CENTER FOR RESPONSIBLE SHALE DEVELOPMENT

PERFORMANCE STANDARDS

Version 1.5

Adopted: August 19, 2013; Amended: December 18, 2017

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Geographic Scope and Applicability of CRSD Performance Standards

These standards apply to unconventional exploration, development, and gathering activities including site construction, drilling, hydraulic fracturing and production in the Appalachian Basin. These regional standards consider geology, topography, population density, infrastructure, surface water, ground water and other issues of particular concern in the Appalachian Basin. Accordingly, until such time as the scope of these standards may be amended, these standards and the CRSD evaluation and certification process will be limited to Operators' unconventional activities in the Appalachian Basin.

CENTER FOR RESPONSIBLE SHALE DEVELOPMENT

WATER PERFORMANCE STANDARDS

The goal of the water standards is that there be zero contamination of fresh groundwater[1] and surface waters.

PERFORMANCE STANDARD 1

1. Operators shall maintain zero direct or indirect intentional discharges of shale wastewater (including drilling, flowback and produced waters) to surface water except as provided by this Standard.

2. In order to facilitate comprehensive wastewater management programs that consider environmental, safety, health, and economic factors, Operators may send shale wastewater to a Centralized Waste Treatment facility (CWT) for treatment and discharge if the Operator demonstrates the following conditions are satisfied at the CWT:
   a. The CWT has, and is in substantial compliance with, a NPDES discharge permit to treat and directly discharge shale wastewater;
   b. The CWT meets or exceeds a CRSD shale wastewater effluent performance standard to be based on current best available technology designed to prevent the discharge of toxic pollutants in toxic amounts;
   c. The CWT must use best available technology for all fluids discharged. Best available technology requires a combination of distillation and biological treatment, with the addition of reverse osmosis if CRSD determines based on further analysis that it provides protection necessary to ensure effluent quality. CRSD may authorize the use of different technologies or combinations of technologies that provide equivalent or superior treatment;
   d. The CWT adheres to acceptance procedures designed to assure that the wastewater delivered by the Operator is compatible with the other wastes being treated at the facility, treatable by the treatment system, and consistent with the specific waste stream the facility was permitted to treat and discharge;
   e. The CWT does not indirectly discharge wastewater from a CRSD Operator through a POTW.

3. An uncertified Operator must meet the following obligations prior to certification to this Standard and a certified Operator must meet the obligations prior to the use of a new CWT for discharge:
   a. Operator shall review, compile, analyze, and deliver to CRSD, publicly available information pertaining to the CWTs performance and permit compliance to demonstrate that the CWT satisfies Part 2(a).

[1] "Fresh groundwater" is "water in that portion of the generally recognized hydrologic cycle which occupies the pore spaces and fractures of saturated subsurface materials."

b. In order to help assure the permit writer has all information necessary to consider establishing limits on all pollutants in the expected influent, the permitting agency shall be provided the current CRSD list of chemicals believed to occur in the region's wastewater.
c. In order to confirm the CWT is operating as intended, the Operator shall demonstrate to CRSD that testing at the CWT satisfies the Initial Confirmatory Testing Program or a facility-specific Protocol approved by CRSD.
d. In order to evaluate the potential for CWT effluent toxicity, Operator shall complete WET Testing pursuant to the WET Testing Program or an alternative facility-specific Protocol approved by CRSD.

4. For so long as the Operator delivers shale wastewater to a CWT:
    a. Operator shall conduct effluent monitoring as specified in the CRSD Ongoing Monitoring Program or facility-specific Protocol approved for that CWT by CRSD.
    b. Every six months, Operator shall review, compile, analyze and deliver to CRSD publically available information about the CWT's performance and permit compliance.
    c. Unless CRSD determines that ongoing WET testing is not necessary, Operator shall complete WET testing at a frequency to be determined in the WET Testing Program or facility-specific Protocol.

5. Operators may not initiate, and will immediately cease, deliveries to a CWT:
    a. If the CRSD Board determines that discharges from the CWT may increase the risk of harm to human health or the environment. This determination may take into account data and reports submitted to CRSD under this standard, deterioration in effluent quality, research to be sponsored by CRSD or by other parties, and/or any other data or available research.
    b. That exhibits substantial non-compliance with its NPDES permit.

    Deliveries shall not be resumed until the Operator demonstrates to the satisfaction of CRSD that appropriate corrective measures have been made.

