pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMENT RESPONSE DOCUMENT
Part 1 of 2 Appendices

Environmental Protection Performance Standards at Oil and Gas Well Sites

Title 25. Environmental Protection
Part I. Department of Environmental Protection
Subpart C. Protection of Natural Resources
Article II. Land Resources
Chapter 78. Oil and Gas Wells

43 Pa.B. 7377 (December 14, 2013)
Environmental Quality Board Regulation #7-484
Independent Regulatory Review Commission #3042

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Contents

Appendix 1

867.1 867.2(a)

SECTION 867—COMPOST BLANKET AND COMPOST FILTER BERM

867.1 DESCRIPTION—This work is furnishing, placement, and maintenance of organic compost, water permeable, erosion and sedimentation pollution control systems.

867.2 MATERIAL—

(a) Compost. Well-decomposed, stable, weed-free, organic compost meeting AASHTO MP-9, Standard Specification for Compost for Erosion/Sediment Control (Filter Berms) and AASHTO MP-10, Standard Specification for Compost for Erosion/Sediment Control (Compost Blankets) derived from a variety of feedstocks including agricultural, forestry, food, or industrial residuals; bio-solids (treated sewage sludge); leaf and yard trimmings; manure; or tree wood with no objectionable odors or substances toxic to plants. Material aerobically composted at a DEP, Bureau of Waste Management permitted site and conforming to CFR 503. Test in accordance with U.S. Composting Council's Test Methods for Examining of Composting and Compost (TMECC). Provide compost with the U.S. Composting Council's Seal of Testing Assurance Program (STA) certification and STA product label. Compost having the following physical properties:

TMECC Test Methodologies —

• Moisture content, dry mass (weight) basis	30% - 60%
• pH	5.5 to 8.5
• Soluble salt concentration (electrical conductivity) maximum	5.0 dS/m
• Man-made inert contaminants, dry mass, (weight) basis	Less than 1%
• Organic matter content, dry mass (weight) basis (compost to be seeded)	25%-65%
• Organic matter content, dry mass (weight) basis (compost that will not be seeded)	25%-80%

filtrexx supplied value

1. Compost Blanket Material.

Particle size, % passing mesh size, dry mass (weight) basis:

material passing 75 mm (3 inches)	100
material passing 25 mm (1 inch)	90 to 100
material passing 19 mm (3/4 inch)	65 to 100
material passing 6.4 mm (1/4 inch)	0 to 75

150 mm (6 inches) maximum particle length

2. Compost Filter Berm Material.

Particle size, % passing mesh size, dry mass (weight) basis:

material passing 75 mm (3 inches)	100
material passing 50 mm (2 inches)	99
material passing 9.5 mm (3/8 inch)	30 minimum – 75 maximum

acceptable general particle sizes of 13 mm – 50 mm (1/2 inch – 2 inches)
150 mm (6 inches) maximum particle length

Plant Nutrients and Fresh Mushroom Compost

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The purpose of this research project was to measure the plant nutrient content and particle size distribution of fresh mushroom compost. Mushroom compost, formerly referred to as "spent mushroom substrate" or "SMS," is the composted organic material remaining after a mushroom crop is harvested. Although there have been a few scattered reports and observations on the chemical compounds found in mushroom compost that are useful for the growth of agricultural crops and other plants, no formal record exists specifically for fresh mushroom compost. The key word is "fresh" – the material obtained directly as it is removed from a commercial mushroom production facility and not "static-aged" by being stockpiled outdoors in a field for several months.

During late winter/early spring 2005, 30 fresh mushroom compost samples were collected from mushroom farms in Berks and Chester counties. Each sample was placed in a one-gallon plastic container, sealed and sent to the Agricultural Analytical Services Laboratory (Pennsylvania State University, University Park, PA) for processing and analysis. For this study, fresh mushroom compost samples were processed and analyzed, and results are presented on a wet weight basis, wet volume basis, and dry weight basis (Table 1), particle size distribution (Figure 1), and amount of plant nutrients on a per acre basis (Table 2).

pH Most agricultural and horticultural crops grow best within a soil pH range of 6.0 to 7.0 (i.e., < 7.0 is acidic, 7 is neutral, and > 7 is alkaline). Within this pH range, most nutrients in the soil exist in an available form that can be taken-up by plant roots. Keep in mind, there are exceptions. For example, blueberries prefer a more acidic soil pH. The average pH of fresh mushroom compost is 6.6, an excellent pH for any compost used as an organic fertilizer or soil amendment. Unfortunately, rumors have bounced around for years about the pH of mushroom compost being too acidic or too alkaline for growing plants but this is not the case.

Soluble Salts This statement has been repeated many times over the years: "…you can't use mushroom compost because of the high salt content." With soils and composts, the salts of concern are those positively charged cations: potassium (K^+), calcium (Ca^{2+}), magnesium (Mg^{2+}) and sodium (Na^+). An excessive amount of these salts dissolved in the soil solution (i.e., the soil water environment) can increase the osmotic pressure of the soil solution, and this "salt effect," also referred to as salinity, inhibits water absorption by seeds and roots. Many composts and fertilizer products contain these salts in varying amounts. Potassium, calcium, and magnesium are actually essential nutrients beneficial to growing plants. When adding compost

or fertilizer to soil, these salts are often diluted by leaching with adequate rainfall or irrigation, or by tilling or mixing those materials into the soil.

Soluble salt content in soil and compost is measured indirectly by electrical conductivity, and the methods vary with each laboratory. Penn State's laboratory determines soluble salts using a 1:5 (compost:water) slurry. The average soluble salt content of fresh mushroom compost is not in an amount high enough to cause problems with plant growth. With fresh mushroom compost or any other compost or fertilizer, however, over-application or incorrect application of these materials to the soil can result in an excessive salt load.

Excess sodium salt in soil can result in problems with soil structure and drainage as well as inhibiting water absorption by plant roots. The best way to address this issue with fresh mushroom compost or any compost or organic soil amendment is to calculate the sodium adsorption ratio (SAR) of the product or material. The SAR compares the sodium concentration relative to the concentrations of calcium and magnesium. The SAR is calculated as follows:

$$SAR = \frac{[Na^{+}]}{\sqrt{\frac{([Ca^{2+}] + [Mg^{2+}])}{2}}}$$

A SAR value ≥ 15 indicates an excess amount of sodium compared to calcium and magnesium, and that sodium would be adsorbed by the soil clay particles thus causing problems mentioned above. Applying 40 tons of fresh mushroom compost to one acre of land (calculated by using a bulk density amount of 575 lbs/yd^3) results in a SAR = 0.38, which is very low! Therefore, the presence of sodium in fresh mushroom compost is not a negative aspect of this product, since there is an ample amount of calcium and magnesium present to prevent sodium from accumulating on those soil particles.

The *bottom line* with fresh mushroom compost, or any compost or organic soil amendment or fertilizer, is *environmental stewardship*. Compost products used for agricultural crop production, horticulture plant production, gardening, or land use reclamation should be applied correctly and in the proper amount. For many years, mushroom compost was mislabeled as "mushroom soil," and the product was unfortunately treated like a soil. As a result, Pennsylvania's mushroom industry had to deal with the negative feedback of trying to explain why their mushroom compost was not behaving like topsoil. Mushroom compost is not topsoil, rather an excellent compost useful to improve soil health and plant growth.

Bulk Density, Solids and Moisture The average bulk density of fresh mushroom compost is essentially 575 lbs/yd^3 (wet volume basis), with over half of the overall weight attributed to water. Fresh mushroom compost contains solids at 42.7 percent (wet weight) or 243.4 lbs/yd^3 (wet volume), and moisture or water at 57.3 percent (wet weight) or 331.5 lbs/yd^3 (wet volume). The ideal moisture content of compost depends on the water holding capacity of materials used to produce the compost. Overall, composts higher in organic matter have a higher water holding capacity. A range of 35 to 55 percent (wet weight) for solids and 45 to 65 percent

(wet weight) for moisture is ideal for most compost products. Fresh mushroom compost falls into those ranges.

Organic Matter and Carbon The average organic matter content of fresh mushroom compost is 26 percent (wet weight) or 147 lbs/yd^3 (wet volume). Fresh mushroom compost is an excellent source of organic matter, which represents a pool of plant nutrients to be slowly released over time. Also, due to the high organic matter and carbon content, fresh mushroom compost would be extremely useful to amend soils low in organic matter and nutrient availability, especially sand-based soils.

Carbon:Nitrogen (C:N) ratio The amount of carbon relative to the amount of nitrogen is an indicator of nitrogen availability for plant growth. The ideal C:N ratio for good composts should be within the range of 10:1 to 15:1, and no greater that 30:1. At higher C:N ratios, soil microorganisms can immobilize or tie-up nitrogen making it unavailable for plant roots. The average C:N ratio for fresh mushroom compost is ideal at 13:1.

Primary Macronutrients Nitrogen (N), phosphorus (P) and potassium (K) are important and essential primary plant macronutrients needed in higher quantities by plants than other nutrients. The average total N content of fresh mushroom compost is 1.1 percent (wet weight) or 6.4 lbs/yd^3 (wet volume). The majority of this N is in the organic form, with a very small percentage in the ammonium-form. In general, all organic compost materials (for example, composts made from landscape and yard wastes, plant residues, animal wastes) have low N content usually in the 1 to 3 percent range. Compost is a natural organic source of N, and the N is released slowly by soil microbial decomposition. Plants use N for growth and development, especially for amino acid and protein synthesis, and also for chlorophyll production. The average phosphate (phosphorus in the form of P_2O_5) content of fresh mushroom compost is 0.7 percent (wet weight) or 3.8 lbs/yd^3 (wet volume). Phosphorus is needed in plants for cell energy transfer and electron transport, and for DNA and RNA synthesis. Also, phosphorus is essential for seed germination and emergence. The average potash (potassium in the form of K_2O) content of fresh mushroom compost is 1.3 percent (wet weight) or 7.1 lbs/yd^3 (wet volume). Potassium is used by plants for enzyme reactions and the osmotic regulation of cells.

Secondary Macronutrients Calcium (Ca), magnesium (Mg), and sulfur (S) are considered secondary plant macronutrients, and are also required by most plants, but not in large quantities like the primary macronutrients of N, P, or K. Fresh mushroom compost contains Ca at 2.3 percent (wet weight) or 13.2 lbs/ yd^3 (wet volume), Mg at 0.4 % (wet weight) or 2.0 lbs/ yd^3 (wet volume), and S at 0.9 percent (wet weight) or 4.9 lbs/ yd^3 (wet volume). Calcium is important in plants for cell membrane structure and function. In plants, Mg is a central component of chlorophyll and vital for photosynthesis, and S is important for amino acid synthesis.

Micronutrients Iron (Fe), manganese (Mn), copper (Cu), and zinc (Zn) are all considered plant micronutrients and are needed in much smaller quantities compared to the macronutrients. Sodium (Na) and aluminum (Al) are not typically listed as micronutrients but are included in most compost analysis tests. All of these nutrients are available in fresh mushroom compost at a very low average range of 0.01 to 0.2 percent (wet weight) or 0.03 to 1.1 lbs/yd^3 (wet volume). Refer to Table 1 for the exact amounts of each nutrient. In plants, chlorophyll synthesis (Fe), formation of oxygen during photosynthesis (Mn), cellular respiration (Cu), and enzyme functions (Zn) are supported by these micronutrients. Again, rumors of excessive or toxic amounts of zinc present in fresh mushroom compost are not accurate as these results indicate.

Particle Size Approximately 91 percent of fresh mushroom compost is ≤ 3/8 inches in diameter (Figure 1). Therefore, fresh mushroom compost has a consistent and uniform size, which translates to ease of transport and application. Fresh mushroom compost is not "clumpy" or difficult to handle.

So, how much of these plant nutrients are supplied from fresh mushroom compost on a per acre basis? To apply evenly one-inch thick fresh mushroom compost to one acre of land would require 40 tons of fresh mushroom compost as calculated from an average bulk density of 575 lbs/yd^3 (Table 2). This calculation shows a total nitrogen amount of 891 lbs, of which 29 lbs is quickly available nitrogen (ammonium-nitrogen) used immediately by a crop in the same growing season when this compost is applied. A remaining amount of 862 lbs of organic nitrogen represents nitrogen that is slowly released over time. A typical "rule of thumb" is that 10 to 20 percent (86 to 192 lbs) of nitrogen could potentially become available during the growing season from this organic nitrogen pool. This kind of information is useful in field crop production in order to calculate nitrogen supplied by compost and nitrogen needed from fertilizer inputs. With the recent increase in synthetic fertilizer costs, nitrogen supplied from fresh mushroom compost represents an economical way to meet crop nutrient needs while minimizing the expense of applying synthetic fertilizers. Phosphate information on a per acre basis is also useful, since some states require detailed nutrient management plans for the purpose of monitoring the amount of phosphate being applied to the land.

In conclusion, fresh mushroom compost applied to soil or incorporated into soil has many benefits: improves soil structure, provides plant nutrients, increases plant nutrient availability, increases soil microbial populations, increases soil cation exchange capacity, increases plant root structure, increases soil aeration, improves soil water status, and reduces soil compaction. Fresh mushroom compost is a viable "green" product as an organic soil amendment and fertilizer for crop production systems and other land management issues.

For more information on the cost of Penn State's compost analysis and other related information, refer to the laboratory Web site at www.aasl.psu.edu. Also, before sending compost samples to any laboratory, make sure it is U.S. Compost Council certified (www.compostcouncil.org).

Acknowledgements

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CAC's Mushroom Compost Committee under the direction of Tom Brosius, Marlboro Mushrooms; Don Needham, Hy-Tech Mushroom Compost, Inc.; and Eugene D. Richard, Richard Enterprises Inc., provided technical support for this research project.

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Further Reading

For more information on soils, refer to these publications:

Brady, N.C. and R.R. Weil. 2000. Elements of the nature and properties of soils. Prentice Hall, Upper Saddle River, NJ.

Brady, N.C. and R.R. Weil. 1996. The nature and properties of soils. Prentice Hall, Upper Saddle River, NJ.

Foth, H.D. 1984. Fundamentals of soil science. John Wiley and Sons, New York, NY.

Miller, R.W. and D.T. Gardiner. 2001. Soils in our environment. Prentice Hall, Upper Saddle River, NJ.

Singer, M.J. and D.N. Munns. 2002. Soils, an introduction. Prentice Hall, Upper Saddle River, NJ.

Sidebar: Success Story!

The Pennsylvania Department of Agriculture had classified mushroom compost (formerly listed as "spent mushroom substrate" or "SMS") as an agricultural waste product, which then involved regulation through the Pennsylvania Department of Environmental Protection. This classification was incorrect, and resulted in unfortunate environmental and economic challenges for Pennsylvania's mushroom industry. As a result of this research by Drs. Mike Fidanza and David Beyer, and CAC's Mushroom Compost Committee, mushroom compost has been reclassified correctly as a fertilizer and soil amendment. For a copy of a fertilizer/soil amendment label for fresh mushroom compost, refer to the website www.mushroomcompost.org or AMI's website www.americanmushroom.org.

Table 1. Average values from analysis of fresh mushroom compost on a wet weight basis, wet volume basis, and dry weight basis.

Parameter Measured[1]	*Wet Weight Basis*[2]	*Wet Volume Basis*[2]	*Dry Weight Basis*[2]
pH	6.6	---	---
Soluble Salts [3]	13.3 mmhos/cm	---	---
Bulk Density	---	574.7 lbs/yd^3	---
Solids	42.7 %	243.4 lbs/yd^3	---
Moisture	57.3 %	331.5 lbs/yd^3	---
Organic Matter	25.9 %	146.7 lbs/yd^3	61.0 %
Carbon	14.3 %	81.1 lbs/yd^3	33.4 %
Carbon:Nitrogen Ratio	12.8:1 (~13:1)	12.8:1 (~13:1)	12.8:1 (~13:1)
Total Nitrogen	1.1 %	6.4 lbs/yd^3	2.7 %
Organic Nitrogen	1.1 %	6.2 lbs/yd^3	2.6 %
Ammonium Nitrogen (NH_4-N)	0.03 %	0.2 lbs/yd^3	0.08 %
Phosphate (P_2O_5)	0.7 %	3.8 lbs/yd^3	1.6 %
Potash (K_2O)	1.3 %	7.1 lbs/yd^3	2.9 %
Calcium	2.3 %	13.2 lbs/yd^3	5.4 %
Magnesium	0.4 %	2.0 lbs/yd^3	0.8 %
Sulfur	0.9 %	4.9 lbs/yd^3	2.0 %
Sodium	0.1 %	0.7 lbs/yd^3	0.3 %
Aluminum	0.1 %	0.9 lbs/yd^3	0.3 %
Iron	0.2 %	1.1 lbs/yd^3	0.4 %
Manganese	0.02 %	0.1 lbs/yd^3	0.04 %
Copper	0.01 %	0.03 lbs/yd^3	0.01 %
Zinc	0.01 %	0.05 lbs/yd^3	0.02 %

[1]Fresh mushroom compost samples (n = 30) collected in one-gallon size amounts were analyzed by the Agricultural Analytical Services Laboratory (Pennsylvania State University, University Park, PA), from January through April 2005.
[2]Mushroom compost samples analyzed "as is" when received at the laboratory for wet weight and wet volume measurements; for dry weight basis, samples oven-dried to remove moisture, then analyzed.
[3]Soluble salts determined by measuring electrical conductivity in a 1:5 (compost:water, weight ratio) slurry.

