Comparison of Air Emission Standards

CSSD Performance Standards (Issued August 19, 2013) and Pennsylvania General Plan Approval and/or General Operating Permit BAQ-GPA/GP-5 GP-5 (Issued February 1, 2013).

1/14/2014

The Center for Sustainable Shale Development (CSSD) is an independent nonprofit organization based in Pittsburg, Pennsylvania. The Center provides a forum for a diverse group of stakeholders to share expertise with the common objective of developing solutions and serving as a center of excellence for shale gas development. CSSD's mission is to support continuous improvement and innovative practices through performance standards and third-party certification. CSSD has developed initial performance standards for operators engaged in unconventional exploration, development, and gathering activities including site construction, drilling, hydraulic fracturing and production in the Appalachian Basin. These standards represent consensus on what is achievable and protective of human health and the environment.

Bureau of Air quality of the Pennsylvania Department of Environmental Protection developed a General Permit, ***Pennsylvania General Plan Approval and/or General Operating Permit BAQ-GPA/GP-5 GP-5*** to authorize the construction, modification, and/or operation of natural gas compression and/or natural gas processing facilities.

This document provides a comparison of the requirements in air standards.

No.	CSSD Performance Standard	Pennsylvania
9	Reduced Emissions Completions (REC) • Beginning on 1/1/14 – direct all pipeline-quality gas during completion of development wells and re-completion or workover of any well into a pipeline for sales. • No venting allowed – must be flared in accordance with CSSD Performance Standard No. 10. • Acceptable reasons for flaring – low content of flammable gas and safety reasons. • Unacceptable reasons for flaring – i) lack of pipeline connection except for exploratory or extension wells; ii) inadequate water disposal capacity; iii) inadequate or lack of flowback equipment or operating personnel.	Exemption Category No. 38[1] • Requires compliance with NSPS requirements in 40 CFR Part 60, Subpart OOOO. • Beginning 10/15/12 - No venting allowed – must capture and direct flowback emissions to a completion combustion device, except in conditions that may result in a fire hazard or explosion. • Beginning on 1/1/15 – direct all pipeline-quality gas during completion of development wells and re-completion or workover of any well into a pipeline for sales. • Open Flaring is only allowed under the following circumstances: o used at exploration wells to determine whether oil and/or gas exists in geological formations or to appraise the physical extent, reserves and likely production rate of an oil or gas field. o Flaring used for repair, maintenance, emergency or safety purposes. o Flaring used for other operations at a wellhead or facility to comply with 40 CFR Part 60, Subpart OOOO requirements. • Enclosed combustion device including enclosed flare must be used for all permanent flaring operations at a wellhead or facility. These flaring operations will be designed and operated in accordance with the requirements of 40 CFR § 60.18. • VOC emissions less than 2.7 tpy VOCs from facility are exempted. If 95% control from storage tanks is achieved, those emissions are exempted. No de minimis emission threshold per tank as allowed in NSPS Subpart OOOO. If the VOCs include HAPs, the HAP exemption criteria in this paragraph will be met. Combined HAP emissions at the facility less than 1000 lbs of a single HAP or one ton of a combination of HAPs in any consecutive 12-month period.

Note: The above highlights are not explicitly included.

[1] "Pennsylvania's Air Quality Permit Exemptions

No.	CSSD Performance Standard	Pennsylvania
10	Flaring • **Raised**/elevated flares or engineered combustion device with a reliable continuous ignition source. • 98% destruction efficiency. • Development well: flaring no more than 14-days (for life of well). • Exploratory/Extension wells: Flaring no more than 30-days (for life of well). • No visible emissions from flares except for periods not to exceed a total of five minutes during any two consecutive hours.	Exemption Category No. 38 [2] • Flaring during completions as allowed by NSPS Subpart OOOO. Other requirements include the following: • Enclosed flare (Raised/elevated flares or engineered combustion device) must be used for permanent installations. • All permanent enclosed flaring operations must be designed and operated in accordance with the requirements of 40 CFR § 60.18. • Open Flaring is only allowed under the following circumstances: o Flaring used at exploration wells to determine whether oil and/or gas exists in geological formations or to appraise the physical extent, reserves and likely production rate of an oil or gas field. o Flaring used for repair, maintenance, emergency or safety purposes. o Flaring used for other operations at a wellhead or facility to comply with 40 CFR Part 60, Subpart OOOO requirements. • Opacity is limited to 20% or greater for an aggregated 3 min period in any 1 hour, but cannot be equal to or greater than 60% opacity at any time.

