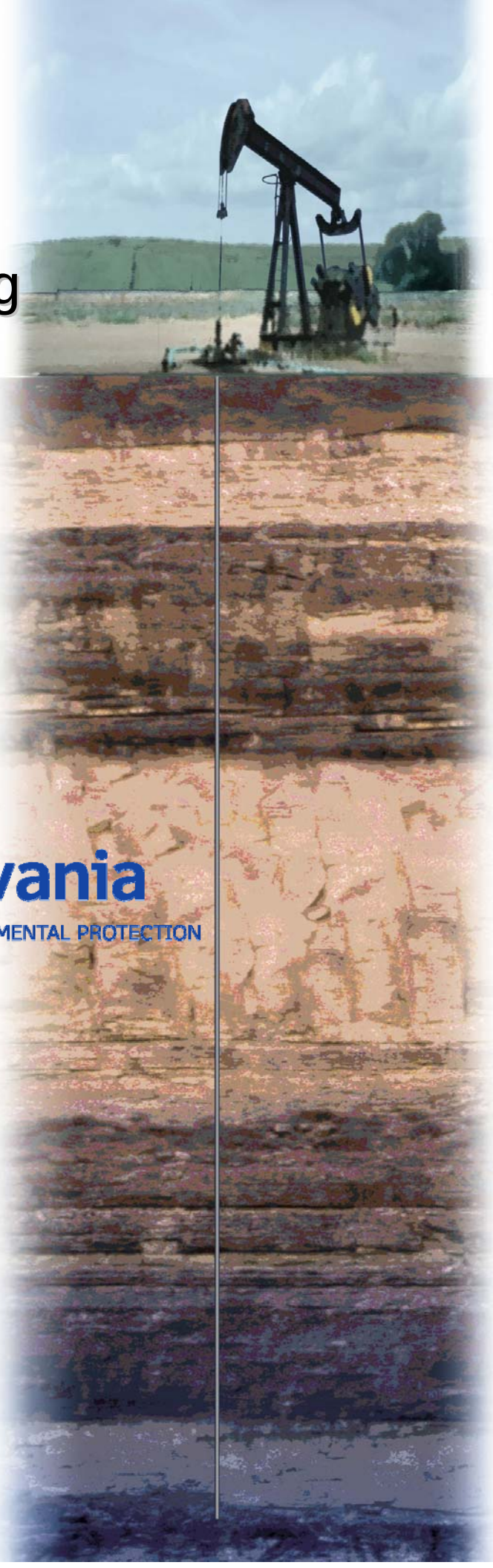

Pennsylvania Hydraulic Fracturing State Review

September, 2010

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

STRONGER
State Review of Oil & Natural Gas Environmental Regulations

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INTRODUCTION

In 1990, the Interstate Oil Compact Commission (IOCC) and the U.S. Environmental Protection Agency (USEPA) jointly published a Study of State Regulation of Oil and Gas Exploration and Production Waste, which contained guidelines for the regulation of oil and gas exploration and production wastes by the IOCC member states (the "1990 Guidelines"). The published guidelines, developed by state, environmental and industry stakeholders, provided the basis for the State Review Program, a multi-stakeholder review of state exploration and production (E&P) waste management programs against the guidelines. The purposes of the State Review Process are to document the successes of states in regulating E&P wastes and to offer recommendations for program improvement. In 1994, the guidelines were updated and revised (the "1994 Guidelines) by the IOCC, now named the Interstate Oil and Gas Compact Commission (IOGCC).

In 1999, administration of the State Review Program devolved to a non-profit, multi-stakeholder organization named State Review of Oil and Natural Gas Environmental Regulations, Inc. (STRONGER). STRONGER again revised, expanded and updated the Guidelines, which were accepted by the IOGCC and published in June 2000 as Guidelines for the Review of State Oil and Natural Gas Environmental Regulatory Programs (the "2000 Guidelines"). In 2005, STRONGER again revised, expanded and updated the Guidelines.

In 2009, STRONGER formed a Hydraulic Fracturing Workgroup consisting of stakeholders to review issues associated with hydraulic fracturing and develop guidelines for state regulatory programs to address identified issues. After several meetings and a round of public comment, the workgroup submitted to STRONGER a set of guidelines that represented the consensus of the workgroup. In 2010, STRONGER distributed the workgroup's guidelines for state regulation of hydraulic fracturing. Those guidelines were used as the basis of this review.

In May 2010, the Pennsylvania Department of Environmental Protection (DEP) volunteered to have its hydraulic fracturing program reviewed by STRONGER. The Pennsylvania oil and gas regulatory program has undergone three prior reviews. The report of the initial review of the Pennsylvania oil and gas regulatory program was published in 1992. The reports of two follow-up reviews, conducted after both the Pennsylvania regulations and the guidelines were revised, were published in 1997 and 2004.

The current review began with a questionnaire that was sent to the Bureau of Oil and Gas Management (BOGM). The questionnaire had been prepared by the STRONGER Board. STRONGER intended the questionnaire to capture the status of the Pennsylvania program relative to the 2010 Hydraulic Fracturing Guidelines. The BOGM prepared a response to the questionnaire, which was then sent to the review team.

In July and August 2010 a seven-person team appointed by STRONGER conducted a review to evaluate the DEP program compared to the 2010 Hydraulic Fracturing Guidelines. The review team consisted of three team members and four official observers. The three team members were: Lori Wrotenbery, Oil and Gas Conservation Division of the Oklahoma Corporation Commission; Wilma Subra, Subra Co., New Iberia, Louisiana; and Jim Collins, Independent

Petroleum Association of America. The official observers were: Tom Au, Pennsylvania Chapter of the Sierra Club; Steve Rhoads, East Resources; Brad Field, Division of Mineral Resources of the New York Department of Environmental Conservation; and Dave Rectenwald, U.S. Environmental Protection Agency.

The review team conducted a meeting, the in-state portion of the review, in the conference facilities of the DEP, in Harrisburg, Pennsylvania on July 15, 2010. Mr. Scott Perry, Director of BOGM, presented an overview of hydraulic fracturing requirements in Pennsylvania. Mr. Perry and Mr. Gene Pine, also of the BOGM, Mr. Steve Socash of the Bureau of Waste Management, and Ms. Susan Weaver of the Bureau of Watershed Management responded to questions from the team members and official observers. In addition to the four DEP representatives who participated in the review, there were eight environmental, six industry and five state attendees who observed the proceedings and offered questions for consideration by the review team. Following the meeting and after reviewing the written materials provided by the BOGM, the team members compiled this review report.