6. Operator reporting under this standard shall be as follows:
    a. Data from all testing and any additional information gathering required under this standard, shall be analyzed, compiled, and submitted to CRSD by the Operator.
    b. Where an operator discovers a potential non-compliance with an existing NPDES discharge permit as part of the monitoring and auditing requirements required under this Standard, the Operator shall immediately report such findings to the CWT, the permitting agency, and CRSD.

Note: This standard does not apply to nor prohibit disposal of wastewater by deep well injection.

Adopted: August 19, 2013; Amended: December 9, 2014

PERFORMANCE STANDARD 2

1. Operators shall maintain and adhere to a plan to recycle, to the maximum extent practicable, flowback and produced water for use in fracturing and in drilling wells at depths below the surface casing.

2. For water withdrawals, operators shall develop an evaluation, monitoring, and action plan that prevents and/or minimizes site-specific and cumulative adverse impacts to surface and ground water resources. The plan should include the following:

    a. For surface waters, the plan should identify measures taken to protect flow regime of the waterway, and avoid temporary or permanent impairment.

    b. Plans should justify, and describe protection measures utilized, for withdrawals from any of the following:
        i. Waters classified or designated as Tier 3 (or state regulatory equivalent); or Tier 2 (or state regulatory equivalent) by an appropriate state or federal authority under the Clean Water Act's anti-degradation program.[2]
        ii. Headwaters or creeks (waters having an upstream drainage area less than 38.61 square miles)
        iii. Waters classified or designated as Intermittent by an appropriate state or federal authority.
        iv. If applicable, any waterway during seasonal or periodic (e.g. drought) low flow conditions, as identified by state or federal regulatory agencies.

    c. For ground waters, the Plan should assess the feasibility and sustainability of the groundwater source at the proposed withdrawal rate and withdrawal location, and identify all groundwater management measures taken in order to ensure that there are no adverse impacts to: groundwater availability (allowing for the rate of groundwater recharge); hydraulically connected wetlands; private water wells; and the baseflow of hydraulically connected surface waters.

    d. Operators shall meter (or otherwise measure) and record daily the volume of water withdrawals. Measuring devices and methods shall be accurate to within 5% of actual flow.

Adopted: August 19, 2013; Amended: December 18, 2017 (see addendum, page 17)

[2] Exceptional Value or High Quality waters in Pennsylvania; Special High Quality Waters in Ohio; and Tier 2 Protection (high quality waters) and Tier 3 Protection (Outstanding National Resource Waters) streams in West Virginia. **[Internal Note: Ohio has not designated any Tier 3 streams under the antidegradation rules]**

PITS/IMPOUNDMENTS PERFORMANCE STANDARDS

PERFORMANCE STANDARD 3

1. Any new pits designed shall be double-lined and equipped with leak detection.

2. Operators, by March 20, 2014 or initial date of application for certification (whichever is later), shall contain drilling fluid, when using oil-containing drilling fluids to drill a well, in a closed loop system at the well pad (e.g. no ground pits).

3. Operators, by March 20, 2015 or initial date of application for certification (whichever is later), shall contain drilling fluid and flowback water in a closed loop system at the well pad, eliminating the use of pits for all wells.[3]

Adopted: August 19, 2013

PERFORMANCE STANDARD 4

1. When utilizing centralized impoundments for the storage of flowback and/or produced waters, Operators shall ensure that free hydrocarbons are removed from the water prior to storage and that new impoundments are double-lined with an impermeable material, equipped with leak detection and take measures to reasonably prevent hazards to wildlife. Total hydrocarbons should be substantially removed.

Adopted: August 19, 2013; Amended: April 7, 2016 *(see addendum, page 17)*

[3] For guidance document:
Pit – any in-ground impression constructed on a well site that is used for the storage and disposal of residual waste from the development of a natural gas well.

Centralized Impoundment – any in-ground impression constructed off of the well site which is used to store and aggregate flowback water for use in the hydraulic fracturing process.