Note: Enclosed Flare information is missing.

[2] Pennsylvania's Air Quality Permit Exemptions

No.	CSSD Performance Standard	Pennsylvania
11	Diesel Nonroad Drilling Rig Engines • Meet EPA Tier 2 standards by March 20, 2013. • 25% of owner/operator engine utilization (hp) meeting EPA Tier 4 standards for PM by March 20, 2015. • 75% of owner/operator engine utilization (hp) meeting EPA Tier 4 standards for PM by September 24, 2015. • 95% of owner/operator engine utilization meeting EPA Tier 4 standards for PM by September 24, 2016. • Use ultra-low sulfur diesel (15ppm of sulfur) at all times.	• States including Pennsylvania are precluded from establishing any emissions limitations other than those required by 40 CFR Part 89. • Non-road engines are exempt from permitting requirements under Exemption Category No. 38.[3] • All non-road engines must comply with federal emission standards found in 40 CFR Part 89, Subpart B or 40 CFR Part 1039, Subpart B based upon the engine's model year. • Only ultra-low sulfur diesel fuel will be available.

Note: State preemption is included in the footnote.

[3] Pennsylvania's Air Quality Permit Exemptions

No.	CSSD Performance Standard	Pennsylvania
11.1	<u>Diesel Nonroad Fracturing Pump Engines</u> • Meet EPA Tier 2 standards by March 20, 2014. • 25% of owner/operator engine utilization (hp) meeting EPA Tier 4 standards for PM by September 24, 2015/ March 20, 2016. • 75% of owner/operator engine utilization (hp) meeting EPA Tier 4 standards for PM by September 24, 2016. • 95% of owner/operator engine utilization meeting EPA Tier 4 standards for PM by September 24, 2017. • Use ultra-low sulfur diesel (15ppm of sulfur) at all times.	• States including Pennsylvania are precluded from establishing any emissions limitations other than those required by 40 CFR Part 89. • Non-road engines are exempt from permitting requirements under Exemption Category No. 38. • All non-road engines must comply with federal emission standards found in 40 CFR Part 89, Subpart B or 40 CFR Part 1039, Subpart B based upon the engine's model year. • Only ultra-low sulfur diesel fuel will be available.

Note: State preemption is included in the footnote.

No.	CSSD Performance Standard	Pennsylvania
11.2	<u>Diesel Heavy-Duty Vehicle Fracturing Pump Engines</u> • 50% of engines meeting EPA 2007 and Later Model Year Highway Heavy-Duty Vehicles and Engines emissions standards for PM by September24, 2017. • 80% of engines meeting EPA 2007 and Later Model Year Highway Heavy-Duty Vehicles and Engines emissions standards for PM by September 24, 2014. • Use ultra-low sulfur diesel (15ppm of sulfur) at all times.	• States including Pennsylvania are precluded from establishing any emissions limitations other than those required by 40 CFR Part 86. • Heavy duty vehicle engines are exempt from permitting requirements under Exemption Category No. 38. • All Heavy Duty vehicle engines must comply with federal emission standards found in 40 CFR Part 86. • Only ultra-low sulfur diesel fuel will be available.

Note: State preemption is included in the footnote.

No.	CSSD Performance Standard	Pennsylvania
12	Existing Compressor Engines • By March 20, 2014 – 1.5 g/hphr NOx emission limitation for existing compressor engines greater than 100 hp. o CO – None o VOC – None	Previous Exemption Category No. 38 • Existing compressor engines (those installed prior to August 10, 2013) – exempt from any permitting or emission limitation requirements if less than 100 hp. Previous GP-5 • Prior to February 2013 - compressor engines greater than or equal to 100 hp and less than 1500 hp were subject to the previous GP-5 emissions limitations: ○ 2.0 g/hp-hr NOx. ○ 2.0 g/hp-hr CO. ○ 2.0 g/hp-hr VOCs. • Emission test results indicate that the existing compressor engines authorized under the previous GP-5 are generally meeting the CCSD performance standard of 1.5 g/bhp-hr of NOx.[4]