This is the report of the review of the Pennsylvania program against the 2010 Hydraulic Fracturing Guidelines of STRONGER. Appendix A is a glossary of all acronyms used in the report. Appendix B contains Pennsylvania's written response to the STRONGER questionnaire.

EXECUTIVE SUMMARY

An in-depth review of the Pennsylvania hydraulic fracturing regulatory program has been completed by a multi-stakeholder review team. The review team has concluded that the Pennsylvania program is, over all, well-managed, professional and meeting its program objectives. The review team also made recommendations for improvements in the program.

Program Strengths

During the 2010 review of Pennsylvania's regulation of hydraulic fracturing, the review team and observers were granted full access to DEP staff, and all questions were answered in a responsive and open manner. During the review, the review team identified strengths of the Pennsylvania program, which also are noted in several of the report's findings. The following offers an overview of some of the Pennsylvania program's strengths.

1. Comprehensive Water Planning Process

In 2002, the Water Resources Planning Act was enacted, It requires entities withdrawing more than 300,000 gallons of water over a 30-day period to register their water withdrawal. By registering water uses, DEP began the process of tracking this activity outside the Susquehanna and Delaware River basins, where interstate commissions have jurisdiction.

As a result of the development of the Marcellus shale, in 2008 BOGM began requiring water management plans to identify where water would be withdrawn and the volumes of withdrawal. The purpose of this inquiry is to ensure that water quality standards are maintained and protected. By law, DEP cannot issue permits for an activity that will violate the laws it administers. Because large withdrawals of surface water can, individually or cumulatively, impact water quality, DEP must assure that excessive withdrawals do not occur. DEP follows water withdrawal guidance promulgated by the Susquehanna River Basin Commission (SRBC) to ensure uniform statewide evaluation. The Delaware River Basin Commission (DRBC) also has a role in evaluating impacts within that river basin. The DRBC is in the process of promulgating regulations to address Marcellus shale well drilling within its jurisdiction.

Studies are underway by Pennsylvania universities, such as the University of Pittsburgh, that are attempting to provide for the greater use of water impacted by acid mine drainage (AMD) for hydraulic fracturing. In addition, Pennsylvania State University is conducting a study of groundwater before and after hydraulic fracturing operations. Industry has been testing wastewater from hydraulic fracturing flowback to establish a baseline of chemical quality through time. BOGM is expanding the Penn State study to additional producing areas and is participating in the other studies.

The review team commends DEP for taking steps to ensure that demands on water resources related to hydraulic fracturing operations are addressed through a comprehensive water planning process.

2. Baseline Water Sampling and Groundwater Studies

The Pennsylvania Oil and Gas Act includes a provision that an oil and gas well operator is presumed to be responsible for pollution of a water supply if it occurs within six months of drilling and is within 1,000 feet of the well. One of the defenses against this presumption is a pre-drilling survey that documents baseline water quality. Proposed changes to the regulations will require results of such testing to be provided to the landowner and to DEP.

The review team commends Pennsylvania for encouraging the baseline groundwater quality testing that is done in the vicinity of wells.

3. PPC Planning Process

Regulations at 25 Pa. Code §§ 78.55 and 91.34 require operators to identify potential risks and plan for the possibility of an accident occurring at the well site through a Prevention, Preparedness and Contingency (PPC) plan. The first objective in preparing and implementing a PPC plan is for the operator to review its operations and identify all pollutional substances and wastes, both solid and liquid, that will be used or generated, and identify the methods for control and disposal of those substances or wastes. The second objective of the PPC plan involves recognizing that accidents and unexpected conditions do occur. Such accidents or conditions would require an immediate response to mitigate any detrimental effects. Planning the actions to be taken should prevent polluting substances from reaching the waters of the Commonwealth.

As part of the PPC plan operators must list the chemicals or additives utilized and the different wastes generated during hydraulic fracturing. The PPC plan includes Material Safety Data Sheets (MSDS), cleanup procedures, toxicological data and waste chemical characteristics. The approximate quantities of each material and the method of storage (sack, barrels, tanks, etc.) may be specified.

PPC plans are to be available at the well site and must be submitted to DEP upon request. When new operators apply for permits in Pennsylvania, BOGM staff request a copy of the operator's PPC plan prior to permit issuance, as is the case with all Marcellus Shale well operators.

The review team commends DEP for requiring PPC plans and for requiring MSDS as part of the PPC plan.

4. Waste Identification, Tracking and Reporting Process

Hydraulic fracturing waste characterization requirements are provided through the residual waste program implemented by the DEP Bureau of Waste Management. This Bureau provides a reporting mechanism for generators of waste hydraulic fracturing fluids through use of its Form 26R, *Chemical Analysis of Residual Waste, Annual Report by the Generator*. This form was recently modified to incorporate a comprehensive list of required analytical parameters for wastewater produced from the drilling, completion and production of Marcellus or other gas wells. For impoundments and tanks, the chemical analysis must represent the volume of wastewater stored in the impoundment or tank. If large volumes of water, wastewater or other

fluids are added to an impoundment, a new chemical analysis must be performed that is representative of the impoundment.

Hydraulic fracturing waste generation, transportation and disposal tracking requirements are integrated into DEP's residual waste regulations. Requirements found at 25 Pa, Code Chapter 287 specify the reporting, recordkeeping and waste stream analytical requirements for generators of hydraulic fracturing wastes. Form 26R, described above, provides the analytical and reporting requirements for generators of hydraulic fracturing wastes. This form also requires information on the processing or disposal facilities that will accept the waste. 25 Pa. Code Chapter 299 provides standards for the transportation of residual waste to a commercial or centralized facility. These include requirements for transportation, accident prevention and contingency planning, emergencies, wastes from accidents and spills, recordkeeping and reporting, and appropriate signage on vehicles. Waste haulers are required to be permitted and are subject to the requirements of the DEP Waste Transportation and Safety Program.

Information pertaining to waste volumes and the location of disposal or recycling facilities are submitted annually to BOGM as part of the operator's annual production and waste report.

The review team commends DEP on the use of Form 26R which contains the analyses and reporting requirements for hydraulic fracturing wastes transported off-site and for its annual production and waste reporting requirements that include volumes and disposition of waste hydraulic fracturing materials.

