Technical Advisory Committee (AQTAC) meeting, it appears that PADEP's proposed emissions inventory reporting system contains several significant flaws.

We recognize that no emissions estimation effort is perfect and that PADEP's unconventional gas reporting system is certain to improve in future years. We also appreciate that the Department has little time to address the issues raised in this letter: PADEP has already sent many operators emissions notification letters and operators' emissions reporting deadline is March 1. However, the January 12 AQTAC meeting provided our first opportunity to review details of the emissions inventory reporting system. The problems described below are relatively simple to correct and failure to correct them will greatly compromise the accuracy of the inventory. GASP respectfully requests that PADEP correct these problems for the 2011 inventory effort.

1. **PADEP failed to send emissions inventory notification letters to multiple companies engaged in natural gas midstream operations.**

The omission of several natural gas midstream operators was first raised by the Clean Air Council in a December 29, 2011 letter to PADEP. Clean Air Council listed six operators who had not received a notification letter. PADEP acknowledged the omission and it is GASP's understanding that the Department has since notified the companies Clean Air Council identified. However, in addition to the operators identified by the Clean Air Council, the following operators of compression or processing facilities that may handle unconventional natural gas were not included in the initial round of emissions inventory notification letters:

CLIENT ID	OPERATOR
93241	AMER EXPLORATION CO
276496	ANADARKO MARCELLUS MIDSTREAM LLC
273033	ANGELINA GATHERING CO LLC
286989	APPALACHIA MIDSTREAM LLC
273767	APPALACHIA MIDSTREAM SVC LLC
146586	ATLAS AMER INC
261903	ATLAS ENERGY RESOURCES LLC
234309	ATLAS PIPELINE PA LLC
6422	ATLAS RESOURCES INC
38413	BELDEN & BLAKE CORP
278842	CAIMAN PENN MIDSTREAM LLC
76535	CATALYST ENERGY INC
265009	CHIEF GATHERING LLC
29248	COLUMBIA GAS TRANS LLC
268391	DAKOTA EXTRACTIONS LLC
81426	DOMINION PEOPLES
225798	DOUGLAS OIL & GAS LP
135012	EMKEY GATHERING LLC
155074	ENERGY RESOURCES OF AMER INC
263974	EPSILON ENERGY USA INC
274393	EQT GATHERING LLC
262578	EQUITABLE GATHERING LP
139115	EQUITRANS INC
27639	EQUITRANS LP
208722	FAIRMAN CORP
29235	FAIRMAN DRILLING CO
286740	HAYDEN HARPER ENERGY KA LLC
273855	KEYROCK ENERGY LLC
277788	KEYSTONE MIDSTREAM SVC LLC
134908	KRIEBEL MINERALS INC
283677	LASER NORTHEAST GATHERING CO LLC
274129	LAUREL MTN MIDSTREAM LLC
242599	LINN OPR INC
289643	M3 APPALACHIA GATHERING LLC
280245	MAINESBURG GATHERING SYS LLC
281299	MAINESBURG GS LP
264960	MARKWEST LIBERTY GAS GATHERING LLC
271958	MARKWEST LIBERTY MIDSTREAM & RESOURCES LLC
87845	MID EAST OIL CO
74858	MSL OIL & GAS CORP
280792	MTN GATHERING LLC
74892	NATL FUEL GAS SUPPLY CORP
241132	NCL NATURAL RESOURCES LLC

289492	NFG MIDSTREAM TROUT RUN LLC
24972	PHILLIPS PROD CO
47393	POWER GAS MKT & TRANS INC
279457	PVR MARCELLUS GAS GATHERING LLC
268526	REX ENERGY I LLC
278273	RW GATHERING LLC
282425	SOMERSET GAS GATHERING OF PA LLC
279214	STONEHAVEN ENERGY MGT CO LLC
276272	STRYKER ENERGY LLC
82080	TENNESSEE GAS PIPELINE CO
24453	TW PHILLIPS GAS & OIL CO
280218	VESSELS ECONERGY CAMBRIA 33 RESOURCES LLC
3372	VISTA RESOURCES INC
283562	WILLIAMS FIELD SVC CO LLC