[4] Emission Test Results

No.	CSSD Performance Standard	Pennsylvania
12.1	"New" Lean-Burn Compressor Engines • Emissions limitations for new, purchased, replacement, reconstructed, or relocated lean-burn engines greater than 100 hp: o 0.5 g/hp-hr NOx. o 2.0 g/hp-hr CO. o 0.7 g/hp-hr VOCs. o Formaldehyde – None o HAPS – No facility wide limit	Exemption Category No. 38 (Compressor Engines at the Wellpad)[5] • Compressor engines at the wellpad (those installed on or after August 10, 2013) are exempt from permitting requirements provided that: o NOx emissions from stationary internal combustion engines at the wells, and wellheads are less than 100 lbs/hr, 1000 lbs/day, 2.75 tons per ozone season (May 1 to September 30); and 6.6. tons per year on a 12-month rolling basis. o VOC emissions from facility is less than 2.7 tpy, VOC from facility is exempted. If the VOCs include HAPs, the HAP exemption criteria in this paragraph will be met. Combined HAP emissions at the facility less than 1000 lbs of a single HAP or one ton of a combination of HAPs in any consecutive 12-month period. GP-5 (Compressor Engines at Natural Gas Compression and/or Processing Facilities) (Feb. 2013) • The facility emissions are limited to non-major emission thresholds. (Synthetic Minor)[6] • Natural gas fired lean burn engines less than or equal to 100 hp:[7] ○ 2.0 g/hp-hr for NOx. ○ 2.0 g/hp-hr for CO. • Natural gas lean burn engines greater than 100 hp and less than or equal to 500 hp:[8] ○ 1.0 g/hp-hr for NOx. ○ 2.0 g/hp-hr for CO ○ 0.7 g/hp-hr for non-methane/non-ethane hydrocarbons (except formaldehyde). • Natural gas lean burn engines greater than 500 hp:[9] ○ 0.5 g/hp-hr for NOx. ○ 93% reduction for CO. ○ 0.25 g/hp-hr for non-methane/non-ethane hydrocarbons (except formaldehyde). ○ 0.05 g/hp-hr for formaldehyde.

[5] Pennsylvania's Air Quality Permit Exemptions

[6] A synthetic minor permit restricts the facility's actual emissions to less than any of the major facility thresholds on a 12-month rolling basis. Individual sources at the facility cannot exceed any source specific emission limitation included in the GP-5. This provision allows the companies to use lower emitting equipment and process more gas resulting in lower emissions per unit of natural gas processed. This provision also maximizes the gas processed at one facility which should ultimately result in fewer facilities and a smaller operational footprint for a company.

[7] Pennsylvania's GP-5 -Natural Gas Compression and/or Processing Facilities, Section B

[8] Pennsylvania's GP-5 -Natural Gas Compression and/or Processing Facilities, Section B

[9] Pennsylvania's GP-5 -Natural Gas Compression and/or Processing Facilities, Section B

Note: Synthetic Minor information is missing.

No.	CSSD Performance Standard	Pennsylvania
12.2	"New" Rich-Burn Compressor Engines • Emissions limitations for new, purchased, replacement, reconstructed, or relocated rich-burn engines greater than 100 hp: o 0.3 g/hp-hr NOx. o 2.0 g/hp-hr CO. o 0.7 g/hp-hr VOCSs. o Formaldehyde - None	Exemption Category No. 38 (Compressor Engines at the Wellpad)[10] • Compressor engines at the wellpad (those installed on or after August 10, 2013) exempt from permitting where: o NOx emissions from stationary internal combustion engines at the wells, and wellheads are less than 100 lbs/hr, 1000 lbs/day, 2.75 tons per ozone season (May 1 to September 30); and 6.6 tons per year on a 12-month rolling basis. o VOC emissions less than 2.7 tpy, VOCs from facility are exempted. If the VOCs include HAPs, the HAP exemption criteria in this paragraph will be met. Combined HAP emissions at the facility less than 1000 lbs of a single HAP or one ton of a combination of HAPs in any consecutive 12-month period. Coverage under GP-5 (Compressor Engines at Natural Gas Compression and/or Processing Facilities) (Feb. 2013) • The facility emissions are limited to non-major emission thresholds. (Synthetic Minor)[11] • Natural gas fired rich burn engines less than or equal to 100 hp: [12] o 2.0 g/hp-hr NOx. o 2.0 g/hp-hr CO. • Natural gas rich burn engines greater than 100 hp and less than or equal to 500 hp:[13] o 0.25 g/hp-hr NOx. o 0.30 g/hp-hr CO; o 0.2 g/hp-hr for non-methane/non-ethane hydrocarbons (except formaldehyde). • Natural gas rich burn engines greater than 500 hp:[14] o 0.20 g/hp-hr NOx. o 0.30 g/hp-hr CO. o 0.20 g/hp-hr for non-methane/non-ethane hydrocarbons (except formaldehyde). o 76% reduction for formaldehyde.