5. Increase in Staffing Levels

In 2009, BOGM increased its well permit fees for the first time since the Oil and Gas Act was enacted in 1984. Pennsylvania's oil and gas program is now completely funded by well permit fees. The increase in permit fees allowed DEP to increase the size of its permitting, compliance and enforcement staff. BOGM's orphan and abandoned well plugging program continues to be completely funded by a surcharge on operator's well permit fees. BOGM added 37 oil and gas staff in 2009, and opened a new office in Williamsport to serve the needs of the north central region that will continue to see increased Marcellus Shale activity. In addition, in 2010 the Governor directed BOGM to hire an additional 68 staff to respond to the continued growth of Marcellus Shale development. This year BOGM opened a new office in Scranton dedicated to oversight of oil and gas drilling in the northeastern counties.

The total complement of staff regulating oil and gas well development in Pennsylvania is 196 people. This number includes inspectors, permitting, enforcement and management staff, and administrative and legal staff.

The review team supports DEP's efforts to increase staff levels to deal with increased drilling activities. Increasing staff levels was a recommendation in the 2004 report of the prior review of the Pennsylvania program. The review team finds that recommendation is being implemented.

Program Recommendations

The following are the primary areas where recommendations are made by the review team for improvements of the Pennsylvania hydraulic fracturing program. Discussion and findings for these recommendations can be found in the various sections of the report. Readers are encouraged to review the specific discussion and finding for each recommendation

1. Pending Rulemaking

DEP has developed proposed rulemaking to amend 25 Pa. Code Chapter 78 to strengthen its regulatory requirements. On May 17, 2010, the Environmental Quality Board adopted the amendments as Proposed Rulemaking and published the changes on July 10, 2010 for a 30-day public comment period.

The Proposed Rulemaking requires that operators prepare a casing and cementing plan and keep it on site during well construction for review by DEP. The Proposed Rulemaking also requires that a cement job log, that documents the actual procedures and specifications of the cementing operation, be maintained by the operator. The Proposed Rulemaking also addresses blow-out prevention equipment requirements, centralizers, areas where alternate methods are required, lost circulation, and intermediate and production casing.

The review team recommends that DEP finalize its Proposed Rulemaking in a manner that provides at least the levels of protection that were presented by the BOGM during the review.

2. Baseline Surveys

The Pennsylvania Oil and Gas Act includes a provision that an oil and gas well operator is presumed to be responsible for pollution of a water supply if it occurs within six months of drilling and is within 1,000 feet of the well. One of the defenses against this presumption is a pre-drilling survey that documents baseline water quality. Proposed changes to the regulations will require results of such testing to be provided to the landowner and to DEP.

The review team discussed whether pre-drilling testing should extend beyond the vicinity of the vertical portion of a well to the full aerial extent of the hydraulically fractures horizontal laterals. The review team recommends that the Commonwealth consider whether there are areas or situations in which risk factors, such as the absence of confining rock layers or the presence of potential pathways for fluid movement into groundwater, establish a basis for encouraging more extensive baseline groundwater quality testing.

The review team also noted that DEP has not required operators to identify potential conduits for fluid migration (such as active and abandoned wells) in the area of hydraulic fracturing. The review team recommends that DEP consider whether there are areas or situations in which wells (active and abandoned) in the vicinity of hydraulic fracturing operations provide pathways for fluid movement into groundwater. In such areas or situations, DEP should require operators to identify and eliminate these potential pathways for fluid movement into groundwater before conducting hydraulic fracturing operations.

3. Casing and Cementing Plans

The Proposed Rulemaking requires that operators prepare a casing and cementing plan and keep it on site during well construction for review by DEP. The Proposed Rulemaking also requires that a cement job log, that documents the actual procedures and specifications of the cementing operation, be maintained by the operator. The casing and cementing plan is not required to be provided with the well drilling permit application for review.

The review team recommends that the depth of surface casing be added to the well drilling permit application so that BOGM can assure that groundwater protection concerns are addressed.

4. Chemical Information Availability

As part of the PPC plan operators must list the chemicals or additives utilized and the different wastes generated during hydraulic fracturing. The PPC plan includes Material Safety Data Sheets (MSDS), cleanup procedures, toxicological data and waste chemical characteristics. The approximate quantities of each material and the method of storage (sack, barrels, tanks, etc.) may be specified.

Though PPC plans should be available at the well site and must be submitted to DEP upon request, the PPC plan requirements do not clearly identify the mechanisms or procedures by which information on chemical constituents used in fracturing fluids would be made available to medical personnel in the event of a medical emergency related to hydraulic fracturing. The review team recommends that the Commonwealth of Pennsylvania adopt provisions necessary to assure that information on chemical constituents used in fracturing fluids is available to medical personnel in the event of a medical emergency related to hydraulic fracturing.

5. Prior Notification of Hydraulic Fracturing Operations

The Pennsylvania Oil and Gas Act requires well operators to notify DEP at least 24 hours prior to the commencement of drilling. The Department's proposed well construction regulation requires 24-hours notice prior to cementing the surface casing unless cementing will begin within 72 hours of drilling. There is no specific requirement for notification prior to hydraulic fracturing nor is this notice contemplated in the revised regulations. BOGM receives information on the hydraulic fracturing operations as part of the completion report on a well.

The review team recommends that DEP require notification prior to hydraulic fracturing operations. DEP should have the opportunity to conduct inspections at critical stages, including during hydraulic fracturing and flowback.

6. Pit Construction

BOGM regulations at 25 Pa. Code 78.56 and 57 specify the requirements for the temporary storage of pollutional substances and wastes, including stimulation fluids and the associated flow back. These substances must be contained in pits or tanks that are structurally sound, protected from unauthorized acts, and constructed and maintained with sufficient capacity to contain all

pollutional substances and wastes that are used or produced during drilling, altering, hydraulic fracturing, completing and plugging the well.

Two feet of freeboard must be maintained in pits and open tanks. The sub-base of any pit must be free of rocks or debris and the pit must be lined with an impermeable liner that is of sufficient strength and thickness to maintain the integrity of the liner. The liner must be designed, constructed and maintained so that the physical and chemical characteristics of the liner are not adversely affected by the waste, and the liner must be resistant to physical, chemical and other failure during transportation, handling, installation and use.

Liners or secondary containment around tanks or other facilities storing pollutional substances are not required, but are recommended.

The review team recommends that, during the next round of rulemaking, procedures for inspecting pit construction or a certification process for pit construction, that includes pit bottom preparation and liner placement, should be considered. The review team further recommends that secondary containment requirements be established for tanks used in hydraulic fracturing operations.