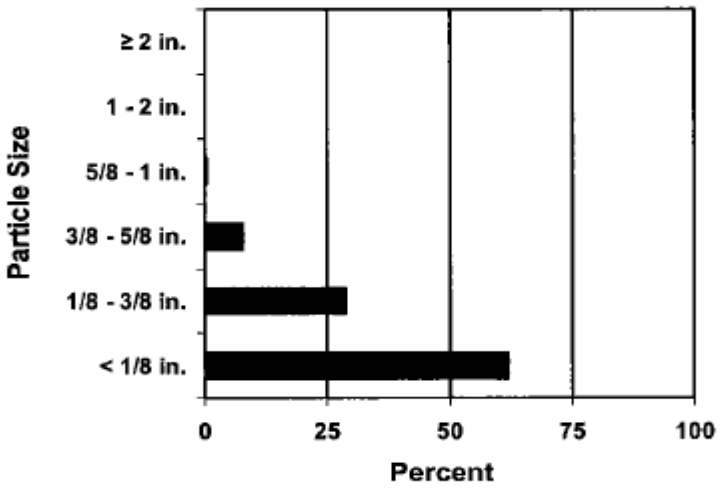

Figure 1. Average diameter values for particle size distribution of fresh mushroom compost as determined from a wet weight basis. Fresh mushroom compost samples (n = 30) collected in one-gallon size amounts were analyzed by the Agricultural Analytical Services Laboratory (Pennsylvania State University, University Park, PA), from January through April 2005.

Table 2. Amount of plant nutrients from 40 tons of fresh mushroom compost applied to one acre of land.

Parameter[1]	*Amount (lbs)*[2]
Solids	33,877
Moisture	46,140
Organic Matter	20,425
Carbon	11,294
Total Nitrogen	891
Organic Nitrogen	862
Ammonium Nitrogen (NH_4-N)	29
Phosphate (P_2O_5)	531
Potash (K_2O)	988
Calcium	1,834
Magnesium	280
Sulfur	683
Sodium	94
Aluminum	124
Iron	150
Manganese	17
Copper	6
Zinc	7

[1]pH = 6.6; C:N ratio = 13:1.

[2]Calculation based on applying one-inch thickness of fresh mushroom compost to one acre of land (one acre = 43,560 ft^2), which requires approximately 40 tons per acre using an average bulk density of 575 lbs/yd^3. For example, applying 40 tons fresh mushroom compost per acre will supply 531 lbs phosphate per acre.

Soil & Plant Laboratory

Compost – A Guide for Evaluating and Using Compost Materials as Soil Amendments

By William Darlington, Consultant
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Compost is defined as the product resulting from the controlled biological decomposition of organic material. Compost can be derived from a number of feed stocks including yard trimmings, biosolids (sewage sludge), wood by-products, animals manures, crop residues, biodegradable packing, and food scraps. Mature compost has little resemblance in physical form to the original biodegradable from which it is made. Compost is valued for its organic matter content, and it typically used as a soil amendment to enhance the chemical, physical and biological properties of soil. Compost is typically not a fertilizer, although when used at normal rates it can reduce the amount of required fertilizer.

Compost can increase the water holding capacity of sandy textured soils, and can improve structure and water movement through heavier textured soils that are high in silt and clay content. By increasing the organic content of the soil, biological activity can be enhanced. Water and nutrient holding capacity can be improved in some soils. Some composts have the ability to suppress fungal diseases; research in this area is ongoing.

Due to the diverse nature of feed stock and composting processes, the quality of available compost materials can vary widely. Successful use of compost relies on evaluating the soil to be amended followed by an evaluation of available compost materials, and then determining the best material and rate to meet the desired objectives.

Soil testing is a first step in evaluating soils slated for landscape use. A standard horticultural soil test will usually include determinations of soil pH, salinity, sodium hazard, boron hazard, lime content, organic matter and soil texture. Most laboratories will also determine available nutrient levels. A laboratory will usually suggest organic and/or chemical amendments. Non-routine testing may be required if there is a suspicion of soil sterilants (under asphalt or in right-of-ways) or contamination.

COMPOST QUALITY PARAMETERS

A number of important compost parameters can also be determined by laboratory testing. Table 1 lists suggested parameters for high quality compost.

Gradation

Gradation or particle size is determined by passing the compost through a set of sieves and then determining the weight fraction retained on each sieve size. For turf or landscape establishment all the particles should pass a one-inch screen with a minimum of 90% of the material by weight passing a ½ inch screen. Although a fine textured compost is generally preferred, excessive dust fraction (particles less than 500 micron) can cause difficulties in handling and can also be an indication of low organic content.

Organic content

Organic matter is the measure of carbon based materials in the compost. High quality compost will usually have a minimum of 50% organic content based on dry weight. Another means of expressing organic content is to list the weight of organic matter per unit volume of compost. Most high quality composts will have a minimum of 250 pounds of organic material per cubic yard.

Carbon to nitrogen ratio

The carbon to nitrogen ratio is a parameter used to determine if a compost is nitrogen stable. Composts that are derived primarily from wood by-products have high carbon to nitrogen ratios unless additional nitrogen is added during the composting process. Biosolids and manures generally have low carbon to nitrogen ratios since these materials are nitrogen rich. In general, a carbon to nitrogen ratio of 35 or lower is preferred if the material is claimed to be nitrogen stablilized. At higher carbon to nitrogen ratios, nitrogen can be tied as the compost further decomposes. Nitrogen is then less available to plant material, and high levels of nitrogen fertilization are required to maintain optimum plant color and growth. Products with low carbon to nitrogen ratios (less than 20) can supply significant quantities of nitrogen as they decompose.

pH

pH is a numerical measure of the acidity or alkalinity of the soil. The pH scale ranges from 0 to 14 with a pH or 7 indicating neutrality. Most compost has a pH between 6 and 8. Products derived from wood residuals or peat moss can have pH values as low as 4.5, while manures are frequently alkaline (pH 8.0-8.5). Since specific plant species sometimes prefer a specific pH range, knowledge of both soil and compost pH can be important. pH can be further adjusted through the use of such materials as lime (to increase pH) and sulfur or iron sulfate (to decrease pH). Composts with very low pH (<4.0) should be used with caution since the low pH can be an indication or poor

TABLE 1 - YARD WASTE COMPOST FOR USE AS AN INCORPORATED SOIL AMENDMENT -SPECIFICATION GUIDELINES-

1) **Gradation:** A minimum of 90% of the material by weight shall pass a ½" screen. Material passing the ½" screen shall meet the following criteria.

Percent Passing	Sieve Designation
85 – 100	9.51 mm (3/8")
50 – 80	2.38 mm (No. 8)
0 – 40	500 micron (No. 35)

2) **Organic content:** Minimum 50% based on dry weight and determined by ash method. Minimum 250 lbs. organic matter per cubic yard of compost.

3) **Carbon to nitrogen ratio:** Maximum 35:1 if material is claimed to be nitrogen stabilized.

4) **pH:** 5.5 – 8.0 as determined in saturated paste.

5) **Soluble salts:** Soluble nutrients typically account for most of the salinity levels but sodium should account for less than 25% of the total. To avoid a leaching requirement, the addition of the compost shall result in a final ECe of the amended soil of less than 4.0 dS/m @ 25 degrees C. as determined in a saturation extract. Use the following table to determine the maximum allowable ECe (dS/m of saturation extract) of compost at the desired use rate.

Desired Use Rate		Salinity (ECe) of On-Site Soil		
Cu. Yds. Amendment per 1000 sq. ft. for incorporation to 6" depth	Volume Percentage of Amendment	3 dS/m	2 dS/m	1 dS/m
		Maximum ECe of Compost		
1	5	**14**	**28**	**42**
2	11	**7**	**14**	**21**
3	16	**5**	**9.5**	**14**
4	22	**3.5**	**7**	**10.5**
5	27	**3**	**5.5**	**8.5**
6	32	**2.5**	**4.5**	**7**

Example: Specification calls for 6 cu. yds. compost per 1000 sq. ft. for incorporation to a 6" depth, and site soil has an ECe of 2.0. In order to avoid exceeding an ECe of 4 in the final blend, compost ECe should be less than 4.5 dS/m.

6) **Moisture content:** 35-60%

7) **Contaminants:** The compost shall be free of contaminants such as glass, metal and visible plastic. Heavy metals, fecal coliform, and *Salmonella sp* shall not exceed levels outlined in California Integrated Waste Management regulations.

8) **Maturity:** Physical characteristics suggestive of maturity include:
color: dark brown to black
odor: Acceptable = none, soil-like, musty or moldy Unacceptable = sour, ammonia or putrid
particle characterization: identifiable wood pieces are acceptable but the balance of material should be soil-like without recognizable grass or leaves.

HY-TECH MUSHROOM COMPOST, INC.
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www.Hy-TechMushroomCompost.com

Fresh Pasteurized Mushroom Compost Analysis

CUMULATIVE AVERAGE

Material as is since 2008, n=10	value	unit	#/ton *	SD of value
pH	6.7			0.6
Organic Matter	26.0	%		2.6
Moisture	60.2	%		4.3
Nitrogen, Total	1.0	%	21.1	0.1
Nitrogen Ammonium	0.1	%	1.4	0.1
Nitrogen, Organic	1.0	%	19.7	0.1
Phosphorus [P2O5], Total	0.6	%	12.4	0.1
Potassium, [K20]	1.1	%	23.7	0.2
Carbon	14.3	%		3.1
C:N Ratio	14.3			3.8
Soluble Salts	13.7	mmhos/cm		2.1
Calcium	2.3	%	47.8	0.3
Magnesium	0.3	%	5.7	0.0
Sulfur	0.8	%	15.1	0.1
Boron	29.0	ppm	0.0	8.5
Copper	39.2	ppm	0.1	12.4
Iron	1025.6	ppm	2.1	274.0
Manganese	134.1	ppm	0.2	17.4
Zinc	79.8	ppm	0.2	13.6
Aluminum	652.9	ppm		134.5
Sodium	1174.5	ppm		282.7
Sodium Adsorption Ratio (SAR)	2.6			0.6
As	1.8	ppm		2.2
Cd	0.9	ppm		1.9
Pb	3.4	ppm		5.1
Hg	0.0	ppm		0.0
Ni	4.2	ppm		1.9
Se	1.3	ppm		1.8
Mo	1.2	ppm		0.3

* calculated values

(117)

Appendix 2

Center for Sustainable Shale Development

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PERFORMANCE STANDARDS
(March 2013)

GEOGRAPHIC SCOPE AND APPLICABILITY OF CSSD 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 CSSD evaluation and certification process will be limited to operators' unconventional activities in the Appalachian Basin.

WATER PERFORMANCE STANDARDS

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

Wastewater Performance Standards

Performance Standard No. 1: Operators shall maintain zero discharge of wastewater (including drilling, flowback and produced waters) to Waters of the Commonwealth of Pennsylvania and other states until such time as CSSD adopts a standard for treating shale wastewater to allow for safe discharge. Such standard will be adopted by September 1, 2014.

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

Performance Standard No. 2:

1. Operators shall maintain a plan to recycle flowback and produced water, for usage in drilling or fracturing a well, to the maximum extent possible.

2. Within two (2) years following implementation of these standards [or for each new well that obtains an ESCGP-1 permit, or other earth disturbance permit, following implementation of these standards] Operators must recycle a minimum of 90% of the flowback and produced water, by volume, from its wells in all core operating areas in which an Operator is a net water user.

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[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."

Center for Sustainable Shale Development

3. CSSD will consider a recycling standard for a net water producer within one year. Operators will maximize the use of recycled water to the extent possible during this time.

Pits/Impoundments Performance Standards

Performance Standard No. 3:

2. Operators, within 12 months of implementation of these standards, 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).

1. After the promulgation date of these standards, any new pits designed shall be double-lined and equipped with leak detection.

3. Operators, within 24 months of implementation of these standards, shall contain drilling fluid and flowback water in a closed loop system at the well pad, eliminating the use of pits for all wells.[2]

Performance Standard No. 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.

2. Additionally, CSSD will facilitate research designed to determine the extent of hydrocarbon emissions from these waters so that by September 1, 2014, a decision can be made as to whether, and to what extent, this standard should be amended.

Groundwater Protection Performance Standards

Performance Standard No. 5: 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(s) above the production zone that will prevent adverse migration of hydraulic fracturing

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[2] *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 and subject to 25 Pa. Code, Chapter 78.

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 and subject to 25 Pa. Code, Chapters 78 and 105.

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.

Performance Standard No. 6:

1. Operators shall develop and implement a plan for monitoring existing water sources, including aquifers and surface waters [terms to be defined in guidance 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 potentially 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.

Performance Standard No. 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. CSSD will develop a standard relating to the public disclosure of chemicals other than well stimulation fluids by September 1, 2013.

5. Operators will also work toward use of more environmentally neutral additives for hydraulic fracturing fluid. Mechanical integrity tests shall be performed when refracturing an existing well.

Performance Standard No. 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[3].

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.

AIR PERFORMANCE STANDARDS

Performance Standard No. 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[4], and re-completion or workover of any well into a pipeline for sales.

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[3] 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.

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

2. Any gas not captured and put in the sales pipeline may not be vented[5] 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.

Performance Standard No. 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:

[5] 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.

(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[6] 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.[7] 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.

Performance Standard No. 11

1. The following standard applies only to nonroad dedicated diesel horizontal drilling rig engines at the wellpad. CSSD 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:

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[6] 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.

[7] 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.

(a) By the promulgation date of these performance standards, operator and contractor nonroad engines shall achieve horse power-hour weighted average [8] site emissions equivalent to U.S. EPA Tier 2 nonroad diesel engine standards or better.

(b) Within 30 months of the promulgation date of these performance standards, 25% of all operator and contractor engine utilization (hp) shall comply with U.S. EPA Tier 4 emissions standards for particulate matter (PM).[9]

(c) Within 3-years of the promulgation date of these performance standards, 75% of all operator and contractor engine utilization (hp) shall comply with U.S. EPA Tier 4 emissions standards for particulate matter (PM).[10]

(d) Within 4-years of the promulgation date of these performance standards, 95% of operator or contractor engine utilization (hp) shall comply with U.S. EPA Tier 4 emissions standards for particulate matter (PM).[11]

(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. CSSD encourages and supports the conversion of fracturing pump engines to either dual-fuel, electricity or natural gas.

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[8] 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.

[9] 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.

[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.

(a) If the fracturing pump is a nonroad dedicated diesel engine powered solely by diesel fuel, then the following emissions standards apply:

(i) Within 1-year of the promulgation date of these performance standards, operator and contractor nonroad engines shall achieve horse power-hour weighted average[12] site emissions equivalent to U.S. EPA Tier 2 nonroad diesel engine standards or better.

(ii) Within 3-years of the promulgation date of these performance standards, 25% of all operator and contractor engine utilization (hp) shall comply with U.S. EPA Tier 4 emissions standards for particulate matter (PM).[13]

(iii) Within 4-years of the promulgation date of these performance standards, 75% of all operator and contractor engine utilization (hp) shall comply with U.S. EPA Tier 4 emissions standards for particulate matter (PM).[14]

(iv) Within 5-years of the promulgation date of these performance standards, 95% of all operator and contractor engine utilization (hp) shall comply with U.S. EPA Tier 4 emissions standards for particulate matter (PM).[15]

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[12] 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.

[13] 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.

[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 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.

(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 the promulgation date of these performance standards, 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.[16]

(ii) Within two years of the promulgation date of these performance standards, 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 (PM) emissions.[17]

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

3. Within 1-year of the promulgation date of these standards, CSSD will develop a standard and implementation date for all other engines located at the wellpad.

Performance Standard No. 12

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

[16] 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.

[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.

1. Within one-year of the promulgation date of these standards, 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 may not emit more than 0.5 g/hp-hr for NOx; 2.0 g/hp-hr for CO; 0.7 g/hp-hr for VOCs.

3. Any new, purchased, replacement, reconstructed, or relocated rich-burn engines greater than 100 horsepower may not emit more than 0.3 g/hp-hr for NOx; 2.0 g/hp-hr for CO; 0.7 g/hp-hr for VOCs. Note: This standard will be updated to reflect any future determinations from regulatory agencies with regard to the NOx limitation.

Performance Standard No. 13

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.

Performance Standard No. 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. Within 1-year of the promulgation date of these standards, 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.