The possibility that PADEP had overlooked additional midstream operators was discussed at the January AQTAC meeting. One potential remedy the Department discussed was to assemble a list of all companies operating a facility permitted under Bureau of Air Quality General Permit 5 (GP5) for natural gas production or recovery facilities. GASP supports this suggestion but notes that while this measure would identify many operators engaged in unconventional gas midstream operations, it would still exclude those companies that only operate natural gas production or recovery facilities under full plan approvals. For instance, GASP believes the following companies operate no GP5 facilities but do operate gas processing plants or compressor stations permitted under full plan approvals:

CLIENT ID	OPERATOR
24453	TW PHILLIPS GAS & OIL CO
27639	EQUITRANS LP
29248	COLUMBIA GAS TRANS LLC
74892	NATL FUEL GAS SUPPLY CORP
82080	TENNESSEE GAS PIPELINE CO
139115	EQUITRANS INC

The companies listed above would not receive an emissions inventory notification letter if PADEP assembles its notification list based solely on operators of GP5 facilities. In order to ensure that a complete emissions inventory is generated, PADEP must expand its search for unconventional gas midstream companies to include operators of compressor stations and gas processing plants permitted under full plan approvals, in addition to operators of GP5 facilities.

2. PADEP's emissions reporting system currently excludes all unconventional natural gas emission units that are not associated with a well pad, general permit, or plan approval.

The emissions reporting system as it was described at the January 12, 2012 AQTAC meeting would require operators to provide emissions associated with wells or well pads and emissions associated with facilities permitted under a general permit or plan approval. However, PADEP fails to provide a reporting mechanism for those

unconventional natural gas emission units that are not located at a well pad or a permitted facility. Condensate and produced water tank batteries, metering stations, and flowback water impoundments are among the emissions sources that may be present in a production field without being located at a well pad or permitted facility. PADEP conducted ambient air monitoring at both a tank farm and an impoundment during its Marcellus Shale short term ambient air sampling studies.[1] If such source categories merited inclusion in the short term ambient air sampling initiative, surely they should also be included in the unconventional gas emissions inventory.

Remedying this problem could be as simple as including a sentence in the emissions inventory reporting instructions directing operators to submit an additional emissions spreadsheet for any unconventional gas stationary emission units not located at a well pad or permitted site.

3. **PADEP's fugitive emissions calculations fail to differentiate between wet and dry gas streams, which will result in significant underestimation of VOC emissions due to equipment leaks.**

While the emissions reporting spreadsheet relies on operators to perform the emissions calculations for most unconventional gas emission units and pollutant emitting activities, for equipment leaks operators are currently only required provide a component count. The reporting spreadsheet would then derive VOC emissions from this component count using a PADEP-provided formula. Presumably the PADEP formula will be based on a typical dry or pipeline-quality gas composition. However, the VOC weight percentage of wet gas is significantly higher than that of dry or pipeline-quality gas. Failure to account for this variation in VOC weight percentage would result in significant underestimation of VOC emissions from equipment leaks in wet gas areas.

The following table provides emissions estimates for 20 valves in dry gas service and 20 valves in wet gas service. The dry gas and wet gas scenarios use the same total organic compound (TOC) emission rate provided in EPA's Protocol for Equipment Leak Emission Estimates.[2] The only difference between the two calculations is that the first estimate uses a VOC weight % of TOC typical of dry gas,[3] while the second uses a VOC weight % typical of wet gas.[4]

[1] PADEP, Southwestern Pennsylvania Marcellus Shale Short-Term Ambient Air Sampling Report (Nov. 1, 2010) at 11 & 13, *available at:* http://www.dep.state.pa.us/dep/deputate/airwaste/aq/aqm/docs/Marcellus_SW_11-01-10.pdf.
[2] USEPA, Protocol for Equipment Leak Emission Estimates (Nov. 1995) at 2-15, *available at:* http://www.epa.gov/ttn/chief/efdocs/equiplks.pdf.
[3] Attachment 1 – dry gas composition.
[4] Attachment 2 – wet gas composition.