GROUNDWATER PROTECTION PERFORMANCE STANDARDS

PERFORMANCE STANDARD 5

1. Operators shall establish an Area of Review (AOR), prior to drilling a well, which encompasses both the vertical and horizontal legs of the planned well. Within the AOR, the Operator must conduct a comprehensive characterization of subsurface geology, including a risk analysis that demonstrates the presence of an adequate confining layer above the production zone that will prevent adverse migration of hydraulic fracturing fluids. As part of the risk analysis, and before proceeding with hydraulic fracturing, the Operator must also conduct a thorough investigation of any active or abandoned wellbores within such area of review or other geologic vulnerabilities (e.g., faults) that penetrate the confining layer and adequately address identified risks.

Adopted: August 19, 2013

PERFORMANCE STANDARD 6

1. Operators shall develop and implement a plan for monitoring existing water sources, including aquifers and surface waters (as defined in the CRSD Guidance for Auditors document) within a 2,500 foot radius of the wellhead (or greater distance, if a need is clearly indicated by geologic characterization), and demonstrate that water quality and chemistry measured during a pre-drilling assessment are not impacted by operations.

2. Operators must conduct periodic monitoring for at least one year following completion of the well. Such monitoring must be extended if results indicate potential adverse impacts on water quality or chemistry by operations.

3. In the event that monitoring establishes a possible link between an Operator's activities and contamination of a water source, the Operator shall develop and implement an investigative plan and, if a positive link is established, implement a corrective action plan.

4. The testing and monitoring plan should provide for additional monitoring in the event a well is re-stimulated.

Adopted: August 19, 2013

PERFORMANCE STANDARD 7

1. Operators shall design and install casing and cement to completely isolate the well and all drilling and produced fluids from surface waters and aquifers, to preserve the geological seal that separates fracture network development from aquifers, and prevent vertical movement of fluids in the annulus.

2. Operators will not use diesel fuel in their hydraulic fracturing fluids.

3. Operators will publically disclose the chemical constituents intentionally used in well stimulation fluids. Disclosures will include: information identifying the well, the Operator and the dates of the well stimulation; the type and total volume of the base fluid; the type and amount of any proppant; all chemical additive products used in a well stimulation, including the name under which the product is marketed or sold, the vendor, and a descriptor of additive's purpose or purposes (e.g. biocide, breaker, corrosion inhibitor, etc.); the common name and Chemical Abstracts Service registry number for each chemical ingredient used in a stimulation fluid; the actual or maximum concentration of each chemical ingredient, expressed as a percent by mass of the total stimulation fluid. Chemical ingredients should be disclosed in a manner that does not link them to their respective chemical additive products. Disclosure of the above information will be offered to the relevant state agency and will also be posted on FracFocus.org. If an Operator, service company or vendor claims that the identity of a chemical ingredient is entitled to trade secret protection, the Operator will include in its disclosures a notation that trade secret protection has been asserted and will instead disclose the relevant chemical family name. Operators will implement measures consistent with state law to assist medical professionals in quickly obtaining trade secret information from the Operator, service company or vendor holding the trade secret that may be needed for clinical diagnosis or treatment purposes.

4. Operators will also work toward use of more environmentally neutral additives for hydraulic fracturing fluid.

5. Mechanical integrity tests shall be performed when refracturing an existing well.

6. CRSD will develop a standard relating to the public disclosure of chemicals other than well stimulation fluids by September 1, 2013.

Adopted: August 19, 2013

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PERFORMANCE STANDARD 8

1. Operators shall design each well pad to minimize the risk that drilling related fluids and wastes come in contact with surface waters and fresh groundwater[4].

2. In preparation for any spill or release event, Operators shall prior to commencement of drilling, develop and implement an emergency response plan, ensure local responders have appropriate training in the event of an emergency, and work with the local governing body, in which the well is located, to verify that local responders have appropriate equipment to respond to an emergency at a well.

3. In addition, in the event of spill or release, beyond the well pad, Operators shall immediately provide notification to the local governing body and any affected landowner.

Adopted: August 19, 2013

[4] Fresh groundwater is defined as water in that portion of the generally recognized hydrologic cycle which occupies the pore spaces and fractures of saturated subsurface materials.

AIR PERFORMANCE STANDARDS

PERFORMANCE STANDARD 9

1. Beginning on January 1, 2014, in accordance with the conditions set forth in Paragraphs 3 and 4 below, an Operator must direct all pipeline-quality gas during well completion of development wells[5], and re-completion or workover of any well into a pipeline for sales.

2. Any gas not captured and put in the sales pipeline may not be vented[6] and must be flared in accordance with Standard No. 10 below.