HYDRAULIC FRACTURING

I. BACKGROUND

Hydraulic fracturing has been used in Pennsylvania since the 1950s. Since the 1980s, nearly all wells drilled in Pennsylvania have been fractured. Although thousands of wells have been fractured in Pennsylvania, DEP has not identified any instances where groundwater has been contaminated by hydraulic fracturing. DEP and Pennsylvania State University are currently conducting various groundwater studies and investigations to determine whether there are adverse impacts associated with hydraulic fracturing.

While there have not been any identified instances of groundwater being affected by hydraulic fracturing, there are a number of surface and subsurface control issues associated with the practice. These include water withdrawal; Prevention, Preparedness and Contingency (PPC) plans; pits, tanks and centralized impoundments; and hydraulic fracturing wastewater management.

II. GENERAL

As a result of the development of the Marcellus shale, in 2008 BOGM began requiring water management plans to identify where water would be withdrawn and the volumes of withdrawal. The purpose of this inquiry is to ensure that surface water quality standards are maintained and protected.

Wastewater generated by hydraulic fracturing operations is managed four different ways in Pennsylvania:

1) Reused to fracture additional wells;
2) Treated and discharged to surface water;
3) Injected into underground disposal wells; and
3) Transported to out-of-state facilities.

DEP has encouraged source reduction and recycling through the distribution of its Operators Manual, and has noticed, particularly with operators in the Marcellus shale, the increased recycling and reuse of all fluids associated with drilling, completion and stimulation activities. The wastewater treatment industry is offering mobile and cost-effective treatment methods that frequently make recycling and reuse economically preferable to disposal and reduce demands on water resources.

Recently DEP has developed a total dissolved solids (TDS) strategy that is applicable to new and expanded discharges of wastewater to surface water. Discharges from gas exploration and production (E&P) activities are required to meet effluent limits of 500 mg/l TDS, 250 mg/l chlorides, and 10 mg/l barium and strontium. This requirement to treat gas activity discharges to drinking water standards is included in regulations recently adopted as final by the Environmental Quality Board (EQB) and approved by the Independent Regulatory Review Commission (IRRC).

DEP has not accepted primacy for the Underground Injection Control (UIC) program. Therefore, USEPA administers the UIC program in Pennsylvania. There are seven Class II disposal wells in Pennsylvania, of which only one is a commercial well. There are applications for at least 20 additional disposal well injectivity reviews presently before USEPA.

Subsurface control issues associated with hydraulic fracturing include planning and preparation activities associated with well drilling, completion, stimulation, production and plugging. Well construction practices that assure the structural integrity of the well are essential in containing hydraulic fracturing fluids within the wellbore. In addition, adequate reporting requirements are a necessary component of the regulatory program.

DEP has developed proposed rulemaking to amend 25 Pa. Code Chapter 78 to strengthen its regulatory requirements. On May 17, 2010, the EQB adopted the amendments as Proposed Rulemaking and published the changes on July 10, 2010 for a 30-day public comment period.

The Proposed Rulemaking requires that operators prepare a casing and cementing plan and keep it on site during well construction for review by DEP. The Proposed Rulemaking also requires that a cement job log, that documents the actual procedures and specifications of the cementing operation, be maintained by the operator. The Proposed Rulemaking also addresses blow-out prevention equipment requirements, centralizers, areas where alternate methods are required, lost circulation, and intermediate and production casing.

BOGM indicated that there are plans for Phase II revisions to 25 Pa. Code Chapter 78. This proposed rulemaking will address, among other things, water management plan requirements and surface facilities.

BOGM has expanded its Naturally Occurring Radioactive Materials (NORM) survey activities, which were reviewed in 1997, to include E&P wastes from Marcellus shale operations.

BOGM has recently begun implementation of the Risk Based Data Management System (RBDMS) which is used by most oil and gas producing states. Use of RBDMS will assist data management efforts and make information more readily available to DEP staff and the public.

Finding 9.2.1.

The review team recognizes and supports DEP actions to update and improve its rules.

Recommendation 9.2.1.

The review team recommends that DEP finalize its Proposed Rulemaking in a manner that provides at least the levels of protection that were presented by the BOGM during the review. (STRONGER Guidelines Section 9.2.)

Finding 9.2.2.

The review team supports DEP's efforts to redesign its data management system in a manner to increase the availability and accessibility of data to DEP staff and the public.

STANDARDS

Current BOGM standards for all well casing and cementing practices require that the operator conduct casing and cementing activities to accomplish the following:

(1) Allow effective control of the well at all times,

(2) Prevent the migration of gas or other fluids into sources of fresh groundwater,

(3) Prevent pollution or diminution of fresh groundwater, and

(4) Prevent the migration of gas or other fluids into coal seams.

BOGM is in the process of revising its well casing and cementing standards to add greater specificity to the above narrative standards. The proposed regulations include several important revisions. The structural integrity of the well is essential to containing hydraulic fracturing fluid within the well bore. To achieve this, operators will be required to develop and maintain at the well site a casing and cementing plan that describes the casing to be used, the proposed depths to which it will be set, the proposed placement of centralizers (which will now be required), the volume of cement to be used, and the proposed cement additives.

As a companion to the casing and cementing plan, operators will also be required to maintain a cement job log that documents the actual procedures and specifications of the cementing operation. Cementing operation requirements have also been modified to require a true eight-hour wait-on-cement time where the operator is not permitted to disturb the cement while it sets.

BOGM well casing regulations are also being significantly revised. The amendments will prohibit the use of surface casing as production casing if cement is not circulated behind the surface casing and returned to the surface, in which case an additional string of casing will have to be installed in a well unless the well is only used to produce oil, does not present a threat to groundwater, or if the operator of a gas well demonstrates that all gas and fluids will be contained in the well. If cement is circulated behind the surface casing and returned to the surface, an additional string of casing will not be required provided that the well bore pressure does not exceed 80% of the hydrostatic pressure at the surface casing seat and a pressure test on the casing seat demonstrates that no gas can escape the well. Additionally, new pressure testing requirements will apply to specific casing strings.

Casing that is attached to a blow out preventer with a pressure rating of 3,000 psi or greater will be required to be pressure tested. Pressure testing will also be required for used or welded casing. A passing pressure test is defined as holding 120% of the maximum anticipated working pressure to which the casing will be exposed for 30 minutes with no more than a 10% decrease in pressure.

The Pennsylvania Oil and Gas Act includes a provision that an oil and gas well operator is presumed to be responsible for pollution of a water supply if it occurs within six months of drilling and is within 1,000 feet of the well. One of the defenses against this presumption is a

pre-drilling survey that documents baseline water quality. Proposed changes to the regulations will require results of such testing to be provided to the landowner and to DEP.