Performance Standard No. 15

1. Within one-year of the promulgation date of these performance standards, 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.[18]

2. Within 3-years of the promulgation date of these performance standards, 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.[19]

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.

[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.

[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.

(138)

Appendix 3

WR-35

Date July 13, 2005
API # 47- 039 - 05714

State of West Virginia
Division of Environmental Protection
Section of Oil and Gas
Well Operator's Report of Well Work

Farm Name: Dennis & Christine Smartley Operator Well No.: Raymond City #11

LOCATION: Elevation: 1051.99' Quadrangle: Bancroft
District: Union County: Kanawha
Latitude: 6550' feet South of 38° DEG. 32' MIN. 30" SEC.
Longitude: 1068' feet West of 81° DEG. 45' MIN. 00" SEC.

Company: Cabot Oil & Gas Corporation
900 Lee Street East, Suite 500
Charleston, WV 25301

Agent: Thomas S. Liberatore
Inspector: Carlos Hively
Permit Issued: 3/30/2005
Well Work Commenced: April 10, 2005
Well Work Completed: May 10, 2005
Verbal Plugging:
Permission granted on:
Rotary X Cable
Total Depth (feet) 5085'
Fresh Water Depths (ft) 92'
Salt Water Depths (ft) None reported
Is coal being mined in area (Y / N) ? Y
Coal Depths (ft) 378'-380', 445'-447'

Casing & Tubing Size	Used in Drilling	Left In Well	Cement Fill Up Cu. Ft.
13 3/8"	28'	28'	N/A
9 5/8"	586'	586'	280
7"	2311'	2311'	465
4 1/2"		5070'	350
2 3/8"		4904'	

OPEN FLOW DATA

Producing Formation Marcellus Shale / Huron Shale Pay Zone Depth (ft) 5042'-4801' / 4381'-3866'

Gas: Initial Open Flow TSTM MCF/d Oil: Initial Open Flow 0 Bbl/d
Final Open Flow 348 (COMMINGLED) MCF/d Final Open Flow 0 Bbl/d
Time of open flow between initial and final tests 96 Hours
Static rock pressure 360 psig surface pressure after 14 Hours

Second Producing Formation Devonian Shale Pay Zone Depth (ft) 3334'-3306'

Gas: Initial Open Flow TSTM MCF/d Oil: Initial Open Flow 0 Bbl/d
Final Open Flow 348 (COMMINGLED) MCF/d Final Open Flow 0 Bbl/d
Time of open flow between initial and final tests 96 Hours
Static rock pressure 360 psig surface pressure after 14 Hours

NOTE: ON BACK OF THIS FORM PUT THE FOLLOWING: 1.) DETAILS OF PERFORATED INTERVALS, FRACTURING OR STIMULATING, PHYSICAL CHANGE, ETC. 2.) THE WELL LOG WHICH IS SYSTEMATIC DETAILED GEOLOGICAL RECORD OF ALL FORMATIONS, INCLUDING COAL ENCOUNTERED BY THE WELLBORE

For: CABOT OIL & GAS CORPORATION
By: Drilling Superintendent
Date: 7/22/05

RECEIVED
Office of Oil & Gas
Office of Chief
JUL 26 2005
WV Department of Environmental Protection

KAN 5714

AUG 26 2005

STAGE	PERFS	ACID 15% HCl	FOAM	SAND (lbs)	NITROGEN (scf)	BDP	ATP	MTP	ISIP
1-Marcellus Shale	5042-4801 (35)	250 gal	80Q	4,000	452,496	2476	2893	3104	2471
2-Huron Shale	4381-3866 (37)	500 gal	80Q	10,000	819,823	2410	2535	2640	1880
3-Devonian Shale	3334-3306 (29)	250 gal			404,725	1594	1650	1734	1300
4-Berea	2642-2656 (29)	500 gal	80Q	4,000	423,989	3207	3362	3537	2724

FORMATION	TOP	BOTTOM	REMARKS
Sand and Shale	0	378	
Coal	378	380	
Sand & Shale	380	445	
Coal	445	447	
Sand & Shale	447	860	
Sand	860	894	
Shale	894	904	
Sand	904	946	
Shale	946	967	
Sand	967	992	
Shale	992	1010	
Sand	1010	1026	
Silt & Shale	1026	1125	
Sand	1125	1250	
Sand & Shale	1250	1530	
Sand	1530	1570	
Silt & Sand	1570	1660	
Salt Sand	1660	1965	
Big Lime	1965	2161	
Shale	2161	2169	
Injun	2169	2212	
Silt & Sand	2212	2397	
Shale	2397	2624	
Sunbury Shale	2624	2642	
Berea Sand	2642	2656	
Shale	2656	3866	
Huron Shale	3866	4382	
Shale	4382	4765	
Rhinestreet Shale	4765	4992	
Marcellus Shale	4992	5045	
Onondaga	5045	5085	TD

Environmental Assessment for 47-039-05714, Raymond City #11, Kanawha County, West Virginia

George Monk and Molly Schaffnit
Poca, West Virginia
November 2009

Description of Site

The site is immediately off of Harmon's Creek Road on the Kanawha County side of the Putnam and Kanawha County lines, north of Charleston. The well was drilled in 2005 to the Marcellus formation and that and two other Devonian shale formations were fractured according to the operator's completion report filed with the state.[1]

George originally visited the site in November 2008 but because of construction equipment parked on the pad (for a waterline being installed along Harmon's Creek Road) his observations were limited to the perimeter of the pad and the production equipment.[2]

We returned to the site with one of the surface owners on 20 July 2009. Our objective at that time was to try to determine the location of the pit and possible location of the land application of drill waste. What we found was a large area on the pad, north of the wellhead, where sections of thick black plastic were sticking up out of the ground. The exposed plastic surrounded an area that was bare of vegetation in some places, sparsely vegetated in others. The owner told us that this was where the pit had been located when the well was drilled. He also indicated north of the pad where he and his wife had observed a powdery "cement colored" substance on leaves and vegetation. This was the presumed land application area.

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[1] The well completion report is available online at http://downloads.wvgs.wvnet.edu/BatchInfo/kanawha/4703905714compO.tif.

[2] Photographs of the site taken in November 2008 are on the *Gas Well Study, 2008* portion of our website: http://members.citynet.net/sootypaws/Woods/gaswell/comments/otherwells/5714.html. A secondary containment dike for the condensate storage tank was constructed in October 2009.

We received permission from the surface owners and began to assess the site.[3]

Description of Pad and Surroundings

The cleared area for the pad was about 100 by 200 feet, oriented roughly west to east with the wellhead more or less in the center. There seems to have been little required in the leveling of the site as there was not a cut into a hillside. The fill slope was short and the sedimentation control along the northern edge of the site consisted of a branch and log barrier. A pipeline to a nearby compressor station passed along the northern edge of the site.

The pad had a slant and depressions. The highest part of the pad was at the southeast corner, above the paved Harmon's Creek Road. From south to north there was a slight downward slope with the lowest portion of the pad being where the pit had been. It was in this area where we observed standing water in the form of shallow puddles.

Vegetation coverage on the fill slope and the southeastern corner was the best on the site. There were areas not related to the exposed plastic perimeter where coverage was sparse, similar to what we've seen at other sites reclaimed at about the same time by this operator.

A steep hillside at the north of the pad drops to a hollow. About 326 feet from the well, according to our GPS, is a spring-fed cistern on the surface owners' property.

Exposed Plastic Perimeter

Exposed black plastic created a perimeter that was roughly 15 feet wide and 100 long. At the western end within this perimeter there was no vegetation at all. Vegetation became progressively less sparse towards the east.[4] There was a portion of thick steel cable emerging from approximately the center of the space within the perimeter of exposed plastic.

Soil in this area was a fine, tan colored clay. There were small patches of darker material showing and next to one of the exposed pieces of plastic this darker material had the appearance of drill waste -- dark gray, cement-like in appearance.

When the chloride test sample for S5 was collected, less than 2 inches below the surface a dark gray horizon was encountered, similar to the

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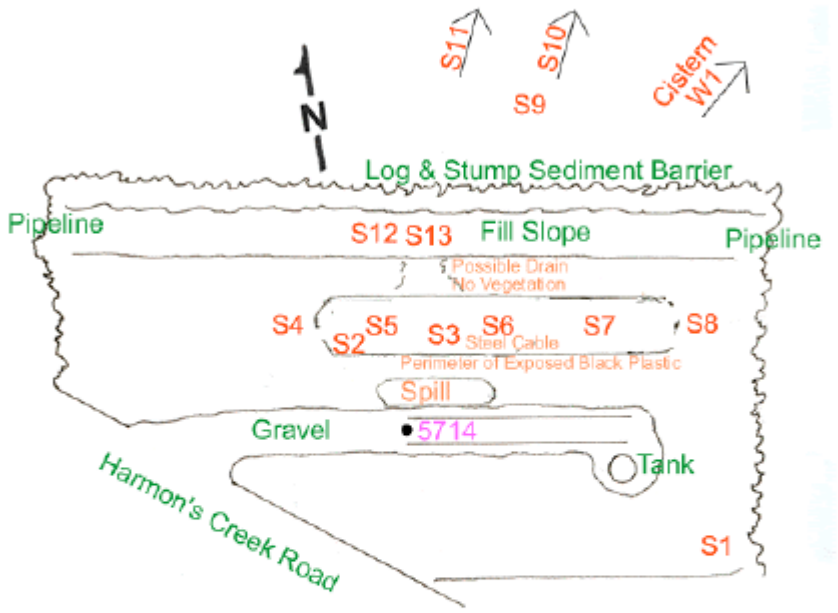
[3] The surface owners had a verbal agreement with the operator that all drill waste was to be disposed of off site. This was also the understanding of neighboring surface owners.

[4] The predominate form of vegetation on the pad is tall fescue grass. At least one variety of tall fescue is vulnerable to high chloride in soil which prohibits germination. See David A. Munn and Raymond Stewart, 1989, "Effect of Oil Well Brine on Germination and Seedling Growth of Several Crops," *Ohio Journal of Science*.

cement-like material. When the laboratory sample was collected at the same location as S5, the dark gray horizon extended from about 2 inches below the surface to as far was we excavated during sample collection, 6 inches. About a foot east of this location, there was dark gray colored soil on the surface. The only place when collecting samples where we encountered what we believe to be drill waste was within the exposed plastic perimeter.



Soil Testing

For preliminary soil and water testing we used Hach Quantab low range chloride test strips with an effective range of concentrations between 30 and 650 mg/l.[5] For lower concentration tests we consider Quantab 0.2 and 0.4 as trace and 0.6 and 0.8 as <30 mg/l chloride.

All but one of the samples collected were soil samples and were taken to try to assess two different issues. On the pad itself, soil samples were taken to try to determine the extent and nature of soil contamination in the pit area. Away from the pit area, soil samples were taken on the hillside below the pad on the north side to try to determine if this was the application area for liquid drill waste. All soil samples, except 5714-A for laboratory analysis, were taken from the surface.

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[5] A description of how we use the Quantab test strips is available on our website, George Monk and Molly Schaffnit, *Environmental Assessment -- Chloride Testing*, Sootypaws website.

One water grab sample was taken from the spring-fed cistern on the hillside below the pad to test the water for chloride.

Hach Quantab Soil Test Locations

During our initial visit to the site (20 July 2009) we tested the cistern's water (<30 mg/l chloride, sample W1) and took two soil samples from the pad within the exposed plastic perimeter where there was no vegetation. Those samples (S2 and S3) showed the presence of chloride at >650 mg/l.

A second visit to the site (on 26 July 2009) was made. After measuring the extent of the black plastic and bare and sparsely vegetated area, we created a traverse line through the length of this affected area, with markers set 28 feet apart. Five markers were set, with the central marker next to a piece of thick steel cable that projected from the soil's surface.[6] These are samples S4-S8 on the map. Samples S4 and S8 were taken outside the perimeter of exposed black plastic.

North of the pad, on the hillside below, three locations were tested (S9 - S11). According to our GPS these were roughly 116 to 216 feet from the wellhead.

On a third visit (6 August 2009) we tested two spots located on the fill slope of the pad (samples S12 and S13) to the north of the perimeter of exposed plastic, where we believed drainage from the pit area possibly was taking place. We also took samples for laboratory analysis in the same location at S5.

High Chloride Locations

The only soil locations that tested greater than a trace concentration of chloride were within the perimeter of exposed black plastic: the two initial soil tests S2 and S3 (>650 mg/l) and the later tests S5 (>650 mg/l), S6 (331 mg/l) and S7 (136 mg/l) along the traverse. One soil test, the easternmost sample on the traverse, S8, showed less than 30 mg/l (Quantab 0.6).

Low Chloride Locations

Soil tests carried out beyond the black plastic perimeter all showed just a trace of chloride or, at the eastern end of the traverse at S8, < 30 mg/l. The water grab sample from the cistern below the site tested at less than 30 mg/l (Quantab 0.8 on the scale of the test strip).

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[6] We have assumed that this is close to the center of the closed pit. We believe the piece of steel cable was used to puncture and hold the folded ends of pit liner while the pit contents were buried. We observed a similar piece of steel projecting above the surface of the closed pit of 47-079-01492, a well operated by a different company.

Table 1. Sample Locations and Chloride Concentrations

ID	Sample Location	Chloride
S1	Soil test sample from southeast corner of pad.	trace
S2	Soil test sample from north of well in area bare of vegetation, inside of exposed black plastic perimeter.	>650 mg/l
S3	Soil test sample from north of well in area bare of vegetation, inside of exposed black plastic perimeter.	>650 mg/l
S4	Soil test sample from westernmost point of traverse, outside of exposed black plastic perimeter.	trace
S5	Soil test sample 28 feet east of S4 on traverse, inside exposed black plastic perimeter.	>650 mg/l
S6	Soil test sample 28 feet east of S5 on traverse, inside exposed black plastic perimeter, next to piece of steel cable.	331 mg/l
S7	Soil test sample 28 feet east of S6 on traverse, inside exposed black plastic perimeter.	136 mg/l
S8	Soil test sample 28 feet east of S7 on traverse, outside exposed black plastic perimeter, at the easternmost end of the traverse.	<30 mg/l
S9	Soil test sample from wooded slope below pad.	trace
S10	Soil test sample from wooded slope below pad, further down slope than S9.	trace
S11	Soil test sample from wooded slope below pad, further down slope than S10.	trace
S12	Soil test sample from fill slope below northern edge of pad.	trace
S13	Soil test sample from fill slope below northern edge of pad, northeast of S12.	trace
5714-A	Soil sample for laboratory analysis, the same location as S5 but from 4-5 inches below the surface.	2,550 mg/l
W1	Water grab sample from spring-fed cistern downhill from pad.	<30 mg/l
Note: Samples taken from surface except where noted. Locations shown on map.		

Laboratory Analysis

We collected two samples of the pit material on 6 August 2009 and sent one to Pace Analytical Laboratories for analysis. The sample submitted to Pace (5714-A) was collected at between 4 and 5 inches below the surface,

where the material appeared to be entirely pit waste by its color and consistency. The sample was collected exactly from the same location as S5.

Table 2. Laboratory Analysis for 5714-A

	Concentration	CAS Number
Chloride	2550 mg/kg	16887-00-6
Arsenic	16 mg/kg	7440-38-2
Barium	203 mg/kg	7440-39-3
Cadmium	Not Detected	7440-43-9
Calcium	37100 mg/kg	7440-70-2
Chromium	27.9 mg/kg	7440-47-3
Lead	23.4 mg/kg	7439-92-1
Magnesium	6400 mg/kg	7439-95-4
Sodium	1230 mg/kg	7440-23-5
Radium 226	1.57 pCi/g	13982-63-3
Radium 228	1.35 pCi/g	15262-20-1

Site Assessment

The following assessment is based only on the concentrations of arsenic and lead found by the laboratory in the sample 5714-A, from within the perimeter of exposed plastic. Three of the metals are not considered a concern -- calcium, magnesium and sodium -- even though their concentrations were high.[7] Radium 226 and Radium 228 had concentrations within the normal background range.

The other five metals tested for were selected because they tend to appear in high concentrations in drill waste. Comparison with state soil background levels shows that the arsenic and lead concentrations were higher than the maximum.[8] Our assessment is based on these two metals, though we are also concerned with the high concentration of chloride in the sample. We believe chloride is directly impacting vegetation on the surface. As mobilizer and transporter of metals of concern, a high chloride concentration also has an influence on how we must assess the site.

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[7] The Sodium Adsorption Ratio (SAR) for the sample was 1.55.

[8] West Virginia soil background concentration levels are found in Table 2-3 of West Virginia Department of Environmental Protection, 2001, *West Virginia Voluntary Remediation and Redevelopment Act: Guidance Manual Version 2.1.*

The conceptual model for this site includes a number of factors, some already mentioned such as the presence of a spring-fed cistern down hill.[9] This cistern marks a point where nearby ground and surface water are hydrologically connected.