	TOC Emission Rate (lb/hr/valve)[5]	Valve Count	TOC (lb/hr)	TOC (TPY)	VOC weight % of TOC	VOC (lb/hr)	VOC (TPY)
Valves (Dry Gas)[6]	9.92E-03	20	0.2	0.876	0.6582	0.13164	0.58
Valves (Wet Gas)[7]	9.92E-03	20	0.2	0.876	13.5859	2.71718	11.90

As the table indicates, the use of a dry gas VOC weight % would lead to ~95% underestimation of VOC fugitive emissions per component in wet gas service. The problem is compounded because wet gas production is more equipment-intensive than production in dry gas areas, meaning there are a greater number of valves, flanges, seals, and other sources of equipment leaks at a typical wet gas site. Each additional wet gas fugitive emission component subjected to an incorrect dry gas emissions calculation will result in greater underestimation of actual total VOC emissions.

This problem could be addressed by requiring operators to supply a VOC weight percentage representative of the gas stream handled at each site. This will pose little additional burden on operators because in most cases they will already have VOC weight percentage information at hand to complete other portions of the emissions report. For instance, the emissions reporting spreadsheet requires operators to estimate VOC emissions from well completions. Operators must know the VOC weight percentage of the gas at the wellhead in order to make this calculation, this information can just as easily be used to accurately calculate VOC fugitive emissions.

4. PADEP must ensure reported stationary internal combustion engine VOC emissions include all compounds regulated as VOCs.

While formaldehyde (HCHO) is classified as a VOC,[8] HCHO emissions are not included when determining compliance with the VOC emission rates contained in the New Source Performance Standards for Stationary Spark Ignition Internal Combustion Engines.[9] Thus, engine manufacturers rarely include HCHO emissions in the VOC emission rates provided in their compressor engine specification sheets, or may treat non-methane non-ethane hydrocarbons as synonymous with VOC, thus excluding all photochemically reactive aldehydes and alcohols.

When engine operators provide emissions calculations for non-NSPS purposes (e.g. emissions inventory requirements, calculating facility potential to emit) they often fail to add HCHO and other excluded VOCs to the engine manufacturers' VOC emission rate. This can result in significant underestimation of VOC emissions from engine

[5] USEPA, Equipment Leak Emission Estimates *supra* note 2 at 2-15
[6] Attachment 1 – dry gas composition.
[7] Attachment 2 – wet gas composition.
[8] 40 C.F.R. § 51.100(s); 40 C.F.R. § 70.2.
[9] 40 CFR § 60.4244(f).

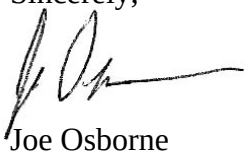
exhaust. For an uncontrolled 4-stroke lean burn natural gas compressor engine HCHO may make up 45% of total VOC emissions.[10] VOC emission from an uncontrolled 4-stroke rich burn natural gas compressor engine may be 70% HCHO.[11]

Left unaddressed, this will significantly reduce the quality of reported VOC emissions from compressors because it will be difficult, if not impossible, to determine how many operators included all VOCs, and how many relied on incomplete VOC emissions rates provided by manufacturers. This problem could be largely avoided by instructing operators to include all VOCs in their engine VOC calculations, or to at least note if they have used an emission rate that excludes HCHO or uses non-methane non-ethane hydrocarbons as a proxy for VOCs.

The problems identified above will greatly compromise the accuracy of the unconventional gas emissions inventory. Further, these problems are relatively simple and straightforward to resolve. Thus we urge the Department correct these problems for the 2011 inventory.

Thank you for considering our comments and for your continuing efforts to protect and improve air quality in Pennsylvania. If you have any questions or require any additional information please feel free to contact us. We look forward to your response.

Sincerely,



Joe Osborne
Legal Director
Group Against Smog & Pollution
joe@gasp-pgh.org
412-924-0604

CC (via email): Dean Van Orden
Michael Rudawski

[10] EPA AP-42, Chapter 3, Table 3.2-2, *available at:* http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s02.pdf.
[11] *Id*. Table 3.2-3.