[10] Pennsylvania's Air Quality Permit Exemptions

[11] A synthetic minor permit restricts the facility's actual emissions to less than any of the major facility thresholds on a 12-month rolling basis. Individual sources at the facility cannot exceed any source specific emission limitation included in the GP-5. This provision allows the companies to use lower emitting equipment and process more gas resulting in lower emissions per unit of natural gas processed. This provision also maximizes the gas processed at one facility which should ultimately result in fewer facilities and a smaller operational footprint for a company.

[12] Pennsylvania's GP-5 -Natural Gas Compression and/or Processing Facilities, Section B

[13] Pennsylvania's GP-5 -Natural Gas Compression and/or Processing Facilities, Section B

[14] Pennsylvania's GP-5 -Natural Gas Compression and/or Processing Facilities, Section B

Note: Synthetic Minor information is missing.

No.	CSSD Performance Standard	Pennsylvania
13	Storage Vessels • By October 15, 2013 – all existing or new individual storage vessels at the wellpad with VOC emissions equal to or greater than 6 tpy must install controls to achieve at least a 95% reduction in VOC emissions.	Exemption Category No. 38[15]: • VOC emissions less than 2.7 tpy from the facility are exempted. If 95% control from storage tanks is documented, those emissions are exempted. No de minimis emission threshold per tank as allowed in NSPS Subpart OOOO. If the VOCs include HAPs, the HAP exemption criteria in this paragraph will be met. Combined HAP emissions at the facility less than 1000 lbs of a single HAP or one ton of a combination of HAPs in any consecutive 12-month period. • Compliance with above criteria ensures compliance with NSPS Subpart OOOO.

[15] Pennsylvania's Air Quality Permit Exemptions

No.	CSSD Performance Standard	Pennsylvania
14.1	Rod Packing at Reciprocating Compressors • Change rod packing at all reciprocating compressors (both existing and new), including those at the wellhead, either every 26,000 hours of operation or after 36 months.	GP-5/ NSPS Subpart OOOO • "New reciprocating compressors (those installed after August 23, 2011) – change rod packing either every 26,000 hours of operation or every 36 months as well as new reciprocating compressors. [16] • Reciprocating compressors located at a well site or an adjacent well site and servicing more than one well site are excluded from this requirement. [17]

Note: This should be reworded to indicate that no additional state specific requirements other than NSPS Subpart OOOO.

[16] 40 C.F.R. §60.5385(a)
[17] 40 C.F.R. §60.5365(c)

No.	CSSD Performance Standard	Pennsylvania
14.2	Pneumatic Controllers • By October 15, 2013, pneumatic controllers (both existing and new): o Low – bleed, with a natural gas bleed rate limit of 6.0 scfh or less. o Zero bleed when electricity (3-phase electrical power) is on-site.	GP-5/ NSPS Subpart OOOO • "New" pneumatic controllers (those constructed (installed), modified or reconstructed on or after October 15, 2013) located between the wellhead and a natural gas processing plant: bleed rate of 6.0 scfh or less.[18] • Exception to 6.0 scfh bleed rate – where use of a greater bleed rate is required based on functional needs, including response time, safety and positive actuation. [19]

Note: GP-5 explicitly requires compliance with NSPS Subpart OOOO.

[18] 40 C.F.R. §60.5390(c)(1)

[19] 40 C.F.R. § 60.5390(a)

No.	CSSD Performance Standard	Pennsylvania
14.3	Centrifugal Compressors • New centrifugal compressors may not contain wet oil seals. • Replace worn out wet seals on existing centrifugal compressors with dry seals.	GP-5 -Natural Gas Compression and/or Processing Facilities • Compliance with NSPS Subpart OOOO requirements for centrifugal compressors.[20] o Reduce VOC emissions from each centrifugal compressor wet seal fluid degassing system by 95.0 percent or greater. o If a control device is used to reduce emissions, you must equip the wet seal fluid degassing system with a cover that meets the requirements of §60.5411(b), that is connected through a closed vent system that meets the requirements of §60.5411(a) and routed to a control device that meets the conditions specified in §60.5412(a), (b) and (c). As an alternative to routing the closed vent system to a control device, you may route the closed vent system to a process.