BOGM identifies and manages risk on an ongoing basis. Risk is identified through bi-weekly conference calls with regional managers, quarterly staff meetings and training sessions. Risk is managed on a case-by-case basis through well permit conditions and inspections. Risk is managed more broadly through permit forms and instructions, technical guidance documents, and via development, implementation and enforcement of regulations.

Regulations at 25 Pa. Code §§ 78.55 and 91.34 require operators to identify potential risks and plan for the possibility of an accident occurring at the well site through a Prevention, Preparedness and Contingency (PPC) plan. The first objective in preparing and implementing a PPC plan is for the operator to review its operations and identify all pollutional substances and wastes, both solid and liquid, that will be used or generated, and identify the methods for control and disposal of those substances or wastes. The second objective of the PPC plan involves recognizing that accidents and unexpected conditions do occur. Such accidents or conditions would require an immediate response to mitigate any detrimental effects. Planning the actions to be taken should prevent polluting substances from reaching the waters of the Commonwealth.

As part of the PPC plan operators must list the chemicals or additives utilized and the different wastes generated during hydraulic fracturing. The PPC plan includes Material Safety Data Sheets (MSDS), cleanup procedures, toxicological data and waste chemical characteristics. The approximate quantities of each material and the method of storage (sack, barrels, tanks, etc.) may be specified.

As noted above, the operator's PPC plan specifies the actions that must be taken if an accident or spill should occur. Regulations promulgated pursuant to the Pennsylvania's Clean Streams Law require immediate notification to DEP if a discharge or spill threatens waters of the Commonwealth or has the potential to damage property.

PPC plans are to be available at the well site and must be submitted to DEP upon request. When new operators apply for permits in Pennsylvania, BOGM staff request a copy of the operator's PPC plan prior to permit issuance, as is the case with all Marcellus Shale well operators.

The operator will also anticipate risk during the development of the casing and cementing plan described above. The proposed regulations themselves embody the identification and management of risk by DEP. One of the unique features of the new regulations is the inclusion of a provision that allows BOGM to designate "areas of alternative methods," which require additional measures to be employed to drill a well in an environmentally protective manner. This provision allows BOGM to react to conditions on the ground faster than the normal rulemaking procedure, thus identifying and managing risk more appropriately and efficiently.

Blow out preventers are required when well head pressures or natural open flows are anticipated at the well site that may result in a blow-out. This requirement would apply to hydraulic fracturing and post-fracturing cleanout operations as these operations occur under pressure at the surface. The proposed regulations require a second set of BOP actuators in instances where the

pressure rating exceeds 3,000 psi. These secondary devices are not associated with the rig hydraulic system and are to be located away from the rig so that the BOP can be operated if control of the well has been lost.

BOGM regulations pertaining to pits and tanks have been subject to previous STRONGER reviews. BOGM regulations at 25 Pa. Code §§78.56 and 57 specify the requirements for the temporary storage of pollutional substances and wastes, including stimulation fluids and the associated flow back. These substances must be contained in pits or tanks that are structurally sound, protected from unauthorized acts, and constructed and maintained with sufficient capacity to contain all pollutional substances and wastes that are used or produced during drilling, altering, completing and plugging the well.

Two feet of freeboard must be maintained in pits and open tanks. The sub-base of any pit must be free of rocks or debris and the pit must be lined with an impermeable liner that is of sufficient strength and thickness to maintain the integrity of the liner. The liner must be designed, constructed and maintained so that the physical and chemical characteristics of the liner are not adversely affected by the waste, and the liner must be resistant to physical, chemical and other failure during transportation, handling, installation and use.

Liners or secondary containment around tanks or other facilities storing pollutional substances are not required, but are recommended.

Pits must be closed within nine months after the completion of well drilling. Free liquid must be removed from the pit and the chemical constituencies of cuttings or residual waste that will be encapsulated in the pit must not exceed regulatory standards.

BOGM's contingency planning has been reviewed previously by STRONGER. As described above and in accordance with 25 Pa. Code § 78.55, prior to generation of waste, the well operator must prepare and implement a PPC plan for the control and disposal of fluids, including top-hole water, brines, drilling fluids, additives, drilling mud, stimulation fluids, flowback, well servicing fluids, oil, production fluids and drill cuttings from the drilling, alteration, production, plugging or other activity associated with oil and gas wells.

Hydraulic fracturing waste characterization requirements are provided through the residual waste program implemented by the DEP Bureau of Waste Management. This Bureau provides a reporting mechanism for generators of waste hydraulic fracturing fluids through use of its Form 26R, *Chemical Analysis of Residual Waste, Annual Report by the Generator*. This form was recently modified to incorporate a comprehensive list of required analytical parameters for wastewater produced from the drilling, completion and production of Marcellus or other gas wells. For impoundments and tanks, the chemical analysis must represent the volume of wastewater stored in the impoundment or tank. If large volumes of water, wastewater or other fluids are added to an impoundment, a new chemical analysis must be performed that is representative of the impoundment.

The source reduction and recycling policies of DEP, including the provision related to toxicity reduction, have been previously reviewed by STRONGER and are equally applied to hydraulic

fracturing activities. BOGM has been proactive in encouraging operators and generators of hydraulic fracturing fluid wastes, as well as other wastes associated with the drilling, completion and stimulation phases of well drilling, to develop and expand source reduction and recycling opportunities. Hydraulic fracturing fluids are being increasingly recycled for use at subsequent hydraulic fracturing operations at other wells. This reduces the amount of fresh water employed in the hydraulic fracturing process. BOGM inspectors have also instructed operators to improve, modify and/or better maintain their spill containment measures, which serve to reduce the amount of waste, such as contaminated soil and vegetation, generated at the well site.

Additionally, well servicing companies that perform hydraulic fracturing operations are developing more environmentally friendly, or more "green," substitutes for certain additives employed in the hydraulic fracturing operation. This evolving process is supported by DEP.

DEP allows only water and sand to be used in the hydraulic fracturing of coalbed methane wells since the coalbeds are shallower than other gas producing formations and are sometimes used as a source of drinking water. This requirement is imposed through the use of an alternate method during well permitting.

Finding 9.2.1.1.

The review team finds that one of the defenses against the presumption of liability for water supply contamination within 1,000 feet of a newly drilled well is a pre-drilling survey that documents baseline groundwater quality.

Recommendation 9.2.1.1.