Attachment 1:
dry gas composition

Inlet Gas Composition
Shamrock Compressor Station

Compound	Mole %	Mole Fraction (M%/EM%)	MW	lb/lb mol (MW*MF)	Weight % (M%*MW/Elb/lbmole)
Nitrogen	0.58	0.0058000	28.01	0.1625	0.9652
Oxygen	0.48	0.0048000	32.00	0.1536	0.9126
C02	0.58	0.0058000	44.01	0.2553	1.5166
CO	0	0.0000000	32.01	0.0000	0.0000
methane	95.21	0.9521000	16.043	15.2745	90.7530
ethane	2.92	0.0292000	30.07	0.8780	5.2167
propane	0.19	0.0019000	44.10	0.0838	0.4978
i-butane	0.02	0.0002000	58.12	0.0116	0.0691
N-butane	0.02	0.0002000	58.12	0.0116	0.0691
i-pentane	0	0.0000000	72.15	0.0000	0.0000
n-penane	0	0.0000000	72.15	0.0000	0.0000
hexanes +	0	0.0000000	114.00	0.0000	0.0000
benzene	0	0.0000000	78.11	0.0000	0.0000
toluene	0	0.0000000	92.14	0.0000	0.0000
ethylbenzene	0	0.0000000	106.17	0.0000	0.0000
xylenes	0	0.0000000	106.16	0.0000	0.0000
Totals	100	1		16.8309	100.0000

MW of Gas = 16.8309
Weight % NM/E VOCs = 0.6359
Weight % Methane/Ethane = 95.9697
Weight % of total HCs= 96.6056
hexanes + assume mw of 114 (average of hexanes-decanes)
Universal Gas Content = 379.4/lb-mol @ 60 F and 14.696 psia
Calculation:
Pound " X"/ scf = Wt Fraction (wt%) * MW of Gas * 1 lb mol/379.4 scf
lbs NM/E VOC/scf = 0.000282
lbs Methane/Ethane/scf 0.0426
lbs total HC/scf = 0.0429

Source: Project charter

Attachment 2:
wet gas composition

HOUSTON LABORATORIES
8820 INTERCHANGE DRIVE
HOUSTON, TEXAS 77054
PHONE (713) 660-0901

CERTIFICATE OF ANALYSIS

Number : 2009110494-004A

Chesapeake Energy Corporation
Jim Cooper
PO Box 6070
Charleston, WV 25362

Field:	Charleston, WV	Report Date:	12/01/09
Station:	Victory	Sample Of:	Spot - Gas
Station No.:		Sample Date:	11/16/2009 11:30
Sample Point:	Dehy Inlet	Sample Conditions:	926 psi ,72° F
Cylinder # :	1156	PO / Ref. No.:	

Comments:

ANALYTICAL DATA

Components	Mol %	Wt%	GPM at 14.730 psia	Method	Lab	Date
					Tech.	Analyzed
				GPA-2286	JL	12/01/09
Nitrogen	0.320	0.456		(MC14)		
Methane	81.325	66.105				
Carbon Dioxide	0.192	0.426				
Ethane	12.921	19.686	3.455			
Propane	3.588	8.016	0.988			
iso Butane	0.458	1.348	0.150			
n-Butane	0.751	2.209	0.237			
iso Pentane	0.176	0.644	0.064			
n-Pentane	0.138	0.507	0.050			
i-Hexanes	0.056	0.242	0.023			
n-Hexane	0.029	0.120	0.011			
Benzene	0.001	0.003	NIL			
Cyclohexane	0.003	0.012	0.001			
i-Heptanes	0.021	0.108	0.010			
n-Heptane	0.007	0.034	0.003			
Toluene	0.001	0.006	NIL			
i-Octanes	0.011	0.059	0.005			
n-Octane	0.002	0.010	0.001			
*e-Benzene	NIL	NIL	NIL			
*m,o,&p-Xylene	NIL	0.002	NIL			
i-Nonanes	NIL	0.005	NIL			
n-Nonane	NIL	0.002	NIL			
i-Decanes	NIL	NIL	NIL			
n-Decane	NIL	NIL	NIL			
Undecanes	NIL	NIL	NIL			
Dodecanes	NIL	NIL	NIL			
Tridecanes	NIL	NIL	NIL			
Tetradecanes Plus	NIL	NIL	NIL			
Totals	100.000	100.000	4.998			

Calculated Values	TOTAL	C6+	C7+
Molecular Weight	19.735	90.909	100.484
Real Dry BTU @ 14.73 psia, 60 °F	1205.4	4979.9	5443.2
Real Wet BTU @ 14.73 psia, 60 °F	1185.3	4894.1	5349.3
Relative Density	0.6831	3.1373	3.4662

	TOTAL	C2+	iC5+
GPM's at 14.73 psia, 60 °F	4.998	4.998	0.168
Compressibility Factor	0.9968		

Chris Staley
Hydrocarbon Laboratory Manager