The Tolley residence and vegetable garden is about 200 feet from the laboratory sample location.[10] The spring-fed cistern is located about 300 feet in the opposite direction. City water has recently become available to residents, but some may still use similar cisterns.

The operator's well completion report notes fresh water 92 feet below the surface, though it is possible that a perched aquifer also exists much closer to the surface as is found elsewhere on this ridge. A mile away, the seasonal high water table is just a few feet from the surface.

After the well has finished production and equipment has been removed, the pad would make an ideal homesite because of its location next to the paved road and easy access to utilities. For this reason, and also because of the existing Tolley residence, we consider this a residential site.

We noted deer hoof prints in the vicinity of the hot spot and believe that deer are attracted to this location because of the salts in the soil which they ingest.[11]

Our assessment concerns are, as derived from the site description: possible effects to surface and ground water; possible effects to humans as they live, play and garden nearby (and possibly in the future, on the site); and possible ecological effects to wildlife and vegetation.

Table 3. Screening Levels for Soil to Ground Water

	Concentration mg/kg	EPA Soil to Groundwater mg/kg	WV Soil to Groundwater mg/kg
Arsenic	16	0.292	5.8
Lead	23.4	13.5	270

EPA's soil to groundwater screening levels shows there should be a concern for both arsenic and lead's concentrations in the sample. The EPA

[9] At this time the cistern is not being used for domestic or agricultural water supply.

[10] According to Annette Tolley, the well is 185 feet from her home and the vegetable garden is approximately 100 feet from the well.

[11] Taylor Campbell et al, 2004, "Unusual white-tailed deer movements to a gas well in the central Appalachians," *Wildlife Society Bulletin*. This study found deer traveling up to 6 km to visit a spot contaminated by gas well brine.

has two default Dilution-Attenuation Factors (DAF), a factor of 1 and a factor of 20.[12] The state's soil screening levels (taken from the de minimis soil screening levels in 60CSR3) use a DAF of 20 and still arsenic's concentration is almost 3 times higher.

There is a possibility that groundwater is being negatively affected by pit waste.

Table 4. Screening Levels for Residential Soil

	Concentration mg/kg	EPA Residential Soil mg/kg
Arsenic	16	0.389
Lead	23.4	400

Residential soil screening levels show that the arsenic concentration is 41 times the EPA's soil screening level. There is a strong possibility that current residents living nearby are being negatively affected by exposure to arsenic, and a similarly strong possibility that future residents on the site would be affected.

Table 5. Ecological Soil Screening Levels

	Concentration mg/kg	NOAA SQuiRTs Eco-SSL mg/kg	EPA Eco-SSL mg/kg
Arsenic	16	5.7 (mammals)	43 (avian) 2000 (mammals)
Lead	23.4	0.0537 (mammals)	11 (avian) 56 (mammals)

The NOAA ecological soil screening levels are much more protective than the EPA's and are based on recent research. There are no overriding reasons to use Eco-SSLs (such as endangered species or climax habitat), but we believe they need to be taken in consideration. Vegetation has been adversely affected and wildlife is attracted to the site by the presence of salts in the soil. Wildlife, such as deer, which is hunted and consumed by humans,

[12] The DAF is a mathematical expression of the diminution of a contaminant's concentration upon entering a large aquifer. See [New Jersey Department of Environment Protection], 2008, *Guidance for the Determination of the Dilution-Attenuation Factor for the Impact to Ground Water Quality*

provides an additional pathway of exposure for the chemicals of concern on the site.

Conclusions

Soil testing for chloride was not able to show whether or not land application of liquid pit waste occurred on the hillside to the north of the site. Land application, if it occurred, happened in 2005 and chloride doesn't reside in soil for long periods of time. Other types of soil testing, such as for elevated sodium or heavy metals, should be used in a situation of this sort.

Soil testing was able to show the extent of surface contamination from the contents of the pit but did not seem to show migration of the contamination to elsewhere on the site or to off the site. We were not able to visit the site during a heavy rain to see how the pad's drainage worked. It is possible that the pit area drains west, toward the Tolley residence across Harmon's Creek Road, instead of north. Diminishing surface chloride concentrations on the eastern segments of the traverse suggest that the pit's liner bottom may not be intact.

Heavy equipment and pipe parked on the pit area in 2008 and early 2009 while a water line was being installed along Harmon's Creek Road may have been a factor toward the disturbance of pit material and liner. The primary factor was the shallow and improper burial of the pit's contents. The shallow burial of pit waste and destruction of pit liner cover occurred earlier, during reclamation of the site by the operator after completion of the well. The highest point on the pad, where sample S1 was taken, was constructed of soil scraped from other parts of the pad as bits of torn black plastic and orange plastic fencing, used around the pit, attest. The state's regulations do not offer guidance, though other states require encapsulation of the pit's contents and a soil cover of at least 18 inches.[13] The Argonne National Laboratory recommends a minimum of 3 feet cover.[14]

Site assessment based on laboratory results from a single sample indicate that further assessment is required if the operator wishes to defer remediation. Screening levels for arsenic show that there's a concern for groundwater contamination and for the health of current nearby residents and potential future residents on the site.

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[13] Commonwealth of Pennsylvania, *Pennsylvania Code, Chapter 78.62*, subsections (A)17 and (A)18.

[14] Argonne National Laboratory, *Fact Sheet - Onsite Burial (Pits, Landfills). Drilling Waste Management.*

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Photograph 1. View of the pit area showing perimeter of exposed black plastic (indicated by red circles). Molly is standing at easternmost edge of perimeter about 100 feet away. Sparsely vegetated area with highest chloride tests is in foreground. Photograph was taken looking east.

Photograph 2. Portion of exposed black plastic. Deer tracks are visible in foreground.

Photograph 3. Taken in October 2009, this photograph shows extensive deer activity at the location where samples S2, S3 and S5 were taken. The location for sample S5 and laboratory sample 5714-A is indicated by the green shotgun shell.

Photograph 4. Piece of steel cable emerging from surface. This is the approximate center of the perimeter of exposed black plastic and is the location of soil test S6.

Photograph 5. Traverse through pit area with locations of soil amples. Residence is on other side of Harmon's Creek Road. Photograph taken looking west.

Photograph 6. Looking up hillside below the well toward the northern lge of the pad. The hillside grade is approximately 36%. This photograph was taken from the cistern area.

notograph 7. The spring-fed cistern below the well pad. The cement block cistern is covered with sheets of metal roofing and its overflow drainage is visible in the foreground.

Environmental Assessment for 47-039-02026, Raymond City #6, Kanawha County, West Virginia

George Monk and Molly Schaffnit
Poca, West Virginia
June 2009

Description of site

The well site is on a ridge between Harmon's Creek and Kelly's Creek

Roads with its access road off Harmon's Creek Road.

The site is sparsely vegetated with a fringe of pine trees showing where the former cleared extent was. The well was drilled in the mid-1960s and according to state records never had a workover.

Significant clusters of deer tracks were used to identify possible locations of soil contamination from brine. Sparse vegetation on the site was an additional possible indicator.

In January 2008 the tank was allowed to overflow and crude petroleum and brine flowed down the hillside using an existing ditch. The tank in September 2008 had the required secondary containment constructed and the area was seeded. Several weeks later the road was graded, including part of the pad.

We began our examination of this site in September 2008.[1] Originally, we focused on equipment and maintenance of the site but beginning in 2009 we expanded our evaluation using this site as a way to develop our techniques for environmental assessment.[2]

The map shows approximate locations for soil sampling, features (such as supposed pit and "notch"), and scrap pipe and other metal from the operation of the well.

Soil testing

Soil samples were collected and testing was done by mixing an equal amount of soil sample with distilled water, shaking the mixture for 30

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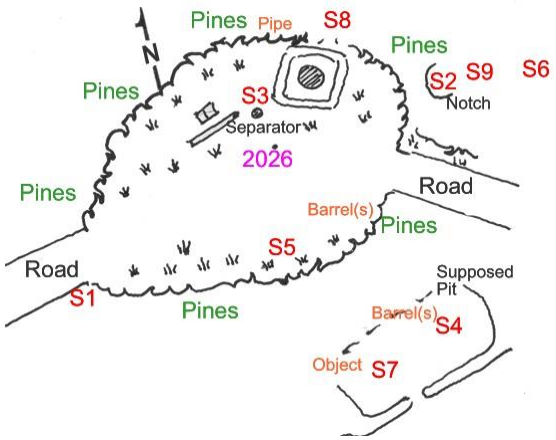
[1] Monk and Schaffnit, 2009, *Gas Well Study, 2008*.

[2] Monk and Schaffnit, "Environmental Assessment" web page.

seconds and letting settle. A Quantab chloride titrator test strip was used determine concentration of chlorides.[3]



Soil test locations

Soil testing occurred on two dates, 27 April 2009 and 20 May 2009. The first set of tests were locations called S1 through S4.[4] The second set of tests enhanced our understanding of the site and were S5 through S9.

Test locations were determined in order to see if we could evaluate the following issues we found in our evaluation. There were two locations (S2 and S3) that showed an unusually high number of deer tracks that we wanted to test to see if they had elevated chlorides.

Another location (S4 and S7) appeared to be an unfilled drilling waste pit. We wanted to see if soil there showed elevated chlorides.

The final set of tests examined the ditch behind the tank that was contaminated by brine and crude petroleum in January 2008 (S8); the hillside below the notch (S6 and S9), one of the heavily deer tracked spots we tested; and finally a test of the soil on the pad itself to see if a situation of elevated chlorides was a reason for lack of vegetation (S5).

High chloride locations

High chloride concentrations were found in the soil in three locations: the notch (136 mg/l), by the separator (136 mg/l) and the ditch contaminated

[3] Otton and Zielinski, 2000, *Simple techniques for assessing impacts of oil and gas operations on Federal Lands: a field evaluation at Big South Fork National River and Recreation Area, Scott County, Tennessee (online edition)*.

[4] Monk and Schaffnit, "47-039-02026" web page.

in January 2008 (42 mg/l). The notch (S2) and the separator (S3) locations

showed evidence of unusual deer activity. High soil chlorides here seems to indicate that where we see high level deer tracking at other sites we can expect also to find elevated chlorides.

Photo 1. Oil sheen on mud in ditch behind tank.

Location of sample S8.

The contaminated ditch showed a lower concentration of chlorides (S8). When the soil sample was taken the petroleum contamination of the soil was still evident in the form of an oily sheen on the mud. This sample, after mixing with distilled water, had a strong condensate odor when the lid of the container was removed. The condensate odor never went away.

Trace and no chloride locations

Three locations showed no evidence of chlorides -- the control sample (S1) taken at the edge of the pad from undisturbed area; a sample from the pad itself (S5); and a sample down the hillside from the notch (S6).

Three samples showed trace chlorides (less than 30 mg/l, the lower limit of the test we used). Two of those samples were from the supposed pit (S4 and S7). The third sample was a short distance downhill from the notch. This sample was taken where a piece of black plastic from the notch rested (S9).

Testing didn't show one way or the other if the supposed pit was a drill waste pit or not. Chlorides would be expected but not necessarily high chlorides. At the same time, soil chlorides possibly would diminish over time in response to weathering.

The two tests down the hillside from the notch seem to indicate that there is no serious migration of chlorides from the site.

Conclusions

Our evaluation allows some conclusions but in other instances opens the door for more questions. Our testing seems to show that unusual deer tracking is a sign of brine contamination of soil. The contamination by the separator wasn't entirely unexpected because of the purpose of that piece of equipment.

Photo 2. Photograph of notch taken in February 2009 showing extensive deer tracking.

What has happened to cause the soil at the notch to be contaminated is one of the questions we'll try to resolve in the future. Fragments of black plastic (pit liner?) seem to indicate that it might be a workover pit but we've been told by the Office of Oil and Gas that no permitted workover has taken place at this site. Soil here always shows signs of moisture, unlike most areas of the pad, and that raises other questions. Does soil contaminated with chlorides hold moisture better? Is there something happening at this spot so that fluids (either water or brine) from below the surface are appearing here?

Poor vegetation on the pad probably isn't caused by chloride contamination, though chlorides do inhibit the germination and development of some varieties of Tall Fescue, the operator's seed of choice.[5] Vegetation problems are most likely due to the continual grading the road and pad receive -- at least once every year or two. The pad was seeded after construction in September 2008, but shows poor growth and no germination at all by the separator. The operator needs to change practices at this site so grass can grow properly.

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[5] Munn and Stewart, 1989, "Effect of Oil Well Brine on Germination and Seedling Growth of Several Crops."

Nothing was done by the operator to mitigate the effects of contamination of the soil by the crude petroleum and brine spill of January 2008. While eventually petroleum hydrocarbons will be broken down by soil bacteria, it appears that this will take years to happen. A question here is whether the high chloride content of the soil inhibits these bacteria.

Soil sample locations

ID	Description	Chlorides
S1	Control, edge of pad	none
S2	Notch	136 mg/l
S3	By separator	136 mg/l
S4	Supposed pit, 6 inches below surface	trace
S5	Pad, between well and supposed pit	none
S6	Below notch, further than S9	none
S7	Supposed pit, 17 inches below surface	trace
S8	Ditch, below tank	42 mg/l
S9	Below notch, between S2 and S6	trace
Note: Samples taken from surface except where noted. Locations shown on map.		

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Photo 3. Pipe for oil and brine running from separator to tank (not shown). Great numbers of deer tracks along here to right up against separator.

Photo 4. The notch with extensive deer tracking

at time soil sample (S2) is being taken. GPS device is in center of photograph.

Photo 5. Ditch behind and below tank. The ditch goes a short way down hillside.

Photo 6. This photo was taken in the supposed pit, showing high bank. The bank appears

to be artificial.

Comments or questions? Email gmonk@citynet.net.

United States Environmental Protection Agency

Fact Sheet: Implementation of the Safe Drinking Water Act's Existing Requirements for Oil and Gas Hydraulic Fracturing Activities Using Diesel Fuels

The EPA has released an interpretive memorandum to clarify Underground Injection Control (UIC) program requirements under the Safe Drinking Water Act (SDWA), for underground injection of diesel fuels in hydraulic fracturing for oil and gas extraction. The agency has also released technical guidance containing recommendations for EPA permit writers to consider in implementing these UIC Class II requirements.

The EPA has developed the memorandum and technical guidance to achieve the following objectives:

- To explain that any owner or operator who injects diesel fuels in hydraulic fracturing for oil or gas extraction must obtain a UIC Class II permit before injection;
- To explain the agency's interpretation of the SDWA statutory term "diesel fuels" for permitting purposes; and,
- To describe existing UIC Class II program requirements for permitting underground injection of diesel fuels in hydraulic fracturing and to provide recommendations for the EPA's permit writers to consider in implementing these requirements to ensure protection of underground sources of drinking water (USDWs).

A key component of our nation's energy future is the safe, responsible development of oil and gas resources. If produced responsibly, natural gas has the potential to improve air quality, stabilize energy prices, and provide greater certainty about future energy reserves. The EPA is committed to working with co-regulators and other stakeholders to ensure that shale gas development occurs safely and responsibly and to encourage use of best practices.

The technical recommendations in the guidance are for EPA Regional Offices to consider when permitting diesel fuels hydraulic fracturing wells. EPA permit writers have the discretion to consider alternative approaches that are consistent with statutory and regulatory requirements. The EPA technical recommendations are consistent with best practices listed in state regulations, model guidelines and voluntary standards developed by industry and stakeholders. States and tribes responsible for issuing UIC and oil and gas well permits and/or updating regulations will find the recommendations useful in improving the protection of USDWs and public health wherever hydraulic fracturing is practiced.

The EPA recognizes that in addition to diesel fuels, other substances included in some hydraulic fracturing fluids contain of chemicals of concern. The EPA will work with

states and industry to explore approaches to promote voluntary use of safer alternatives in hydraulic fracturing fluids.

REGULATION OF HYDRAULIC FRACTURING USING DIESEL FUELS

Underground injection of fluids through wells is subject to the requirements of the SDWA except where specifically excluded by the statute. In the 2005 Energy Policy Act, Congress revised the SDWA definition of "underground injection" to specifically exclude hydraulic fracturing fluids from UIC regulation except where diesel fuels are used (SDWA Section 1421(d)(1)(B)). UIC regulations prohibit any underground injection except as authorized by rule or by permit. Thus, owners or operators who inject diesel fuels for hydraulic fracturing related to oil and gas operations must obtain a UIC permit before injection begins. Owners or operators injecting diesel fuels for hydraulic fracturing without a UIC permit may be subject to enforcement action under Section 1423 of the SDWA.

Hydraulic fracturing fluids are commonly a mixture of water, chemical additives and proppants. The types and concentrations of chemical additives and proppants used in hydraulic fracturing fluids vary depending on site-specific conditions and are usually tailored to needs of the project. In some instances diesel fuels have been used as an additive to achieve a variety of fluid properties. Diesel fuels may contain a number of chemicals of concern including benzene, toluene, ethylbenzene, and xylene compounds (BTEX). BTEX compounds are highly mobile in ground water and are regulated under the SDWA national primary drinking water regulations (NPDWRs) because of the risks they pose to human health.