The review team recommends that DEP identify a standardized methodology to ensure that sampling and analysis for gas content in water is done consistently. (STRONGER Guidelines Section 9.2.1.)

Finding 9.2.1.2.

The review team commends Pennsylvania for encouraging the baseline groundwater quality testing that is done in the vicinity of wells.

Recommendation 9.2.1.2.

The review team discussed whether pre-drilling testing should extend beyond the vicinity of the vertical portion of a well to the full aerial extent of the hydraulic fractured horizontal laterals. The Commonwealth should consider whether there are areas or situations in which risk factors, such as the absence of confining rock layers or the presence of potential pathways for fluid movement into groundwater, establish a basis for encouraging more extensive baseline groundwater quality testing. (STRONGER Guidelines Section 9.2.1.)

Finding 9.2.1.3.

The review team commends BOGM for proposing regulations that require the results of baseline groundwater quality testing be provided to DEP and landowners.

Finding 9.2.1.4.

The review team noted that DEP has not required operators to identify potential conduits for fluid migration (such as active and abandoned wells) in the area of hydraulic fracturing.

Recommendation 9.2.1.4.

DEP should consider whether there are areas or situations in which wells (active and abandoned) in the vicinity of hydraulic fracturing operations provide pathways for fluid movement into groundwater. In such areas or situations, DEP should require operators to identify and eliminate these potential pathways for fluid movement into groundwater before conducting hydraulic fracturing operations. (STRONGER Guidelines Section 9.2.1.)

Finding 9.2.1.5.
The review team commends DEP for requiring the PPC plan.

Recommendation 9.2.1.5.

The review team recommends that DEP finalize its Proposed Rulemaking to include the requirement to keep a copy of the PPC plan at the well site during drilling and completion activities so that specific chemical information can be obtained during an investigation. (STRONGER Guidelines Section 9.2.2.)

Finding 9.2.1.6.

The review team commends DEP for requiring MSDS as part of the PPC plan.

Recommendation 9.2.1.6.

The review team recommends that the Commonwealth of Pennsylvania adopt provisions necessary to assure that information on chemical constituents used in fracturing fluids is available to medical personnel in the event of a medical emergency related to hydraulic fracturing. (STRONGER Guidelines Section 9.2.2.)

Finding 9.2.1.7.

Under the Proposed Rulemaking operators will be required to develop and maintain on site a casing and cementing plan. BOGM can require the casing and cementing plan to be submitted for approval prior to drilling. However, no casing information is required to be submitted with the well permit application.

Recommendation 9.2.1.7.

The review team recommends that the depth of surface casing be added to the well permit application so that BOGM can assure that groundwater protection concerns are addressed. (STRONGER Guidelines Section 9.2.1.)

Finding 9.2.1.8.

The review team understands that proposed amendments to 25 Pa. Code Chapter 78 will prohibit the use of surface casing as production casing if cement is not circulated behind the surface casing and returned to the surface, in which case an additional string of casing will have to be installed in a well unless the well is only used to produce oil, does not present a threat to groundwater, or if the operator of a gas well demonstrates that all gas and fluids will be contained in the well. If cement is circulated behind the surface casing and returned to the surface, an additional string of casing will not be required provided that the well bore pressure does not exceed 80% of the hydrostatic pressure at the surface casing seat and a pressure test on the casing seat demonstrates that no gas can escape the well.

Recommendation 9.2.1.8.

The review team recommends that the proposed amendments, when finally adopted, should clearly address hydraulic fracturing of wells with open hole completion to assure that the annular space above the packer does not fill with fluid to the point that groundwater could be impacted. The operator should make a demonstration through monitoring of the annulus or other acceptable method that fluid does not escape the well bore. (STRONGER Guidelines Section 9.2.1.)

Finding 9.2.1.9.

The review team understands that pits must be lined with impermeable liners.

Recommendation 9.2.1.9.

The review team recommends that, during the next round of rulemaking, procedures for inspecting pit construction or a certification process for pit construction, that includes pit bottom preparation and liner placement, should be considered for pits used to store flowback fluids from hydraulic fracturing. (STRONGER Guidelines Section 9.2.1.)

Finding 9.2.1.10.

The review team understands that there is no requirement for secondary containment around tanks.

Recommendation 9.2.1.10.

The review team recommends that secondary containment requirements be established for tanks used in hydraulic fracturing operations. (STRONGER Guidelines Section 9.2.1.)

Finding 9.2.1.11.

The review team understands that DEP allows only water and sand to be used in the hydraulic fracturing of coalbed methane wells, and that this requirement is imposed through the use of an alternate method during well permitting.

Finding 9.2.1.12.

The review team finds that DEP maintains a complaint tracking system that categorizes complaints by type.

Recommendation 9.2.1.12.

The review team recommends that DEP determine a way to track complaints and investigations related to hydraulic fracturing. (STRONGER Guidelines Section 9.2.1.)

REPORTING

The Pennsylvania Oil and Gas Act requires well operators to notify DEP at least 24 hours prior to the commencement of drilling. The Department's proposed well construction regulation requires 24-hours notice prior to cementing the surface casing unless cementing will begin within 72 hours of drilling. There is no specific requirement for notification prior to hydraulic fracturing nor is this notice contemplated in the revised regulations. While there is no mandated notification before hydraulic fracturing, BOGM inspectors are aware of planned activities at the sites they inspect.

BOGM regulations currently require a completion report to be filed within 30 days of completion of well drilling. Information provided on this report includes: a perforation record, a stimulation record including fluid type and amount, propping agent information, average injection rate, open flow before and after treatment, rock pressure and well service company name. The proposed regulations will additionally require a complete list of the chemicals used to fracture the well along with the volume of recycled flowback water used. DEP is evaluating the need to require the exact proportions of the hydraulic fracturing chemicals as part of revision to the proposed regulations.

Information pertaining to waste volumes and the location of disposal or recycling facilities are submitted annually to BOGM as part of the operator's annual waste and production report.

In addition, the Pennsylvania Worker and Community Right to Know Act, 35 P.S. §§ 7301-7320 provides: "Every employer shall make readily available, in every work area, the Material Safety Data Sheet for every hazardous substance or hazardous mixture to which the employees working in said work area may be exposed. The Material Safety Data Sheets shall be made available in such a manner and in such numbers as to give every employee in that work area easy and unhindered access to the Material Safety Data Sheets without permission or intervention of management or any supervisor."