[20] Pennsylvania's GP-5 -Natural Gas Compression and/or Processing Facilities, Section D

14.4	Directed Inspection and Maintenance Program • By March 20, 2014 – implement a directed inspection and maintenance program (DI&M) for equipment leaks from all existing and new valves, pump seals, flanges, compressor seals, pressure relief valves, open-ended lines, tanks and other process and operation components that result in fugitive emissions. o Monitored by a weekly visual, auditory, and olfactory check. o Yearly mechanical or instrument check to detect leaks. o Repair detected significant leaks in a timely manner. o No leak repair quantification o No FLIR or gas detector	Exemption Category No. 38[21] • Perform a leak detection and repair (LDAR) program within 60 days after the well is put into production and annually thereafter. o Use of optical gas imaging camera (such as FLIR) or gas leak detector. o Conduct on valves, flanges, connectors, storage vessels/storage tanks, and compressor seals. o If leak is discovered – repair within in 15 days unless facility shutdown is required or ordering replacement parts are necessary for the repair. • Upon written request documenting justification – DEP may grant extension for leak detection deadlines or repairs. • A leak is considered repaired if one of the following can be demonstrated: o No detectable emissions consistent with EPA Method 21 specified in 40 CFR Part 60, Appendix A o A concentration of 2.5% methane or less using a gas leak detector and a VOC concentration of 500 ppm or less o No visible leak image when using an optical gas imaging camera o No bubbling at leak interface using a soap solution bubble test specified in EPA Method 21 o Any other method approved in writing by the Department • GP-5 LDAR Program o at a minimum, on a monthly basis perform a leak detection and repair program that includes audible, visual, and olfactory (“AVO”) inspections. o within 180 days after initial startup and at a minimum on a quarterly basis, use forward looking infrared (“FLIR”) cameras or other leak detection monitoring devices approved by the Department for the detection of fugitive leaks. The Department may grant an extension for the use of FLIR camera upon receiving a written request that documents the justification. o repair detected leaks as soon as possible but no later than 15 days after the leak is detected

[21] Pennsylvania’s Air Quality Permit Exemptions

Note: Missing Gp-5 LDAR Program information.

14.5	Well-bore freeze-up emissions • Eliminate VOC emissions associated with the prevention of well-bore freeze-up (only de minimis emissions are permitted).	• Facility VOC emissions exceeding 2.7 tpy may require Plan Approval (case-by-case BAT).
14.6	Blowdown emissions • Existing and new compressors are required to be pressurized when they are off-line for operational reasons in order to reduce blowdown emissions.	• Facility VOC emissions exceeding 2.7 tpy may require Plan Approval (case-by-case BAT).

No.	CSSD Performance Standard	Pennsylvania
15.1 15.2	Truck Emission Requirements • By March 20, 2014 -80% of all trucks used to transport fresh water or well flowback water must meet U.S. EPA's Final Emission Standards for 2007 and Later Model Year Highway Heavy-Duty Vehicles and Engines for particulate matter (PM) emissions. • By September 24, 2015 -95% of all trucks used to transport fresh water or well flowback water must meet U.S. EPA's Final Emission Standards for 2007 and Later Model Year Highway Heavy-Duty Vehicles and Engines for particulate matter (PM) emissions.	• States including Pennsylvania are precluded from establishing any emissions limitations other than those required by 40 CFR Part 86. • Heavy duty vehicle engines are exempt from permitting requirements under Exemption Category No. 38. • All non-road engines must comply with federal emission standards found in 40 CFR Part 86. • Only ultra-low sulfur diesel fuel will be available.
	Truck Load-out Emissions: • None	• Exemption Category No. 38 requires compliance with 95% VOC reduction requirements of other equipment such as tanker truck load-outs, consistent with § 60.5413 or alternate test methods as approved by the Department.

Note: State preemption is included in the footnote.

Requirements for Truck Load-out Emissions not included.

No.	CSSD Performance Standard	Pennsylvania
15.3 15.4	<u>Truck Idling and Fuel Requirements</u> • All on-road vehicles and equipment - limit unnecessary idling to 5 minutes, or abide by applicable local or state laws if they are more stringent. • All on-road and non-road vehicles and equipment -use Ultra-Low Sulfur Diesel fuel (15 ppm of sulfur) at all times.	• Motor vehicles with gross weight of 10,001 lbs or more – 5 minute idling limit in any continuous 60-minute period.[22] • Only ultra-low sulfur diesel fuel is available

[22] 35 P.S. 4603(a)