WHEN DOES A HYDRAULIC FRACTURING ACTIVITY REQUIRE A UIC CLASS II PERMIT?

Owners or operators who inject diesel fuels for hydraulic fracturing related to oil and gas operations must obtain a UIC permit before injection begins. Consistent with the SDWA, the following five Chemical Abstract Service Registry Numbers (CASRN) represent the most appropriate interpretation of the statutory term "diesel fuels" to use for permitting diesel fuels hydraulic fracturing under the UIC Program nationwide, at this time:

- **68334-30-5 Primary Name: Fuels, diesel** Common Synonyms: Automotive diesel oil; Diesel fuel; Diesel oil (petroleum); Diesel oils; Diesel test fuel; Diesel fuels; Diesel fuel No. **1;** Diesel fuel [United Nations-North America (UN/NA) number 1993]; Diesel fuel oil; European Inventory ofExisting Commercial Chemical Substances (EINECS) 269- 822-7.

• **68476-34-6 Primary Name: Fuels, diesel, No.2** Common Synonyms: Diesel fuel No. 2; Diesel fuels No. 2; EINECS 270-676-l ; No. 2 Diesel fuel.

- **68476-30-2 Primary Name: Fuel oil No. 2** Common Synonyms: Diesel fuel; Gas oil or diesel fuel or heating oil, light [UN 1202] No. 2 Home heating oils; API No.2 fuel oil; EINECS 270-671-4; Fuel oil No.2; Home heating oil No. 2; No.2 burner fuel; Distillate fuel oils, light; Fuel No. 2; Fuel oil (No. 1 ,2,4,5 or 6) [NA1993].

- **68476-31-3 Primary Name: Fuel oil, No. 4** Common Synonyms: Caswell No. 2 333AB; Cat cracker feed stock; EINECS 270-673-5; EPA Pesticide Chemical Code 063514; Fuel oil No. 4; Diesel fuel No. 4.

- **8008-20-6 Primary Name: Kerosene** Common Synonyms: JP-5 navy fuel/marine diesel fuel; Deodorized kerosene; JP5 Jet fuel; AF 100 (pesticide); Caswell No. 517; EINECS 232-366-4; EPA Pesticide Chemical Code 063501; Fuel oil No. 1; Fuels, kerosine; Shell 140; Shell sol 2046; Distillate fuel oi ls, light; Kerosene, straight run; Kerosine, (petroleum); Several Others. The EPA may periodically update this list if new products are identified as diesel fuels.

Diesel fuels are sometimes used in oil and gas well development and production applications other than hydraulic fracturing. In non-injection applications the use of diesel fuels is not subject to UIC Class II permitting requirements because they are considered to be part of the well construction process and not injected for purposes of hydraulic fracturing.

TECHNCIAL GUIDANCE:

The revised guidance provides an overview of existing program requirements and technical recommendations pertaining to the follow aspects of Diesel Fuels hydraulic fracturing permitting:

- Permit application submission and review process
- Information submitted with the permit application
- Wells authorized under permits
- Permit duration and well closure
- Area of Review
- Well construction and mechanical integrity testing
- Well operations, monitoring and reporting
- Financial responsibility
- Public notification and environmental justice

FOR MORE INFORMATION:

- The guidance and other related documents are available at **Hydraulic Fracturing Under the Safe Drinking Water Act**, http://water.epa.gov/type/groundwater/uic/class2/hydraulicfracturing/hydraulic-fracturing.cfm.

- Information on agency-wide activities is available at **Natural Gas Extraction –**

Hydraulic Fracturing provides more information on agency-wide activities, www.epa.gov/hydraulicfracturing.

Hydraulic Fracturing Fluid Product Component Information Disclosure

Fracture Date	8/5/2011
State:	PENNSYLVANIA
County:	Tioga
API Number:	37-117-20323
Operator Name:	Seneca Resources Corporation
Well Name and Number:	Pino 1H 50122
Longitude:	-77.152634
Latitude:	41.741102
Long/Lat Projection:	NAD83
Production Type:	Gas
True Vertical Depth (TVD):	6,600
Total Water Volume (gal)*:	4,327,773

Hydraulic Fracturing Fluid Composition:

Trade Name	Supplier	Purpose	Ingredients	Chemical Abstract Service Number (CAS #)	Maximum Ingredient Concentration in Additive (% by mass)**	Maximum Ingredient Concentration in HF Fluid (% by mass)**	Comments
32% Hydrochloric Acid	Universal Well Services	Acid	Hydrogen Chloride	7647-01-0	32.00%	0.0471%	
NE-90	Universal Well Services	Non-Emulsifier	Methanol	67-56-1	60.00%	0.00015%	
			Isopropanol	67-63-0	10.00%	0.00003%	
			Heavy Aromatic Naphtha	64742-94-5	5.00%	0.00001%	
			Polyethylene Glycol	25322-68-3	5.00%	0.00001%	
			EO-C7-9-iso, C8-rich alcohols	78330-19-5	5.00%	0.00001%	
			EO-C9-11-iso, C10-rich alcohols	78330-20-8	5.00%	0.00001%	
			2-ethylhexanol	104-76-7	10.00%	0.00003%	
			Napthalene	91-20-3	1.00%	0.00000%	
Iron Sta IIC	Universal Well Services	Iron Control	Ethylene Glycol	107-21-1	30.00%	0.00032%	
Unihib A	Universal Well Services	Corrosion Inhibitor	Methanol	67-56-1	30.00%	0.00008%	
			C10-C16 Ethoxylated Alcohol	68002-97-1	30.00%	0.00008%	
			Isomeric Aromatic Ammonium Salt	Proprietary	10.00%	0.00003%	
			Petroleum Naphtha	64741-68-0	10.00%	0.00003%	
			Light Aromatic Solvent Naphtha	64742-95-6	10.00%	0.00003%	
			2-substituted Aromatic Amine Salt	Proprietary	5.00%	0.00001%	
			Kerosene	8008-20-6	5.00%	0.00001%	
			Hydrotreated light distillates	64742-47-8	5.00%	0.00001%	
			Kerosine (petroleum), hydrodesulfurized	64742-81-0	5.00%	0.00001%	
			Isopropyl Alcohol	67-63-0	5.00%	0.00001%	
			1,2,4- Trimethylbenzene	95-63-6	5.00%	0.00001%	
			1,3,5- Trimethylbenzene	108-67-8	1.00%	0.000003%	
			Diethylbenzene	25340-17-4	1.00%	0.000003%	
			Cumene	98-82-8	1.00%	0.000003%	
			Xylene	1330-20-7	1.00%	0.000003%	
			Formaldehyde	50-00-0	1.00%	0.000003%	
			Naphthalene	91-20-3	1.00%	0.000003%	
Unislik ST 50	Universal Well Services	Friction Reducer	Hydrotreated Light Distillate	64742-47-8	30.00%	0.01890%	
ScaleHib 100	Universal Well Services	Scale Inhibitor	Ethylene Glycol	107-21-1	60.00%	0.00990%	
Unigel CMHPG	Universal Well Services	Gelling Agent	No Hazardous Components			0.00000%	
LEB-10X	Universal Well Services	Enzyme Breaker	Ethylene Glycol	107-21-1	60.00%	0.00000%	
Sand (Proppant)	Universal Well Services	Proppant	Silica	14808-60-7	99.90%	12.25398%	
Water		Carrier/Base Fluid				87.61579%	
BioRid 20L	Tetra	Biocide	2,2-Dibromo-3-nitrilopropionamide	10222-01-2	20.00%	0.00003%	
			Sodium Bromide	7647-15-6	15.00%	0.00003%	

* Total Water Volume sources may include fresh water, produced water, and/or recycled water

** Information is based on the maximum potential for concentration and thus the total may be over 100%

All component information listed was obtained from the supplier's Material Safety Data Sheets (MSDS). As such, the Operator is not responsible for inaccurate and/or incomplete information. Any questions regarding the content of the MSDS should be directed to the supplier who provided it. The Occupational Safety and Health Administration's (OSHA) regulations govern the criteria for the disclosure of this information. Please note that Federal Law protects "proprietary", "trade secret", and "confidential business information" and the criteria for how this information is reported on an MSDS is subject to 29 CFR 1910.1200(i) and Appendix D.

Hydraulic Fracturing Fluid Product Component Information Disclosure

Fracture Date:	6/6/2011
State:	PENNSYLVANIA
County:	Tioga
API Number:	37-117-20777
Operator Name:	Seneca Resources Corporation
Well Name and Number:	Valldes 4H 50263
Longitude:	-77.10455
Latitude:	41.739056
Long/Lat Projection:	NAD83
Production Type:	Gas
True Vertical Depth (TVD):	6,104
Total Water Volume (gal)*:	3,038,952

Hydraulic Fracturing Fluid Composition:

Trade Name	Supplier	Purpose	Ingredients	Chemical Abstract Service Number (CAS #)	Maximum Ingredient Concentration in Additive (% by mass)**	Maximum Ingredient Concentration in HF Fluid (% by mass)**	Comments
32% Hydrochloric Acid	Universal Well Services	Acid	Hydrogen Chloride	7647-01-0	32.00%	0.04800%	
NE-90	Universal Well Services	Non-Emulsifier	Methanol	67-56-1	60.00%	0.00016%	
			Isopropanol	67-63-0	10.00%	0.00003%	
			Heavy Aromatic Naphtha	64742-94-5	5.00%	0.00001%	
			Polyethylene Glycol	25322-68-3	5.00%	0.00001%	
			EO-C7-9-iso, C8-rich alcohols	78330-19-5	5.00%	0.00001%	
			EO-C9-11-iso, C10-rich alcohols	78330-20-8	5.00%	0.00001%	
			2-ethylhexanol	104-76-7	10.00%	0.00003%	
			Napthalene	91-20-3	1.00%	0.00000%	
Iron Sta IIC	Universal Well Services	Iron Control	Ethylene Glycol	107-21-1	30.00%	0.00033%	
Unihib A	Universal Well Services	Corrosion Inhibitor	Methanol	67-56-1	30.00%	0.00009%	
			C10-C16 Ethoxylated Alcohol	68002-97-1	30.00%	0.00009%	
			Isomeric Aromatic Ammonium Salt	Proprietary	10.00%	0.00003%	
			Petroleum Naphtha	64741-68-0	10.00%	0.00003%	
			Light Aromatic Solvent Naphtha	64742-95-6	10.00%	0.00003%	
			2-substituted Aromatic Amine Salt	Proprietary	5.00%	0.00001%	
			Kerosene	8008-20-6	5.00%	0.00001%	
			Hydrotreated light distillates	64742-47-8	5.00%	0.00001%	
			Kerosine (petroleum), hydrodesulfurized	64742-81-0	5.00%	0.00001%	
			Isopropyl Alcohol	67-63-0	5.00%	0.00001%	
			1,2,4- Trimethylbenzene	95-63-6	5.00%	0.00001%	
			1,3,5- Trimethylbenzene	108-67-8	1.00%	0.00000%	
			Diethylbenzene	25340-17-4	1.00%	0.00000%	
			Cumene	98-82-8	1.00%	0.00000%	
			Xylene	1330-20-7	1.00%	0.00000%	
			Formaldehyde	50-00-0	1.00%	0.00000%	
			Naphthalene	91-20-3	1.00%	0.00000%	
Unislik ST 50	Universal Well Services	Friction Reducer	Hydrotreated Light Distillate	64742-47-8	30.00%	0.01530%	
ScaleHib 100	Universal Well Services	Scale Inhibitor	Ethylene Glycol	107-21-1	60.00%	0.01030%	
Unigel CMHPG	Universal Well Services	Gelling Agent	No Hazardous Components			0.00000%	
LEB-10X	Universal Well Services	Enzyme Breaker	Ethylene Glycol	107-21-1	60.00%	0.00001%	
Sand (Proppant)	Universal Well Services	Proppant	Silica	14808-60-7	99.90%	11.07900%	
Water		Carrier/Base Fluid				88.80171%	
BioRid 20L	Tetra	Biocide	2,2-Dibromo-3-nitrilopropionamide	10222-01-2	20.00%	0.00230%	
			Sodium Bromide	7647-15-6	15.00%	0.00170%	

* Total Water Volume sources may include fresh water, produced water, and/or recycled water

** Information is based on the maximum potential for concentration and thus the total may be over 100%

All component information listed was obtained from the supplier' s Material Safety Data Sheets (MSDS). As such, the Operator is not responsible for inaccurate and/or incomplete information. Any questions regarding the content of the MSDS should be directed to the supplier who provided it. The Occupational Safety and Health Administration' s (OSHA) regulations govern the criteria for the disclosure of this information. Please note that Federal Law protects "proprietary", "trade secret", and "confidential business information" and the criteria for how this information is reported on an MSDS is subject to 29 CFR 1910.1200(I) and Appendix D.

Hydraulic Fracturing Fluid Product Component Information Disclosure

Fracture Date	6/17/2011
State:	PENNSYLVANIA
County:	Tioga
API Number:	37-117-20820
Operator Name:	Seneca Resources Corporation
Well Name and Number:	Valdes 6H 50326
Longitude:	-77.104496
Latitude:	41.739281
Long/Lat Projection:	NAD83
Production Type:	Gas
True Vertical Depth (TVD):	5,941
Total Water Volume (gal)*:	5,180,910

Hydraulic Fracturing Fluid Composition:

Trade Name	Supplier	Purpose	Ingredients	Chemical Abstract Service Number (CAS #)	Maximum Ingredient Concentration in Additive (% by mass)**	Maximum Ingredient Concentration in HF Fluid (% by mass)**	Comments
32% Hydrochloric Acid	Universal Well Services	Acid	Hydrogen Chloride	7647-01-0	32.00%	0.03567%	
NE-90	Universal Well Services	Non-Emulsifier	Methanol	67-56-1	60.00%	0.00012%	
			Isopropanol	67-63-0	10.00%	0.00002%	
			Heavy Aromatic Naphtha	64742-94-5	5.00%	0.00001%	
			Polyethylene Glycol	25322-68-3	5.00%	0.00001%	
			EO-C7-9-iso, C8-rich alcohols	78330-19-5	5.00%	0.00001%	
			EO-C9-11-iso, C10-rich alcohols	78330-20-8	5.00%	0.00001%	
			2-ethylhexanol	104-76-7	10.00%	0.00002%	
			Naphthalene	91-20-3	1.00%	0.00000%	
Iron Sta IIC	Universal Well Services	Iron Control	Ethylene Glycol	107-21-1	30.00%	0.00024%	
Unihib A	Universal Well Services	Corrosion Inhibitor	Methanol	67-56-1	30.00%	0.00006%	
			C10-C16 Ethoxylated Alcohol	68002-97-1	30.00%	0.00006%	
			Isomeric Aromatic Ammonium Salt	Proprietary	10.00%	0.00002%	
			Petroleum Naphtha	64741-68-0	10.00%	0.00002%	
			Light Aromatic Solvent Naphtha	64742-95-6	10.00%	0.00002%	
			2-substituted Aromatic Amine Salt	Proprietary	5.00%	0.00001%	
			Kerosene	8008-20-6	5.00%	0.00001%	
			Hydrotreated light distillates	64742-47-8	5.00%	0.00001%	
			Kerosine (petroleum), hydrodesulfurized	64742-81-0	5.00%	0.00001%	
			Isopropyl Alcohol	67-63-0	5.00%	0.00001%	
			1,2,4- Trimethylbenzene	95-63-6	5.00%	0.00001%	
			1,3,5- Trimethylbenzene	108-67-8	1.00%	0.00000%	
			Diethylbenzene	25340-17-4	1.00%	0.00000%	
			Cumene	98-82-8	1.00%	0.00000%	
			Xylene	1330-20-7	1.00%	0.00000%	
			Formaldehyde	50-00-0	1.00%	0.00000%	
			Naphthalene	91-20-3	1.00%	0.00000%	
Unislik ST 50	Universal Well Services	Friction Reducer	Hydrotreated Light Distillate	64742-47-8	30.00%	0.01730%	
ScaleHib 100	Universal Well Services	Scale Inhibitor	Ethylene Glycol	107-21-1	60.00%	0.01260%	
Unigel GMHPG	Universal Well Services	Gelling Agent	No Hazardous Components			0.00000%	
LEB-10X	Universal Well Services	Enzyme Breaker	Ethylene Glycol	107-21-1	60.00%	0.00001%	
Sand (Proppant)	Universal Well Services	Proppant	Silica	14808-60-7	99.90%	11.83202%	
Water		Carrier/Base Fluid				88.05065%	
BioRid 20L	Tetra	Biocide	2,2-Dibromo-3-nitrilopropionamide	10222-01-2	20.00%	0.00276%	
			Sodium Bromide	7647-15-6	15.00%	0.00207%	

* Total Water Volume sources may include fresh water, produced water, and/or recycled water

** Information is based on the maximum potential for concentration and thus the total may be over 100%

All component information listed was obtained from the supplier's Material Safety Data Sheets (MSDS). As such, the Operator is not responsible for inaccurate and/or incomplete information. Any questions regarding the content of the MSDS should be directed to the supplier who provided it. The Occupational Safety and Health Administration's (OSHA) regulations govern the criteria for the disclosure of this information. Please note that Federal Law protects "proprietary", "trade secret", and "confidential business information" and the criteria for how this information is reported on an MSDS is subject to 29 CFR 1910.1200(i) and Appendix D.