No confidential hydraulic fracturing information is currently submitted to DEP. In the event that confidential proprietary information (CPI) is submitted, Pennsylvania's Right to Know Law contains provisions to protect this information.

The Proposed Rulemaking changes reporting requirements to mandate the electronic reporting of production.

Finding 9.2.2.1.

The review team commends DEP on the use of Form 26R, which contains the analyses and reporting requirements for hydraulic fracturing wastes transported off-site, and for its annual production and waste reporting requirements that include volumes and disposition of waste hydraulic fracturing materials.

Finding 9.2.2.2.

The review team understands that notification of hydraulic fracturing operations occurs after the operation is concluded.

Recommendation 9.2.2.2.

The review team recommends that DEP require notification prior to hydraulic fracturing operations. DEP should have the opportunity to conduct inspections at critical stages including during hydraulic fracturing and flowback. (STRONGER Guidelines Section 9.2.2.)

Finding 9.2.2.3.

The review team commends DEP for acquiring and disseminating production information electronically.

STAFFING AND TRAINING

In 2009, BOGM increased its well permit fees for the first time since the Oil and Gas Act was enacted in 1984. Pennsylvania's oil and gas program is now completely funded by well permit fees. The increase in permit fees allowed DEP to increase the size of its permitting, compliance and enforcement staff. BOGM's orphan and abandoned well plugging program continues to be completely funded by a surcharge on operator's well permit fees. BOGM added 37 oil and gas staff in 2009, and opened a new office in Williamsport to serve the needs of the north-central region that will continue to see increased Marcellus Shale activity. In addition, in 2010 the Governor directed BOGM to hire an additional 68 staff to respond to the continued growth of Marcellus Shale development. This year BOGM opened a new office in Scranton dedicated to oversight of oil and gas drilling in the northeastern counties.

The total complement of staff regulating oil and gas well development in Pennsylvania is 196 people. This number includes inspectors, permitting and management staff, and administrative and legal staff.

With the recent increase in staffing and the recognition that Marcellus Shale well development relies on techniques not traditionally used in Pennsylvania, training programs have been developed to provide ongoing training of new and veteran inspectors. Recent training has been provided on well stimulation techniques, hydraulic fracturing fluid composition and additives, hydraulic fracturing operations and equipment, vertical and horizontal cement evaluation techniques, vertical and horizontal logging in the Marcellus from open hole evaluation to hydraulic fracture monitoring, Marcellus hydraulic fracture design and operations, flowback operations and fluids, water disposal issues, and hydraulic fracturing pressures and forces.

Training programs on well construction and completion practices, safety, well site inspection, and well plugging are being developed and will be offered on an ongoing basis.

In addition to formal training sessions, bi-weekly conference calls and quarterly management meetings offer the opportunity to share new information between staff on a timely basis.

Finding 9.2.3.1.

The review team commends Pennsylvania for developing a mechanism to fully fund its oil and gas regulatory program.

Finding 9.2.3.2.

The review team supports DEP's efforts to increase staff levels to deal with increased drilling activities.

Finding 9.2.3.3.

The review team commends DEP for its training program for new hires and refresher training for existing staff.

Finding 9.2.3.4.

The review team supports DEP training about how to utilize the PPC plan to properly deal with spills during and after hydraulic fracturing.

PUBLIC INFORMATION

With the enormous public interest in the development of the Marcellus Shale, there have been numerous opportunities for dissemination of educational information regarding well construction and hydraulic fracturing. Testimony has been given to the Pennsylvania Legislature on these subjects several times. Public speaking events and conferences have allowed for dozens of additional outreach opportunities. Correspondence by letter, email and phone has been prolific, and BOGM staff has answered all inquiries.

The well construction and TDS regulation developments described above have also provided an opportunity for DEP to receive and respond to thousands of comments from the public. BOGM maintains a website that has provided information regarding the chemicals used at Marcellus wells since 2007. This list has recently been updated, and a description of the hydraulic fracturing process has been added.

Finding 9.2.4.1.

The review team recognizes and commends DEP's comprehensive efforts to proactively address public concerns about hydraulic fracturing.

III. WATER AND WASTE MANAGEMENT

In 2002, the Water Resources Planning Act was enacted that requires entities withdrawing more than 300,000 gallons of water over a 30-day period to register their water withdrawal. By registering water uses, DEP began the process of tracking this activity outside the Susquehanna and Delaware River basins, where interstate commissions have jurisdiction.

As a result of the development of the Marcellus shale, in 2008 BOGM began requiring water management plans to identify where water would be withdrawn and the volumes of withdrawal. The purpose of this inquiry is to ensure that water quality standards are maintained and protected. By law, DEP cannot issue permits for an activity that will violate the laws it administers. Because large withdrawals of surface water can, individually or cumulatively, impact water quality, DEP must assure that excessive withdraws do not occur.
DEP follows water withdrawal guidance promulgated by the Susquehanna River Basin Commission (SRBC) to ensure uniform statewide evaluation. The Delaware River Basin Commission (DRBC) also has a role in evaluating impacts within that river basin. The DRBC is in the process of promulgating regulations to address Marcellus shale well drilling within its jurisdiction.

Pennsylvania has many water sources that are impacted by acid mine drainage (AMD). Use of this water for hydraulic fracturing purposes is encouraged by BOGM. DEP provides funding to watershed groups that treat AMD-impacted water. BOGM promotes the sale of this water for hydraulic fracturing purposes to generate revenues for watershed groups so that additional AMD-impacted water can be restored.

Studies are underway by Pennsylvania universities, such as the University of Pittsburgh, that are attempting to provide for the greater use of AMD-impacted water for hydraulic fracturing. In addition, the Pennsylvania State University is conducting a study of groundwater before and after hydraulic fracturing operations. Industry has been testing wastewater from hydraulic fracturing flowback to establish a baseline of chemical quality through time. BOGM staff is expanding the Penn State study to additional producing areas and are participating in the other studies.

Wastewater generated by hydraulic fracturing operations is managed four different ways in Pennsylvania:

1) Reused to fracture additional wells;
2) Injected into underground disposal wells;
3) Transported to out of state facilities, and;
4) Treated and discharged to surface water.

The vast majority of the wastewater generated by conventional well drillers is treated at centralized waste treatment facilities that discharge to surface waters. These facilities have been operating in Pennsylvania for many years. A small percentage of this wastewater can be taken to Class II disposal wells; however, Pennsylvania only has seven such wells and only one of those is a commercial well.