3. Acceptable reasons for sending gas to a flare and not directing gas into the sales line include:
   a) Low content of flammable gas. Such low-flammability gas must be directed through a flare, past a continuous flame, to insure combustion begins when gas composition becomes flammable;
   b) For safety reasons.

4. Circumstances unacceptable for sending gas to flare, instead of directing it into a sales line, are:
   a) Beginning on January 1, 2014, a lack of a pipeline connection except for wells that are designated as either exploratory or extension wells using SEC definitions (however, companies should minimize flaring and maximize the use of reduced emissions completions on exploratory or extension wells, where possible);
   b) Inadequate water disposal capacity;
   c) Undersized flow back equipment, lack of flow back equipment or lack of equipment operating personnel.

5. Any upset or unexpected condition that leads to flaring of gas, instead of directing it into a sales line, must be documented and records maintained by the Operator, including a description of the condition, the location, date, and quantity of gas flared.

6. Using the SEC definitions, an exploratory well is a well drilled to find a new field or to find a new reservoir in a field previously found to be productive of oil or gas in another reservoir. An extension well is a well drilled to extend the limits of a known reservoir. Wells with these designations must be consistent with Operator reporting of such designations to the SEC, if applicable.

Adopted: August 19, 2013

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[5] Development wells are wells that are not exploratory or extension wells, as those terms are defined and restricted in Paragraph 6.

[6] For purposes of this standard, venting does not include the de minimis fugitive emissions from gas busters (i.e. that may occur from separator vessels during the initial cleanup period of the well). Immediately upon detection of gas in the flowback, Operators must divert the flowback into reduced emission completion ("REC") equipment.

PERFORMANCE STANDARD 10

1. When flaring is permitted during well completion, re-completions or workovers of any well, pursuant to Standard No. 9 above, Operators must adhere to the following requirements.

    a) Operators must either use raised/elevated flares or an engineered combustion device with a reliable continuous ignition source, which have at least a 98% destruction efficiency[7] of methane. No pit flaring is permitted.

    b) Flaring may not be used for more than 14-days on any development well (for the life of the well). Flaring may not be used for more than 30-days on any exploratory or extension wells (for the life of the well), including initial or recompletion production tests, unless operation requires an extension.[8] If flaring continues beyond 30-days for an exploratory or extension well, Operators must document the extent of additional flaring and reasons requiring flaring beyond the 30-days.

    c) Flares shall be designed for and operated with no visible emissions, except for periods not to exceed a total of five minutes during any two consecutive hours.

Adopted: August 19, 2013

[7] Certification of the 98% destruction efficiency may be obtained through either of the following options: (1) a manufacturer's certification and where operation is in accordance with the manufacturer's specifications and parameters; or (2) where the flares are designed and operated in accordance with the following: (a) meet specifications for minimum heating values of waste gas, maximum tip velocity, and pilot flame monitoring found in 40 CFR § 60.18; (b) if necessary to ensure adequate combustion, sufficient gas shall be added to make the gases combustible; (c) an infrared monitor is considered equivalent to a thermocouple for flame monitoring purposes; (d) an automatic ignition system may be used in lieu of a continuous pilot; (e) flares must be lit at all times when gas streams are present; (f) fuel for all flares shall be sweet gas or liquid petroleum gas except where only field gas is available and it is not sweetened at the sites; and (g) flares shall be designed for and operated with no visible emissions, except for periods not to exceed at total of five minutes during any two consecutive hours.

[8] For performance standard 10, the 30-day time limit for flaring was based on West Virginia's rules which allow 30-days of temporary flaring before a permit is required. W. Va. CSR § 45-6-6.1a. Additionally, because all states that have developed a flaring time-limit allow flaring to continue longer than the time limit with approval, certain exceptions to the 30-day time limit were provided in performance standard 10 for emergency and upset conditions and well purging and evaluation tests. These exceptions were based on Wyoming's rules. WOGCC Rules and Regulations, Chapter 3, Section 40. Pennsylvania currently has no regulations addressing flaring directly.