Hydraulic Fracturing Fluid Product Component Information Disclosure

Fracture Date	5/8/2011
State:	PENNSYLVANIA
County:	Tioga
API Number:	37-117-20853
Operator Name:	SENECA RESOURCES CORPORATION
Well Name and Number:	Lehmann 1H 50348
Longitude:	-77.137109
Latitude:	41.746623
Long/Lat Projection:	NAD83
Production Type:	Gas
True Vertical Depth (TVD):	6,380
Total Water Volume (gal)*:	3,412,497

Hydraulic Fracturing Fluid Composition:

Trade Name	Supplier	Purpose	Ingredients	Chemical Abstract Service Number (CAS #)	Maximum Ingredient Concentration in Additive (% by mass)**	Maximum Ingredient Concentration in HF Fluid (% by mass)**	Comments
15% Hydrochloric Acid	Universal Well Services	Acid	Hydrogen Chloride	7647-01-0	15.00%	0.04860%	
NE-90	Universal Well Services	Non-Emulsifier	Methanol	67-56-1	60.00%	0.00016%	
			Isopropanol	67-63-0	10.00%	0.00003%	
			Heavy Aromatic Naphtha	64742-94-5	5.00%	0.00001%	
			Polyethylene Glycol	25322-68-3	5.00%	0.00001%	
			EO-C7-9-iso, C8-rich alcohols	78330-19-5	5.00%	0.00001%	
			EO-C9-11-iso, C10-rich alcohols	78330-20-8	5.00%	0.00001%	
			2-ethylhexanol	104-76-7	10.00%	0.00003%	
			Napthalene	91-20-3	1.00%	0.00000%	
Iron Sta IIC	Universal Well Services	Iron Control	Ethylene Glycol	107-21-1	30.00%	0.00033%	
Unihib A	Universal Well Services	Corrosion Inhibitor	Methanol	67-56-1	30.00%	0.00009%	
			C10-C16 Ethoxylated Alcohol	68002-97-1	30.00%	0.00009%	
			Isomeric Aromatic Ammonium Salt	Proprietary	10.00%	0.00003%	
			Petroleum Naphtha	64741-68-0	10.00%	0.00003%	
			Light Aromatic Solvent Naphtha	64742-95-6	10.00%	0.00003%	
			2-substituted Aromatic Amine Salt	Proprietary	5.00%	0.00001%	
			Kerosene	8008-20-6	5.00%	0.00001%	
			Hydrotreated light distillates	64742-47-8	5.00%	0.00001%	
			Kerosine (petroleum), hydrodesulfurized	64742-81-0	5.00%	0.00001%	
			Isopropyl Alcohol	67-63-0	5.00%	0.00001%	
			1,2,4- Trimethylbenzene	95-63-6	5.00%	0.00001%	
			1,3,5- Trimethylbenzene	108-67-8	1.00%	0.00000%	
			Diethylbenzene	25340-17-4	1.00%	0.00000%	
			Cumene	98-82-8	1.00%	0.00000%	
			Xylene	1330-20-7	1.00%	0.00000%	
			Formaldehyde	50-00-0	1.00%	0.00000%	
			Naphthalene	91-20-3	1.00%	0.00000%	
Unislik ST 50	Universal Well Services	Friction Reducer	Hydrotreated Light Distillate	64742-47-8	60.00%	0.02110%	
ScaleHib 100	Universal Well Services	Scale Inhibitor	Ethylene Glycol	107-21-1	60.00%	0.01230%	
Unigel CMHPG	Universal Well Services	Gelling Agent	No Hazardous Components			0.00000%	
LEB-10X	Universal Well Services	Enzyme Breaker	Ethylene Glycol	107-21-1	60.00%	0.00001%	
Sand (Proppant)	Universal Well Services	Proppant	Silica	14808-60-7	99.90%	12.29202%	
Water		Carrier/Base Fluid				87.56490%	
BioRid 102	Tetra	Biocide	Sulfamic acid, N-Bromo, sodium salt	1004542-84-0	10.20%	0.00131%	
			Di-bromo nitriliopropionamide	10222-01-2	18.30%	0.00235%	

* Total Water Volume sources may include fresh water, produced water, and/or recycled water

** Information is based on the maximum potential for concentration and thus the total may be over 100%

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Hydraulic Fracturing Fluid Product Component Information Disclosure

Fracture Date	5/8/2011
State:	PENNSYLVANIA
County:	Tioga
API Number:	37-117-20855
Operator Name:	SENECA RESOURCES CORPORATION
Well Name and Number:	Lehmann 3H 50350
Longitude:	-77.137213
Latitude:	41.74665
Long/Lat Projection:	NAD83
Production Type:	Gas
True Vertical Depth (TVD):	6,519
Total Water Volume (gal)*:	3,150,741

Hydraulic Fracturing Fluid Composition:

Trade Name	Supplier	Purpose	Ingredients	Chemical Abstract Service Number (CAS #)	Maximum Ingredient Concentration in Additive (% by mass)**	Maximum Ingredient Concentration in HF Fluid (% by mass)**	Comments
15% Hydrochloric Acid	Universal Well Services	Acid	Hydrogen Chloride	7647-01-0	15.00%	0.02570%	
NE-90	Universal Well Services	Non-Emulsifier	Methanol	67-56-1	60.00%	0.00008%	
			Isopropanol	67-63-0	10.00%	0.00001%	
			Heavy Aromatic Naphtha	64742-94-5	5.00%	0.00001%	
			Polyethylene Glycol	25322-68-3	5.00%	0.00001%	
			EO-C7-9-iso, C8-rich alcohols	78330-19-5	5.00%	0.00001%	
			EO-C9-11-iso, C10-rich alcohols	78330-20-8	5.00%	0.00001%	
			2-ethylhexanol	104-76-7	10.00%	0.00001%	
			Napthalene	91-20-3	1.00%	0.00000%	
Iron Sta IIC	Universal Well Services	Iron Control	Ethylene Glycol	107-21-1	30.00%	0.00018%	
Unihib A	Universal Well Services	Corrosion Inhibitor	Methanol	67-56-1	30.00%	0.00005%	
			C10-C16 Ethoxylated Alcohol	68002-97-1	30.00%	0.00005%	
			Isomeric Aromatic Ammonium Salt	Proprietary	10.00%	0.00002%	
			Petroleum Naphtha	64741-68-0	10.00%	0.00002%	
			Light Aromatic Solvent Naphtha	64742-95-6	10.00%	0.00002%	
			2-substituted Aromatic Amine Salt	Proprietary	5.00%	0.00001%	
			Kerosene	8008-20-6	5.00%	0.00001%	
			Hydrotreated light distillates	64742-47-8	5.00%	0.00001%	
			Kerosine (petroleum), hydrodesulfurized	64742-81-0	5.00%	0.00001%	
			Isopropyl Alcohol	67-63-0	5.00%	0.00001%	
			1,2,4- Trimethylbenzene	95-63-6	5.00%	0.00001%	
			1,3,5- Trimethylbenzene	108-67-8	1.00%	0.00000%	
			Diethylbenzene	25340-17-4	1.00%	0.00000%	
			Cumene	98-82-8	1.00%	0.00000%	
			Xylene	1330-20-7	1.00%	0.00000%	
			Formaldehyde	50-00-0	1.00%	0.00000%	
			Naphthalene	91-20-3	1.00%	0.00000%	
Unislik ST 50	Universal Well Services	Friction Reducer	Hydrotreated Light Distillate	64742-47-8	60.00%	0.01670%	
ScaleHib 100	Universal Well Services	Scale Inhibitor	Ethylene Glycol	107-21-1	60.00%	0.01090%	
Unigel CMHPG	Universal Well Services	Gelling Agent	No Hazardous Components			0.00000%	
LEB-10X	Universal Well Services	Enzyme Breaker	Ethylene Glycol	107-21-1	60.00%	0.00001%	
Sand (Proppant)	Universal Well Services	Proppant	Silica	14808-60-7	99.90%	13.11603%	
Water		Carrier/Base Fluid				86.78197%	
BioRid 102	Tetra	Biocide	Sulfamic acid, N-Bromo, sodium salt	1004542-84-0	10.20%	0.00133%	
			Di-bromo nitriliopropionamide	10222-01-2	18.30%	0.00239%	

* Total Water Volume sources may include fresh water, produced water, and/or recycled water

** Information is based on the maximum potential for concentration and thus the total may be over 100%

All component information listed was obtained from the supplier' s Material Safety Data Sheets (MSDS). As such, the Operator is not responsible for inaccurate and/or incomplete information. Any questions regarding the content of the MSDS should be directed to the supplier who provided it. The Occupational Safety and Health Administration' s (OSHA) regulations govern the criteria for the disclosure of this information. Please note that Federal Law protects "proprietary", "trade secret", and "confidential business information" and the criteria for how this information is reported on an MSDS is subject to 29 CFR 1910.1200(i) and Appendix D.

Hydraulic Fracturing Fluid Product Component Information Disclosure

Fracture Date	2/27/2011
State:	Pennsylvania
County:	Tioga
API Number:	37-117-20856
Operator Name:	Seneca Resources
Well Name and Number:	DCNR 007 5H
Longitude:	-77.413052
Latitude:	41.81609
Long/Lat Projection:	NAD83
Production Type:	Gas
True Vertical Depth (TVD):	6,700
Total Water Volume (gal)*:	4,474,050

Hydraulic Fracturing Fluid Composition:

Trade Name	Supplier	Purpose	Ingredients	Chemical Abstract Service Number (CAS #)	Maximum Ingredient Concentration in Additive (% by mass)**	Maximum Ingredient Concentration in HF Fluid (% by mass)**	Comments
Water		Carrier/Base Fluid				88.36813%	
Sand (Proppant)		Proppant	Silica	14808-60-7	99.90%	11.31837%	
15% Hydrochloric Acid	Universal Well Services	Acid	Hydrogen Chloride	7647-01-0	15.00%	0.24080%	
NE-90	Universal Well Services	Non-Emulsifier	Methanol	67-56-1	60.00%	0.00079%	
			Isopropanol	67-63-0	10.00%	0.00013%	
			Heavy Aromatic Naphtha	64742-94-5	5.00%	0.00007%	
			Polyethylene Glycol	25322-68-3	5.00%	0.00007%	
			EO-C7-9-iso, C8-rich alcohols	78330-19-5	5.00%	0.00007%	
			EO-C9-11-iso, C10-rich alcohols	78330-20-8	5.00%	0.00007%	
			2-ethylhexanol	104-76-7	10.00%	0.00013%	
			Napthalene	91-20-3	1.00%	0.00001%	
Iron Sta IIC	Universal Well Services	Iron Control	Ethylene Glycol	107-21-1	30.00%	0.00164%	
Unihib A	Universal Well Services	Corrosion Inhibitor	Methanol	67-56-1	30.00%	0.00043%	
			C10-C16 Ethoxylated Alcohol	68002-97-1	30.00%	0.00043%	
			Isomeric Aromatic Ammonium Salt	Proprietary	10.00%	0.00014%	
			Petroleum Naphtha	64741-68-0	10.00%	0.00014%	
			Light Aromatic Solvent Naphtha	64742-95-6	10.00%	0.00014%	
			2-substituted Aromatic Amine Salt	Proprietary	5.00%	0.00007%	
			Kerosene	8008-20-6	5.00%	0.00007%	
			Hydrotreated light distillates	64742-47-8	5.00%	0.00007%	
			Kerosine (petroleum), hydrodesulfurized	64742-81-0	5.00%	0.00007%	
			Isopropyl Alcohol	67-63-0	5.00%	0.00007%	
			1,2,4- Trimethylbenzene	95-63-6	5.00%	0.00007%	
			1,3,5- Trimethylbenzene	108-67-8	1.00%	0.00001%	
			Diethylbenzene	25340-17-4	1.00%	0.00001%	
			Cumene	98-82-8	1.00%	0.00001%	
			Xylene	1330-20-7	1.00%	0.00001%	
			Formaldehyde	50-00-0	1.00%	0.00001%	
			Naphthalene	91-20-3	1.00%	0.00001%	
FRP-121	Universal Well Services	Friction Reducer	No Hazardous Components				
ScaleHib 100	Universal Well Services	Scale Inhibitor	Ethylene Glycol	107-21-1	60.00%	0.01470%	
Unigel CMHPG	Universal Well Services	Gelling Agent	No Hazardous Components				
LEB-10X	Universal Well Services	Enzyme Breaker	Ethylene Glycol	107-21-1	60.00%	0.00001%	

* Total Water Volume sources may include fresh water, produced water, and/or recycled water

** Information is based on the maximum potential for concentration and thus the total may be over 100%

All component information listed was obtained from the supplier' s Material Safety Data Sheets (MSDS). As such, the Operator is not responsible for inaccurate and/or incomplete information. Any questions regarding the content of the MSDS should be directed to the supplier who provided it. The Occupational Safety and Health Administration' s (OSHA) regulations govern the criteria for the disclosure of this information. Please note that Federal Law protects "proprietary", "trade secret", and "confidential business information" and the criteria for how this information is reported on an MSDS is subject to 29 CFR 1910.1200(i) and Appendix D.

Hydraulic Fracturing Fluid Product Component Information Disclosure

Fracture Date:	4/18/2011
State:	PENNSYLVANIA
County:	Tioga
API Number:	37-117-20890
Operator Name:	Seneca Resources Corporation
Well Name and Number:	Steinmetz 3H 50352
Longitude:	-77.158061
Latitude:	41.727019
Long/Lat Projection:	NAD83
Production Type:	Gas
True Vertical Depth (TVD):	6,803
Total Water Volume (gal)*:	3,645,558

Hydraulic Fracturing Fluid Composition:

Trade Name	Supplier	Purpose	Ingredients	Chemical Abstract Service Number (CAS #)	Maximum Ingredient Concentration in Additive (% by mass)**	Maximum Ingredient Concentration in HF Fluid (% by mass)**	Comments
32% Hydrochloric Acid	Universal Well Services	Acid	Hydrogen Chloride	7647-01-0	32.00%	0.09059%	
NE-90	Universal Well Services	Non-Emulsifier	Methanol	67-56-1	60.00%	0.00030%	
			Isopropanol	67-63-0	10.00%	0.00005%	
			Heavy Aromatic Naphtha	64742-94-5	5.00%	0.00002%	
			Polyethylene Glycol	25322-68-3	5.00%	0.00002%	
			EO-C7-9-iso, C8-rich alcohols	78330-19-5	5.00%	0.00002%	
			EO-C9-11-iso, C10-rich alcohols	78330-20-8	5.00%	0.00002%	
			2-ethylhexanol	104-76-7	10.00%	0.00005%	
			Napthalene	91-20-3	1.00%	0.00000%	
Iron Sta IIC	Universal Well Services	Iron Control	Ethylene Glycol	107-21-1	30.00%	0.00062%	
Unihib A	Universal Well Services	Corrosion Inhibitor	Methanol	67-56-1	30.00%	0.00016%	
			C10-C16 Ethoxylated Alcohol	68002-97-1	30.00%	0.00016%	
			Isomeric Aromatic Ammonium Salt	Proprietary	10.00%	0.00005%	
			Petroleum Naphtha	64741-68-0	10.00%	0.00005%	
			Light Aromatic Solvent Naphtha	64742-95-6	10.00%	0.00005%	
			2-substituted Aromatic Amine Salt	Proprietary	5.00%	0.00003%	
			Kerosene	8008-20-6	5.00%	0.00003%	
			Hydrotreated light distillates	64742-47-8	5.00%	0.00003%	
			Kerosine (petroleum), hydrodesulfurized	64742-81-0	5.00%	0.00003%	
			Isopropyl Alcohol	67-63-0	5.00%	0.00003%	
			1,2,4- Trimethylbenzene	95-63-6	5.00%	0.00003%	
			1,3,5- Trimethylbenzene	108-67-8	1.00%	0.00001%	
			Diethylbenzene	25340-17-4	1.00%	0.00001%	
			Cumene	98-82-8	1.00%	0.00001%	
			Xylene	1330-20-7	1.00%	0.00001%	
			Formaldehyde	50-00-0	1.00%	0.00001%	
			Naphthalene	91-20-3	1.00%	0.00001%	
Unislik ST 50	Universal Well Services	Friction Reducer	Hydrotreated Light Distillate	64742-47-8	30.00%	0.01530%	
ScaleHib 100	Universal Well Services	Scale Inhibitor	Ethylene Glycol	107-21-1	60.00%	0.01050%	
Unigel CMHPG	Universal Well Services	Gelling Agent	No Hazardous Components			0.00000%	
LEB-10X	Universal Well Services	Enzyme Breaker	Ethylene Glycol	107-21-1	60.00%	0.00001%	
Sand (Proppant)	Universal Well Services	Proppant	Silica	14808-60-7	99.90%	11.86075%	
Water		Carrier/Base Fluid				87.96751%	
BioRid 20L	Tetra	Biocide	2,2-Dibromo-3-nitrilopropionamide	10222-01-2	20.00%	0.00500%	
			Sodium Bromide	7647-15-6	15.00%	0.00375%	
FRP-121	Universal Well Services	Friction Reducer	No Hazardous Components				