PERFORMANCE STANDARD 11

1. The following standard applies only to nonroad dedicated diesel horizontal drilling rig engines at the wellpad. CRSD encourages and supports the conversion of drilling rig engines to either dual-fuel, electricity or natural gas. The following emissions standards apply to the nonroad dedicated diesel drilling rig engines.
   a) By March 20, 2013, Operator and contractor nonroad engines shall achieve horse power-hour weighted average[9] site emissions equivalent to U.S. EPA Tier 2 nonroad diesel engine standards or better.
   b) By March 20, 2015**,** 25% of all Operator and contractor engine utilization (hp) shall comply with U.S. EPA Tier 4 emissions standards for particulate matter.[10]
   c) By September 24, 2015, 75% of all Operator and contractor engine utilization (hp) shall comply with U.S. EPA Tier 4 emissions standards for particulate matter. [11]
   d) By September 24, 2016, 95% of Operator or contractor engine utilization (hp) shall comply with U.S. EPA Tier 4 emissions standards for particulate matter.[12]
   e) All nonroad equipment must use Ultra-Low Sulfur Diesel fuel (15 ppm of sulfur) at all times.

2. The following standard applies only to dedicated diesel fracturing pump engines at the wellpad. CRSD encourages and supports the conversion of fracturing pump engines to either dual-fuel, electricity or natural gas.
   a) If the fracturing pump is a nonroad dedicated diesel engine powered solely by diesel fuel, then the following emissions standards apply:
      (i) By March 20, 2014, Operator and contractor nonroad engines shall achieve horse power-hour weighted average[13] site emissions equivalent to U.S. EPA Tier 2 nonroad diesel engine standards or better.
      (ii) By September 24, 2015, 25% of all Operator and contractor engine utilization (hp) shall comply with U.S. EPA Tier 4 emissions standards for particulate matter.[14]

[9] Weighted average emissions are based on an annual weighted average using the certified emissions level of each engine (g/bhp-hr), the rated power of each engine (HP), and the run time (hrs) of each engine over the course of the year.

[10] Meeting U.S. EPA Tier 4 emissions standards for particulate matter (PM) emissions may be accomplished by retrofitting with technology on the current Verified Retrofit Technologies List for U.S. EPA or the California Air Resources Board (CARB), which is capable of achieving at least an 85% reduction in PM emissions, and which is installed and operated according to the conditions of the U.S. EPA or CARB verification protocols.

[11] Meeting U.S. EPA Tier 4 emissions standards for particulate matter (PM) emissions may be accomplished by retrofitting with technology on the current Verified Retrofit Technologies List for U.S. EPA or the California Air Resources Board (CARB), which is capable of achieving at least an 85% reduction in PM emissions, and which is installed and operated according to the conditions of the U.S. EPA or CARB verification protocols.

[12] Meeting U.S. EPA Tier 4 emissions standards for particulate matter (PM) emissions may be accomplished by retrofitting with technology on the current Verified Retrofit Technologies List for U.S. EPA or the California Air Resources Board (CARB), which is capable of achieving at least an 85% reduction in PM emissions, and which is installed and operated according to the conditions of the U.S. EPA or CARB verification protocols.

[13] Weighted average emissions are based on an annual weighted average using the certified level of each engine (g/bhp-hr), the rated power of each engine (HP), and the run time (hrs) of each engine over the course of the year.

[14] Meeting U.S. EPA Tier 4 emissions standards for particulate matter (PM) emissions may be accomplished by retrofitting with technology on the current Verified Retrofit Technologies List for U.S. EPA or the California Air Resources Board (CARB), which

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(iii) By September 24, 2016, 75% of all Operator and contractor engine utilization (hp) shall comply with U.S. EPA Tier 4 emissions standards for particulate matter.[15]

(iv) By September 24, 2017, 95% of all Operator and contractor engine utilization (hp) shall comply with U.S. EPA Tier 4 emissions standards for particulate matter.[16]

(v) These engines must use Ultra-Low Sulfur Diesel fuel (15 ppm of sulfur) at all times.

b) If the fracturing pump is powered by a dedicated diesel heavy-duty vehicle engine, then the following emissions standards apply:

(i) By March 20, 2013, 50% of the heavy-duty vehicle engines used to power fracturing pumps 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.[17]

(ii) By September 24, 2014, 80% of the heavy duty vehicle engines used to power fracturing pumps, must meet U.S. EPA's Final Emission Standards for 2007 and Later Model Year Highway Heavy-Duty Vehicles and Engines for particulate matter emissions.[18]

(iii) These engines must use Ultra-Low Sulfur Diesel fuel (15 ppm of sulfur) at all times.