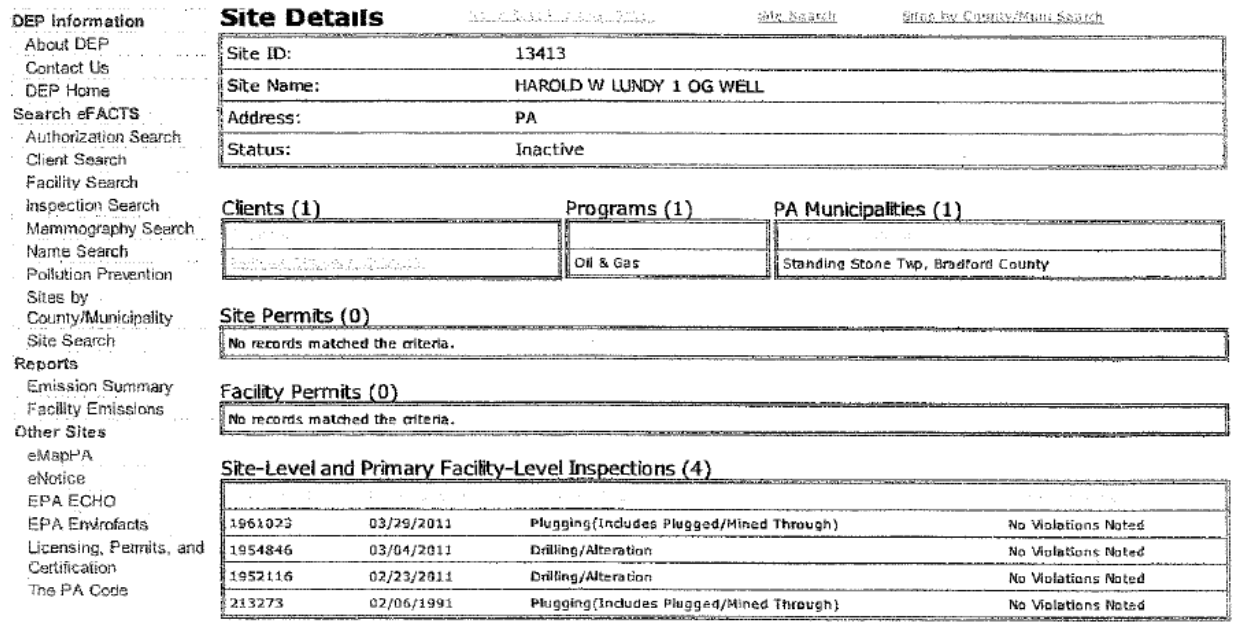
* Total Water Volume sources may include fresh water, produced water, and/or recycled water

** Information is based on the maximum potential for concentration and thus the total may be over 100%

All component information listed was obtained from the supplier' s Material Safety Data Sheets (MSDS). As such, the Operator is not responsible for inaccurate and/or incomplete information. Any questions regarding the content of the MSDS should be directed to the supplier who provided it. The Occupational Safety and Health Administration' s (OSHA) regulations govern the criteria for the disclosure of this information. Please note that Federal Law protects "proprietary", "trade secret", and "confidential business information" and the criteria for how this information is reported on an MSDS is subject to 29 CFR 1910.1200(i) and Appendix D.

(660a)

Appendix 4



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Client Search
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Inspection Search
Mammography Search
Name Search
Pollution Prevention
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Site Search
Reports
Emission Summary
Facility Emissions
Other Sites
eMapPA
eNotice
EPA ECHO
EPA Envirofacts
Licensing, Permits, and Certification
The PA Code

Site Details

Site Search Sites by County/Muni Search

Site ID:	13413
Site Name:	HAROLD W LUNDY 1 OG WELL
Address:	PA
Status:	Inactive

Clients (1)

Programs (1)

Oil & Gas

PA Municipalities (1)

Standing Stone Twp, Bradford County

Site Permits (0)

No records matched the criteria.

Facility Permits (0)

No records matched the criteria.

Site-Level and Primary Facility-Level Inspections (4)

1961023	03/29/2011	Plugging(Includes Plugged/Mined Through)	No Violations Noted
1954846	03/04/2011	Drilling/Alteration	No Violations Noted
1952116	02/23/2011	Drilling/Alteration	No Violations Noted
213273	02/06/1991	Plugging(Includes Plugged/Mined Through)	No Violations Noted

And:
The formula for identifying over-pressurized annular conditions—(0.8 x 0.433 psi/foot) multiplied by casing length in feet—may not be sufficiently protective in areas with a relatively deep water table. We suggest reducing the multiplier from 0.8 to 0.7.

Diane Ward comments:
An operator proposing to drill a well within one mile of an abandoned or orphan well or a well plugged using procedures less protective than those detailed in this revision of 78.92-78.95, shall forward by certified mail a copy of the well location plat showing the location of the abandoned, orphan, or previously plugged well, the drilling, casing and cementing plan for the new well and the anticipated date drilling will commence to the Department and shall submit proof of notification to the Department with the well permit application. The operator will be subsequently required to provide to the Department the well record of the abandoned or orphan well or previously plugged well. Upon request of the Department, the operator will be required to assess the orphan, abandoned, or previously plugged well for mechanical integrity, defective casing or cementing, and excess pressures and provide this assessment to the Department. The Department will determine the appropriate prerequisites to drilling the new well, which may include the plugging of the orphan or abandoned well utilizing current standards as specified in 78.92-78.95, or may specify repair/re-plugging requirements for the previously plugged well which must occur prior to the drilling of the new well.

Earth Justice and Sierra comment:
The Department should develop best flaring practices as well as green completion techniques.

Response:
The Department believes it has appropriately addressed surface casing pressure requirements and remediation measures for when pressures are exceeded.

A survey and assessment of surrounding abandoned wells may be useful to the Department but should not be a prerequisite for well permitting. If well drilling or stimulation causes communication with an abandoned well such that there is the threat to pollution of waters of the Commonwealth, the Department has the authority to order the well operator to remedy the situation.

Finally, best flaring practices is a concept the Department will consider addressing through the development of a guidance document. As previously mentioned, green completion techniques are beyond the scope of these regulations.

§ 78.81. General provisions.

Numerous commentators stated that oil and gas wells should be constructed according to Pennsylvania public water well construction standards. In particular, requiring the diameter of the well bore be at least 3 inches greater than the outside of the casing collar or casing tube so that wells may be cemented using a tube that is placed on the outside of the surface casing ("top jobbing").

PIPP comments:

From: diane ward [pekin_2@yahoo.com]
Sent: Monday, August 09, 2010 6:57 AM
To: EP, RegComments
Subject: 25 PA.?CODE CH. 78?Oil and Gas Wells Proposed Rulemaking EQB- Comments

From: Diane V. Ward
RR #2 Box 68D
Wysox, PA 18854

e-mail:
pekin_2@yahoo.com<http://us.mc343.mail.yahoo.com/mc/compose?to=pekin_2@yahoo.com>

Thank you for your efforts to improve the PA regulations regarding Oil and Gas Wells. After careful review of the proposed rulemaking on Oil and Gas Wells, I hereby submit the following comments for your consideration:

78.83 (2) (c) The requirement for protecting fresh groundwater with surface casing should be that the operator shall drill to approximately 100 feet below the deepest fresh groundwater or at least 100 feet into consolidated rock, whichever is deeper, and immediately set and permanently cement a string of surface casing to that depth. The proposed regulation currently shows a requirement of 50 feet below the groundwater or 50 feet into consolidated rock. The 100 foot requirement was part of the proposal reviewed at the March 25th TAB meeting. I do not know why it is now shown as having reverted back to the original 50 feet requirement. This additional protection for water supplies is justified by the need of the people of PA to protect their pre-existing and lawful private drinking water supplies, and was supported as a needed change by the DEP.

The DEP is also seeking input on the installation of centralizers in this section. Relative to cementing, there is no substitute for a casing which is centered. After the first centralizer within 50 feet of the casing seet, centralizers should be installed in intervals no greater than every 50 feet above the first centralizer. This frequency will help to insure that the cementing operation is successful in protecting the fresh groundwater supplies of the Commonwealth of PA. The current proposal calls for every 150 feet after the first centralizer.

The following is a proposed new standard to proactively reduce the probability of gas migration caused by communication of a gas well with a legacy well.

78.77 Drilling in the area of an abandoned or orphan well or a well plugged using procedures and standards less protective than those detailed in this revision of 78.92, 78.93, 78.94, and 78.95.

An operator proposing to drill a well within one mile of an abandoned or orphan well or a well plugged using procedures less protective than those detailed in this revision of 78.92-78.95, shall forward by certified mail a copy of the well location plat showing the location of the abandoned, orphan, or previously plugged well, the drilling, casing and cementing plan for the new well and the anticipated date drilling will commence to the Department and shall submit proof of notification to the Department with the well permit application. The operator will be subsequently required to provide to the Department the well record of the abandoned or orphan well or previously plugged well. Upon request of the Department, the operator will be required to assess the orphan, abandoned, or previously plugged well for mechanical integrity, defective casing or cementing, and excess pressures and provide this assessment to the Department. The Department will determine the appropriate prerequisites to drilling the new well, which may include the plugging of the orphan or abandoned well utilizing current

standards as specified in 78.92-78.95, or may specify repair/re-plugging requirements for the previously plugged well which must occur prior to the drilling of the new well.

I previously submitted the above proposal for 78.77 in my comments to advance rulemaking. I am resubmitting it now because I feel that the Department's response to my concern about communication with a legacy gas well is insufficient to protect the fresh water supplies of the Commonwealth from gas migration. Basically, the Department's plan to deal with communication with an old gas well causing gas migration is to shut down the new well after the gas migration happens. This strategy is totally reactive, not proactive. It is the proverbial closing of the barn door after the cows get out. We, the people of PA need a proactive stance to the issue of gas migration caused by communication with older, legacy wells. We are not willing to accept the approach proposed by the Department which will cause our private water supplies to be contaminated by methane, and our houses to be uninhabitable. The Department has reviewed page after page of case studies indicating that these legacy wells are an issue. The Department should not permit the drilling of new Marcellus wells in the vicinity of legacy wells if it is not willing to issue regulations requiring the assessment, plugging, repair or other followup actions on legacy wells.

Based on my review of the data on the DEP's website, Bradford County PA has 23 inactive, previously plugged wells. In addition, there are three abandoned or orphan wells which need to be plugged in Bradford County. In some areas of the states, the number of inactive, previously plugged wells and abandoned or orphan wells is even higher. These wells create a serious gas migration risk to the rural private water supplies, and safety, of Bradford County and PA residents as new Marcellus wells are drilled in the vicinity of these legacy wells. An example of this is the Harold W. Lundy 1 OG Well (13413) last inspected/plugged in 1991. In my comments to advance rulemaking I discussed this legacy well and the very nearby Lundy 2H well which was at that time permitted. Five months have passed, and the Lundy 2H well has now been drilled, spud as of 5/13/10 API # 015-20556. It has not yet been hydrofractured. I am hoping for the best, but fear the worst. There are no regulations in place to minimize the chance of a communication event happening when the Lundy 2H is fraced. If gas migration happens in the vicinity of this well, I will consider both Chesapeake and the DEP responsible, since the DEP had advance knowledge of the concern provided to them on multiple occasions in writing, and has chosen to refrain from promulgating regulations restricting gas drilling near legacy wells, or proactively requiring conditional assessments of said legacy wells first. We urgently need a regulation concerning drilling and fracing near legacy wells. Thank you for considering this serious input.

Diane V. Ward

RR #2 Box 68D

Wysox PA 18854

pekin_2@yahoo.com<http://us.mc343.mail.yahoo.com/mc/compose?to=pekin_2@yahoo.com>

570-268-0978

Site Name (Site ID)	Site Address	Status	
AJW HEADLEE 1 OG WELL (13414)	W. Burlington Twp	Inactive	Shaw Obie
BAIRD 1 OG WELL (453277)	[illegible] Twp	Inactive	(Belden + Blake)
CHARLES W [illegible] 1 OG WELL (13412)	Wilmot Twp	Inactive	(Pure Oil Co)
DIMMIG 1 OG WELL (13407)	Columbia Twp	Inactive	(Pennzoil Prod Co)
EDWARD D & MARY STRICKLAND 1 OG WELL (13415)	Wysox Twp	Inactive	(Fenix + Scisson Inc)
FE SIMONS 1 OG WELL (13437)	West Burlington Twp	Inactive	(Angerman Assoc. Inc)
FRANK J BONIN JR & BERNICE E BONIN 1 OG WELL (13418)	Orwell Twp	Inactive	(Weaver Oil + Gas)
DONE HAROLD W [illegible] 1 OG WELL (13413)	Standing Stone Twp	Inactive	(Fairman Drilling Co)
HENRY [illegible] UNIT 1 OG WELL (13410)	Herrick Twp	Inactive	(Shell Oil Co)
[illegible] 01 OG WELL (13443)	Athens Twp	Inactive	(Quaker State Corp)
[illegible] 01 OG WELL (13425)	Athens Twp	Inactive	(Quaker State Corp)
Site Name (Site ID)	**Site Address**	**Status**	
[illegible] 1 OG WELL ([illegible])	Ridgebury Twp BENTLEY CREEK,	Inactive	Consol Gas Co.
[illegible] UNIT 1 OG WELL ([illegible])	Ridgebury Twp BENTLEY CREEK,	Inactive	(Range Resources)
LEONARD [illegible] 1 OG WELL (13439)	Springfield Twp	Inactive	(Columbia Nat. Res.)
LLOYD JONES 1 OG WELL ([illegible])	Granville Twp	Inactive	(Goodwin Ind.)
MARGARET H WALSH 1 OG WELL ([illegible])	Ridgebury Twp BENTLEY CREEK,	Inactive	(Consol Gas Co)
NICHOLS 1 OG WELL ([illegible])	Smithfield Twp	Inactive	(Belden + Blake)
RALPH [illegible] 1 OG WELL ([illegible])	Asylum Twp	Inactive	(Shell Oil)
[illegible] 1 OG WELL ([illegible])	Troy Twp	Inactive	(Angerman Assoc.)
TWIGG 01 OG WELL ([illegible])	Litchfield Twp	Inactive	(Quaker State)
WILLIAM [illegible] 01 OG WELL ([illegible])	Sheshequin Twp	Inactive	(Quaker State Corp)
WOOD 2 OG WELL ([illegible])	Athens Boro	Inactive	(Belden + Blake)
Site Name (Site ID)	**Site Address**	**Status**	
★ [illegible] FARM 1 OG WELL ([illegible])	Rome Twp ROME, PA	Inactive	(Unknown Opr.)

(2014)

COUNTY 08 - Bradford WELL STATUS DEP Abandoned List, DEP Orpha View Report

MUNICIPALITY All REGION All

1 of 1 Find | Next

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

DEP OFFICE OF OIL AND GAS
ORPHAN AND ABANDON

1/27/2014 12:55:04

ounty: 08 - Bradford; Municipality: All; Region: All
/ell Status: All
/ell Count: 5

REGION	COUNTY	MUNICIPALITY	API	WELL STATUS	FARM NAME	WELL TYPE	USGS QU
P DOGO CDO Dstr Off	Bradford	Albany Twp	015-00005	DEP Abandoned List	Burbage 1	Oil	Dushore
P DOGO CDO Dstr Off	Bradford	Rome Boro	015-00003	DEP Abandoned List	Speigel 1	Gas	Rome
P DOGO CDO Dstr Off	Bradford	Rome Boro	015-00004	DEP Abandoned List	Kepplinger 1	Gas	Rome
P DOGO CDO Dstr Off	Bradford	Rome Twp	015-00002	DEP Plugged	Yoder Farm 1	Gas	Rome
P DOGO CDO Dstr Off	Bradford	West Burlington Twp	015-00001	DEP Orphan List	C Dickenson 1	Undetermined	Ulster

SSRS_OG_202 Ver 1.2

Orphan / Abandoned Wells

a

TY	MUNICIPALITY NAME	PERMREG/ API	WELL TYPE	FARM NAME	WELL	TYPE WELL	USGS QUAD	QUAD SECTION
	West Burlington Twp.	015-00001	Orphan	C. Dickenson	1	Unknown	East Troy	5
	Rome Twp.	015-00003	Abandoned	Speigel Farm	3	Gas	Rome	1
	Rome Boro.	015-00004	Abandoned	Kepplinger	C		Rome	1

IDE	LAT OFFSET	LONGITUDE	LONG OFFSET	GPS LATITUDE	GPS LONGITUDE	Lat_Dec	Long_Dec	WELL DEPTH	TC
000	13900	764000	2650	414742.68	764034.98	41.795189	-76.676383		
230	6800	762000	10000	415122.60	762212.14	41.856278	-76.370039		
230	6490	762000	10475	415125.67	762218.42	41.857131	-76.371783		

brian grove (brian.grove@chk.com)

diane

Compose | Search results | Delete | Move | Sp

Inbox (99+)
Drafts (74)
Sent
Spam (99+)
Trash (8)
Folders
Recent

Messenger
Calendar
Contacts
Notepad

Yahoo Mail for Mobile
Send Feedback

Replugging of old "legacy" wells in Bradford ... (2)

Brian Grove
To Me, Eric Haskins, Stacee Bellows

Diane:

Thank you for providing this information. We have shared it with our drilling, regulatory and operations teams to ensure that all are aware. Improperly abandoned wells are an issue that we take very seriously, as evidenced by our efforts on the Lundy property. We will continue to move forward with the same measure of care in other locations as is prudent. Thanks again.

Sincerely,

Brian

From: diane ward (mailto:pekin_2@yahoo.com)
Sent: Monday, February 28, 2011 2:00 PM
To: Eric Haskins; Stacee Bellows; Brian Grove
Subject: Replugging of old "legacy" wells in Bradford County

Eric, Brian, & Stacee:

Now that the replugging of the old Harold Lundy "legacy" well in Standing Stone Township is actually underway, I wanted to thank anyone who had a part in evaluating the well's condition and seeing to it that the well was replugged. This action on CHK's part provides a measure of relief to those of us who have been concerned about the well, considering its proximity to several of CHK's new wells drilled prior to the most recent standards updates, and the potential for it causing gas migration.
As a resident of Standing Stone Township, insuring that this gas well was properly dealt with was the focus of my initial effort, not only for myself, but for the other residents of our community, since there is no easy alternative to

private water wells for supplying this community with residential water.
However, I am also concerned for the rest of Bradford County, since there are 25 inactive legacy wells in our county and 3 orphan/abandoned wells. Last year, I provided the entire county list to our CHK contact Greg Schoffner in the hopes that CHK would follow-up on all the wells in its drilling area, and communicate to other drillers about the hazards these pose in their drilling areas. Companies such as Talisman, Range and Southwestern should be made aware of these legacy wells which could potentially cause gas migration, or cause even worse impacts. In the supplemental material to the article in the New York Times this weekend, the issue of poorly plugged wells was again mentioned as one of the mechanisms for water impairment.

Since Greg Schoffner no longer works for CHK, and another individual, Brad Wittrock, who was aware of our issues also is no longer with you, I wanted to be sure that the data that I provided was not lost in transition, so I am taking the opportunity to provide CHK with the list again.

Perhaps you could take a quick look the attached documents and tell me which wells are on CHK's follow-up list, and whether anyone has informed the other drilling companies about the potential problems associated with drilling near the remaining legacy wells. Are any of the legacy gas wells in CHK's "territory"

Appendix 5

NEWS STORY

RE: Nikolai Briggs

Excerpt from Warren Times- Observer, 13 March 2013, page A1

Clarendon man dies in oil tank explosion

Was welding when torch ignited gas

By BRIAN FERRY
bferry@timesobserver.com

A Clarendon man was killed Wednesday morning as a result of an oil tank explosion in Brokenstraw Township.

According to Pennsylvania State Police, Nikolai G. Briggs, 26, was pronounced dead at the Irvine Run Road accident scene by Warren County Deputy Coroner Stan Taydus.

Police said Briggs was found about 60 feet north of the tank he had been working on.

Taydus estimated the height of the tank at 10 to 12 feet.

"The victim had been welding on the top of the tank when his torch caused vapor in the tank to ignite and explode," police said.

"Death was due to multiple internal injuries" that were due to the explosion, Taydus said. The fatal explosion blew off the entire top of the tank.

Police list the time of the incident as between 8:30 and 10:08 a.m.

Youngsville volunteer firefighters responded to the 10:08 a.m. call, according to Chief Vern Edmisten. Upon their arrival there was no active fire and Edmisten offered no further comment on the incident.

Chronicle

Obituaries

Nikolai Briggs

Nikolai Giles Briggs, 26, of Chapman Dam Road, died suddenly in a work-related accident on Wednesday, March 12, 2014. Nikolai was born April 26, 1987, in Warren, PA; he is the son of Glen B. Briggs, of Warren, PA, and Mary L. Fox (Depto), of Kane, PA.

Nikolai was a 2005 graduate of Sheffield High School. Most recently, he had been working in the Oil and Gas Industry. He was also a skilled mechanic that loved everything with wheels, and had just finished rebuilding his 1982 Toyota Pickup. He was a member of the Jolly Jesters; and loved clowning for children and making them laugh. Nikolai also enjoyed the outdoors; spending his time motorcycling, bicycling, hunting and driving his Toyota. But most of all, Nikolai loved his family, especially his nieces and nephews. He will be missed deeply by all that knew him and called him a friend.

In addition to his parents, Nikolai is survived by his fiance, Kelly M. Johnson, Clarendon, PA; three sisters, Scarlett Kibbey, of Jacksonville, FL, Harmonie Kibbey, and husband, Ian Lester, of Sheffield, PA, and Georie Briggs, and boyfriend, Tracy Long, of Pittsburgh, PA; half-brother, Matt Theuret, of Youngsville, PA; one step-sister; one step-brother; his fiance's parents, Craig and Donna Johnson, and fiance's sister, Kristin Johnson, of Youngsville, PA, his paternal grandparents, Glen and Barb Briggs, of Youngsville, PA; step-grandfather, James Freeman, of Russell, PA; step-father, Randy Depto, of Kane, PA; many nieces, nephews, aunts, uncles, cousins and friends; and his dogs, Turbo and Ellsi.

He was preceded in death by his maternal grandparents, Floyd and Doris Fox; paternal grandmother, Diana Freeman; and uncle, Floyd I. Fox.

Friends will be received at the Peterson - Blick Funeral Home, Inc., 1003 Penn Ave., E., Warren, on Sunday, March 16, from 5 to 8 p.m. Friends will also be received at the Grace United Methodist Church, 501 Penna. Ave. E., on Monday, March 17, from 10 to 11 a.m., at which time, a funeral service will be held there with Rev. Kevin Haley, pastor, and Rev. Marcus Briggs, chaplain and pastor, Warren General Hospital and Rouse Home, co-officiating.

Burial will follow at Pine Grove Cemetery.

The family suggests memorial contributions be made to the Crohn's & Colitis Foundation, National Processing Center, PO Box 1245, Albert Lea, MN 56007-9976, or the Juvenile Arthritis Association, 264 South La Cienega Blvd., Suite 103, Beverly Hills, CA 90211.

Those wishing to send condolences may do so by visiting www.petersonblickfuneralhome.com.

Trees growing in and around rusty old pumpjacks

Above: an idle well with a small maple sapling growing up through the pump jack, seen between Forest Roads 156 and 253 near Warren, 10 May 2010.

Below: another idle well with hemlocks growing through and around pump jack, seen in the Sill Run Area near SR 3005 near Warren, 22 March 2008.

FROM:

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23 December 2013

TO:

Attn.: Mr. Kelly Burch, Regional Office Director;

and Mr. Gary Clark, Environmental Community Relations Specialist Pennsylvania Department of Environmental Protection Northwest Regional Office

230 Chestnut Street

Meadville, Pennsylvania 16335 submitted via electronic mail

PUBLIC COMMENT SUBMISSION

RE: the Pennsylvania Department of Environmental Protection's (DEP) proposed settlement with drilling wastewater treatment operator d/b/a Waste Treatment Corporation (WTC) regarding violations involving dumping of contaminated water into the Allegheny River in Warren, Pennsylvania and processing said wastewater without any permits.

In late November of 2013, the DEP's Northwest Region Office (NRO) announced a settlement (aka "consent decree") regarding violations involving the dumping of Marcellus Shale wastewater into the Allegheny River by WTC, and that WTC was processing the aforementioned wastewater without a permit. We, the commenting party in this letter, hereafter referred to as the Atwoods, are concerned that this is a very serious matter that could have very strong implications for public health. Local news media accounts indicate that the wastewater dumped into the Allegheny River contained dangerous chemicals and radioactive waste.

The Atwoods are alarmed that this could take place, and that such activity could go on without the public's knowledge until the non-profit organization Clean Water Action apparently took legal action and publicized these developments. From 2008 through 2012, the Atwoods planned and administered an annual one-day local reunion event each August at a local park along the Allegheny River, just downriver of where the wastewater discharges are said to have taken place. As part of that annual event, reunion participants would hold a wreath toss into the river, and some people involved in the wreath toss would wade into the water. The possibility that these innocent people, some of whom traveled from other states to participate in this reunion, could have been exposed to

illegally dumped wastewater containing dangerous chemicals and radioactivity, is horrifying. The DEP's mission is supposedly environmental protection. The specter of these innocent people having been exposed to this danger is both outrageous and suggests that the DEP deliberately turned a jaundiced eye to what is happening.

The Atwoods are also concerned about other activities that are the responsibility of both the DEP and WTC. In 2012, WTC, then d/b/a as ARMAC Resources, began setting up an oil lease on land neighboring the Atwoods' homestead on Mohawk Avenue in Pleasant Township of Warren County, Pennsylvania. When DEP provided the Atwoods with permit notices for the drilling of new oil wells by ARMAC/WTC on the Metzgar Lease, the Atwoods made submitted formal objections to the issuance of said permits by the DEP. The Atwoods made it clear that the proposed wells were too close to the Atwood residence, that the proposed lease road to be built to connect the well-pads to Mohawk Avenue would disturb the abandoned Wilbur Dump from the 1950's and 1960's that was located on the land overlaying the Metzgar Lease, and that the proposed drilling and fracking would threaten the Atwood residence's water well. Brian Babb, DEP's representative, told the Atwoods that "I work for the Governor, and my job is to issue permits." The permits were officially approved by the DEP and drilling and hydro^fracking began in the summer and autumn of 2012. On 26 Nov. 2012, that Atwoods complained to DEP after they noticed changes to their tap-water at the Atwood residence. DEP sampled the Atwoods' tap water in Dec. 2012 and in a subsequent letter from DEP's S. Craig Lobins dated 4 Jan 2013, DEP officially determined that ARMAC/WTC's oil and gas activities on the Metzgar Lease had affected the Atwoods' water supply. (see Water Supply Case #293565) To this day, there has been no permanent resolution of the water supply issue. The Atwoods rely on bottled water and must take their clothes elsewhere for laundering.

Since the DEP settlement is based on the acceptance of WTC's ongoing handling of wastewater without a permit, it is logical to consider what other illict activities WTC may be involved in. The entire affair regarding the Metzgar Lease and ARMAC/WTC's oil and gas activities affecting the Atwoods water supply could have been avoided if the DEP had

heeded the Atwoods' objections and not issued those well permits. The Atwoods are concerned that, due to the nature of the alleged illicit processing and dumping of Marcellus Shale wastewater by WTC, said wastewater could have been illicitly used by WTC as a hydro-fracking cocktail for ARMAC/WTC's ongoing oil and gas well activities wherever they may be. If DEP's settlement/consent decree is based on the notion that WTC supposedly has been handling this wastewater outside of the law up to now, why must we assume that anything else WTC does is proper? See *Belitskus v. Willamette and the DEP*, 1997 Pa. Envirn. LEXIS 90, at *28 (Pa. EHB Oct. 21, 1997), stating the DEP's issuance of a discharge permit was unlawful and an abuse of discretion if compliance history shows that the applicant cannot be trusted with the permit.

The Atwood must ask that DEP not move forward with the WTC settlement/consent decree as it is written today. We find this equally unacceptable, outrageous, and a threat to public health. The only reasonable way to move forward is for DEP to shut down <u>all</u> of WTC's waste treatment and oil/gas well operations until such time as:

1. all corrective actions are taken to bring WTC's waste treatment operations are proven to be capable of processing wastewater without any harmful discharges to any public waterways.
2. the matter of WTC's violations regarding the Atwood water supply issue is resolved permanently
3. WTC pays the maximum fine required by law for its past and current outstanding violations; the currently proposed reduced fine is absurd and must be revised upward.

If WTC cannot or will not address all of its violations, fines and other outstanding issues, then the company's oil and gas operations and waste treatment operations should be shut down completely until such time as WTC is prepared to pay its fines and operate lawfully.

We hope DEP will listen to our concerns and revise the settlement/consent decree with WTC. For too long, DEP has been "working for the Governor, and issuing permits" while innocent people and their interests are threatened as a direct result. The Atwoods want to take this opportunity to remind DEP administrators of Article I, Section 27 of the

Pennsylvania Constitution, which supercedes all other public state and local laws and rules in the Commonwealth:

> *"The people have a right to clean air, pure water, and to the preservation of the natural, scenic, historic and esthetic values of the environment. Pennsylvania's public natural resources are the common property of all the people, including generations yet to come. As trustee of these resources, the Commonwealth shall conserve and maintain them for the benefit of all the people."*

In light of the current political climate in Pennsylvania, our past dealings with DEP, and the fact that DEP is now faced with negotiating a settlement with WTC in the first place, the Atwoods wonder if DEP personnel will bother to seriously consider our comments or if they will be ignored along with the Article I, Section 27 of the Commonwealth's Constitution.

Respectfully submitted,

The Atwoods

Excerpted news story from Warren Times Observer,
19 July 2013, pages A1 & A10.

Enviro-group plans suit against WTC

By JOSH COTTON
jcotton@timesobserver.com

An environmental group has filed a notice of intent to file a lawsuit against Waste Treatment Corporation for alleged illegal discharge of oil and gas drilling wastewater into the Allegheny River.

Clean Water Action, a grassroots organization that advocates for clean water and decreased pollution, issued a press release on Thursday announcing the intent to file suit, claiming, in part, that WTC has "violated their water discharge permit nearly 400 times since 2010" and also has no permit from the state of Pennsylvania authorizing them to discharge oil and gas wastewater.

But, to Michael Arnold, vice president of operations for Waste Treatment Corporation, the company is working within its permits.

Referencing the suit, Arnold said, "We'll take each step as it comes. We take all allegations seriously. We know we're op-

See LAWSUIT / A10

Lawsuit by environmentalists...

erating under Pennsylvania state regulations."

Arnold said working in the wastewater business "opens us up as a target for environmental groups. We've been operating since 1988... this is going to happen."

Clean Water Action claims that WTC is contaminating the river without any state intervention.

"The state's own study found that Waste Treatment Corporation is damaging the Allegheny River, yet still no action has been taken to stop this contamination," Myron Arnowitt, Pennsylvania state director for Clean Water Action, said in the release. "We could wait no longer for help from the state or EPA. We filed this case so that companies discharging gas drilling wastewater into our rivers know this practice must end."

Arnold said DEP representatives have toured his facility and that the facility is NPDES (National Pollutant Discharge Elimination System) certified by the state.

According to a statement by Clean Water Action, the state Department of Environmental Protection conducted a study in 2012 that found high levels of salts, metals and radioactive compounds just downstream from Waste Treatment Corporation's discharge pipe in the Allegheny River. Chloride, bromide, lithium, strontium, radium-226 and radium-228 were "all found downstream of WTC's discharge at levels over 100 times the levels upstream of the plant. Not only was there water contamination, but pollutants were building up in the river bed sentiment, where DEP found radioactivity and oily deposits. The plant's discharge of 200,000 gallons of wastewater per day is putting over 125,000 pounds of salt into the Allegheny River each day."

Clean Water Action also alleges, "The company discharged illegal amounts of arsenic, titanium, selenium, as well as having a discharge that had a pH at times too acidic, and at other times too alkaline."

"You hear all the time that gas drilling wastewater doesn't end up in our rivers anymore," Arnowitt said. "However, this is one case in which it clearly is. And the fact that there is radioactivity involved makes it much more likely this wastewater is coming from unconventional gas wells, like the Marcellus Shale. Regardless of the source of the waste, there simply has to be immediate action to stop further pollution of the Allegheny. If Waste Treatment wants to take drilling wastewater, they need to install proper technology to remove these contaminants."

"Inaccurate, very inaccurate," Arnold said, adding that litigation like this hurts the industry and hinders jobs. He also noted, "We drink the same water. (We) swim in the same river."

"This is what they do," Arnold said of environmental groups. He explained the business has no intention of shutting down or selling in the face of litigation. He said the company will move forward, providing a service necessary to the oil and gas industry.

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