3. CRSD will develop a standard and implementation date for all other engines located at the wellpad.

Adopted: August 19, 2013; Amended: April 7, 2016 (see addendum, page 17)

is capable of achieving at least an 85% reduction in PM emissions, and which is installed and operated according to the conditions of the U.S. EPA or CARB verification protocols.

[15] Meeting U.S. EPA Tier 4 emissions standards for particulate matter (PM) emissions may be accomplished by retrofitting with technology on the current Verified Retrofit Technologies List for U.S. EPA or the California Air Resources Board (CARB), which is capable of achieving at least an 85% reduction in PM emissions, and which is installed and operated according to the conditions of the U.S. EPA or CARB verification protocols.

[16] Meeting U.S. EPA Tier 4 emissions standards for particulate matter (PM) emissions may be accomplished by retrofitting with technology on the current Verified Retrofit Technologies List for U.S. EPA or the California Air Resources Board (CARB), which is capable of achieving at least an 85% reduction in PM emissions, and which is installed and operated according to the conditions of the U.S. EPA or CARB verification protocols.

[17] Meeting U.S. EPA's Final Emission Standards for 2007 and Later Model Year Highway Heavy-Duty Vehicles and Engines for particulate matter (PM) emissions may be accomplished by retrofitting with technology on the current Verified Retrofit Technologies List for U.S. EPA or the California Air Resources Board (CARB), which is capable of achieving at least an 85% reduction in PM emissions, and which is installed and operated according to the conditions of the U.S. EPA or CARB verification protocols.

[18] Meeting U.S. EPA's Final Emission Standards for 2007 and Later Model Year Highway Heavy-Duty Vehicles and Engines for particulate matter (PM) emissions may be accomplished by retrofitting with technology on the current Verified Retrofit Technologies List for U.S. EPA or the California Air Resources Board (CARB), which is capable of achieving at least an 85% reduction in PM emissions, and which is installed and operated according to the conditions of the U.S. EPA or CARB verification protocols.

PERFORMANCE STANDARD 12

The following standard is only applicable to compressor engines dedicated to unconventional activities.

1. By March 20, 2014, existing compressor engines greater than 100 horsepower may not emit more than 1.5 grams of NOx per horsepower-hour.

2. Any new, purchased, replacement, reconstructed, or relocated lean-burn engines greater than 100 horsepower and up to 500 horsepower may not emit more than 1.0 g/hp-hr for NOx; 2.0 g/hp-hr for CO; 0.70 g/hp-hr for VOCs.

3. Any new, purchased, replacement, reconstructed, or relocated lean-burn engines greater than 500 horsepower may not emit more than 0.50 g/hp-hr for NOx; 47 ppmvd at 15% O2 or 93% reduction for CO; 0.25 g/hp-hr for VOCs; 0.05 g/hp-hr HCHO.

4. Any new, purchased, replacement, reconstructed, or relocated rich-burn engines greater than 100 horsepower and up to 500 horsepower may not emit more than 0.25 g/hp-hr for NOx; 0.30 g/hp-hr for CO; 0.20 g/hp-hr for VOCs.

5. Any new, purchased, replacement, reconstructed or relocated rich-burn engines greater than 500 horsepower may not emit more than 0.20 g/hp-hr NOx; 0.30 g/hp-hr CO; 0.20 g/hp-hr VOCs; 2.7ppmvd at 15% O2 or 76% reduction for HCHO.

Note: This standard will be updated to reflect any future determinations from regulatory agencies with regard to the NOx limitation.

Adopted: August 19, 2013; Amended: June 2, 2014

PERFORMANCE STANDARD 13

1. 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.

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PERFORMANCE STANDARD 14

This standard is applicable to new and existing equipment dedicated to unconventional activities unless stated otherwise.

1. 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.

2. By October 15, 2013, pneumatic controllers (both existing and new) must be low – bleed, with a natural gas bleed rate limit of 6.0 scfh or less, or zero bleed when electricity (3-phase electrical power) is on-site.

3. New centrifugal compressors may not contain wet oil seals. Operators must replace worn out wet seals on existing centrifugal compressors with dry seals.

4. By March 20, 2014 or date of an Operator's initial application for certification (whichever is later), Operators will 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. Process components subject to DI&M are monitored by a weekly visual, auditory, and olfactory check, and once a year by a mechanical or instrument check to detect leaks. Once significant leaks are detected, they are required to be repaired in a timely manner.

5. Eliminate VOC emissions associated with the prevention of well-bore freeze-up (only de minimis emissions are permitted).

6. Existing and new compressors are required to be pressurized when they are off-line for operational reasons in order to reduce blowdown emissions.

Adopted: August 19, 2013

PERFORMANCE STANDARD 15

1. 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.[19]

2. By September 24, 2015, 95% 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 emissions.[20]

3. All on-road vehicles and equipment must limit unnecessary idling to 5 minutes, or abide by applicable local or state laws if they are more stringent.

4. All on-road and non-road vehicles and equipment must use Ultra-Low Sulfur Diesel fuel (15 ppm of sulfur) at all times.

Adopted: August 19, 2013

[19] Meeting U.S. EPA's Final Emission Standards for 2007 and Later Model Year Highway Heavy-Duty Vehicles and Engines for particulate matter (PM) emissions may be accomplished by retrofitting with technology on the current Verified Retrofit Technologies List for U.S. EPA or the California Air Resources Board (CARB), which is capable of achieving at least an 85% reduction in PM emissions, and which is installed and operated according to the conditions of the U.S. EPA or CARB verification protocols.

[20] Meeting U.S. EPA's Final Emission Standards for 2007 and Later Model Year Highway Heavy-Duty Vehicles and Engines for particulate matter (PM) emissions may be accomplished by retrofitting with technology on the current Verified Retrofit Technologies List for U.S. EPA or the California Air Resources Board (CARB), which is capable of achieving at least an 85% reduction in PM emissions, and which is installed and operated according to the conditions of the U.S. EPA or CARB verification protocols.

ACRONYMS

AOR	Area of Review
CARB	California Air Resources Board
CO	Carbon Monoxide
CRSD	Center for Responsible Shale Development
CWT	Centralized Waste Treatment facility
DI&M	Directed Inspection and Maintenance
EPA	Environmental Protection Agency
g/hp-hr	Grams per Horsepower Hour
g/bhp-hr	Grams per Brake Horsepower-Hour
HCHO	Formaldehyde
NOx	Mono-nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NSPS	New Source Performance Standard
O_2	Oxygen
PM	Particulate Matter
POTW	Publicly Owned Treatment Works
ppm	Parts per Million
ppmvd	Parts Per Million, Volumetric Dry
scfh	Standard Cubic Feet per Hour
SEC	Security and Exchange Commission
tpy	Tons per Year
VOC	Volatile Organic Compound
WET	Whole Effluent Toxicity

ADDENDUM

PERFORMANCE STANDARD 2

As originally adopted in August 2013, Performance Standard 2 provided that operators were to recycle flowback and produced water to the maximum extent possible (2.1) and within one year would recycle at least 90% of flowback and produced water in core operating areas in which they were net water producers (2.2). It went on to state that “CRSD will consider a recycling standard for a new water producer within one year. (2.3) Section 2.3 was included to communicate CRSD’s intention to fully address flowback and produced water recycling for net water producers, but was not auditable as part of CRSD certification procedures as it did not define a standard of performance. On April 7, 2016, CRSD’s Board of Directors approved deletion of Section 2.3 while it acknowledged CRSD’s continued commitment to addressing flowback and produced water recycling and management. Performance Standards 2.1 and 2.2 remained in full force and effect. On December 18, 2017, the Board adopted recommended revisions to Performance Standard 2 adding requirements relating to water sourcing and requires operators to develop plans to prevent and/or minimize site-specific and cumulative adverse impacts to surface and groundwater resources from water withdrawals.

PERFORMANCE STANDARD 4.2

On April 7, 2016, CRSD’s Board of Directors voted to delete Performance Standard 4.2. Performance Standard 4.2 was included to communicate CRSD’s commitment to facilitate research on hydrocarbon emissions from centralized impoundments used to store flowback and/or produced waters, but is not auditable as part of CRSD certification procedures. CRSD remains committed researching this subject. Performance Standard 4.1 remains in full force and effect.

PERFORMANCE STANDARD 11.3

On April 7, 2016, CRSD’s Board of Directors voted to delete date references from Performance Standard 11.3 as it was not auditable as part of CRSD certification procedures. CRSD remains committed to researching the emissions from all other engines located at the wellpad, beyond those presently addressed by sections 11.1 and 11.2 of the Standard.