Wastewater generated by Marcellus shale operators can be taken to some of these same facilities. Increasingly, flowback is being reused to fracture additional wells. According to the SRBC:

- The average recovery of hydraulic fracture fluids injected is 13.5%.
- Of the amount recovered, approximately 60% is reused and 40% is disposed of after treatment.
- The disposal quantity represents approximately 4% of the total amount withdrawn for hydraulic fracturing operations.
- Operators that reuse the flowback water employ various on-site treatment practices ranging from filtering out sediment to removing barium and strontium.

The wastewater that is to be disposed must be taken to facilities that are approved to receive it. These facilities include publically owned treatment works (POTW) and centralized treatment facilities. Some newer centralized treatment facilities have no discharge to surface waters and sell all of the treated water back to operators.

In 2008 and 2009, TDS levels exceeded drinking water standards along the Monongahela River, which is a major source of drinking water. In early September 2009, excessive levels of TDS, primarily from mining discharges, were a primary factor in an environmental disaster in Dunkard Creek that wiped out 26 miles of stream in Greene County. High TDS concentrations led to the death of at least 16 species of freshwater mussels and 18 species of fish. These concentrations, coupled with other factors such as temperature and nutrient levels, lead to the colonization and growth of golden algae and an inhospitable environment for aquatic life. These algae released toxins into the water that wiped out aquatic life, including endangered mussels. Dunkard Creek is an example of what can happen if TDS is not controlled, and the loss of this public resource was an environmental and economic disaster.

To address the TDS issue, DEP issued the Permitting Strategy for High TDS Wastewater Discharges on April 11, 2009. This strategy allowed the department to effectively manage the new and increasing demands for assimilative capacity in surface waters. As part of this strategy, the department proposed revisions to its 25 Pa Code Chapter 95 Wastewater Treatment Requirements to codify key treatment discharge limitations. DEP's new TDS rule will promote reuse of wastewater. Under the new regulations, new and expanded facilities that accept oil and gas wastewater for treatment must meet strict discharge limits of 500 mg/l for TDS, 250 mg/l for chlorides, 10 mg/l for barium and 10 mg/l for strontium on a monthly average. This regulation was approved as a final regulation at the Environmental Quality Board (EQB) May 17, 2010 meeting.

Hydraulic fracturing waste generation, transportation and disposal tracking requirements are integrated into DEP's residual waste regulations. Requirements found at 25 Pa Code Chapter 287 specify the reporting, recordkeeping and waste stream analytical requirements for generators of hydraulic fracturing wastes. Form 26R, described above, provides the analytical and reporting requirements for generators of hydraulic fracturing wastes. This form also requires information on the processing or disposal facilities that will accept the waste. 25 Pa. Code Chapter 299 provides standards for the transportation of residual waste to a commercial or centralized facility. These include requirements for transportation, accident prevention and contingency planning,

emergencies, wastes from accidents and spills, recordkeeping and reporting, and appropriate signage on vehicles. Waste haulers are required to be permitted and are subject to the requirements of the DEP Waste Transportation and Safety Program.

Information pertaining to waste volumes and the location of disposal or recycling facilities are submitted annually to BOGM as part of the operator's annual waste and production report.

The DEP internet home page prominently features a link to "Report an Incident" that provides phone numbers for the public to call if they observe a pollution event occurring. These phone lines are staffed 24 hours a day and designated DEP staff are on call to respond to emergencies at all times. Complaint reports are generated and transmitted to the appropriate DEP office for follow-up investigation. The new amended regulations will require an operator to notify DEP of the receipt of a complaint within 10 days, whether or not the complaint has been resolved. If an emergency related to an oil or gas well is reported, BOGM inspectors are dispatched immediately.

DEP supports complete reuse of flowback and produced water for hydraulic fracturing. There are no additional permit requirements needed to re-use flowback water at another well site. The transportation of water, wastewater and recycled water by truck or by pipeline does not require a permit beyond those already established for stream crossings and waste transporters.

Finding 9.3.1.

The review team commends DEP for developing a comprehensive water planning process and for providing notice to municipalities and counties of the water management plans.

Recommendation 9.3.1.

The review team recommends that DEP provide the opportunity for broader public comment during the water management planning process. (STRONGER Guidelines Section 9.3.)

Finding 9.3.2.

The review team finds that DEP encourages the use of AMD-impacted water and POTW effluent for hydraulic fracturing purposes and evaluates the potential impacts of this practice on streams as part of the water management planning process.

Finding 9.3.3.
The review team understands that interstate river basin commissions have a role in approval of water management plans.

Recommendation 9.3.3.

The review team recommends that DEP work closely with the river basin commissions to incentivize the use of AMD-impacted waters and other wastewater resources through streamlined permitting and inter-basin transfers. (STRONGER Guidelines Section 9.3.)

Finding 9.3.4.

The review team commends DEP for their willingness to evaluate incidents and make improvements to the program.

Finding 9.3.5.

The review team commends DEP on the use of its web site to provide information on filing complaints.

Appendix A

Acronyms

AMD	Acid Mine Drainage
ANPR	Advanced Notice of Proposed Rulemaking
BOGM	Bureau of Oil and Gas Management
BOP	Blow-Out Preventer
CBM	Coal Bed Methane
CPI	Confidential Proprietary Information
DEP	Department of Environmental Protection
DRBC	Delaware River Basin Commission
E&P	Exploration and Production
IOCC	Interstate Oil Compact Commission
IOGCC	Interstate Oil and Gas Compact Commission
IRRC	Independent Regulatory Review Commission
MSDS	Material Safety Data Sheets
NORM	Naturally Occurring Radioactive Materials
POTW	Publicly Owned Treatment Works
PPC	Prevention, Preparedness and Contingency
RBDMS	Risk Based Data Management System
RTKL	Right to Know Law
SRBC	Susquehanna River Basin Commission
STRONGER	State Review of Oil and Natural Gas Environmental Regulations, Inc.
TAB	Oil and Gas Technical Advisory Board
TDS	Total Dissolved Solids
UIC	Underground Injection Control
USEPA	U.S. Environmental Protection Agency

Appendix B

June 23, 2010
Hydraulic Fracturing Questionnaire

(Note: Written responses to questions should be brief (i.e., 1 paragraph in length). Additional information may be requested by the review team during the in-state portion of the review.)

General [X.2]

Has the state evaluated potential risks associated with hydraulic fracturing, taking into account factors such as depth of the reservoir to be fractured, proximity of the reservoir to fresh water resources, well completion practices, well design, and volume and nature of fluids?

Yes. The Bureau of Oil and Gas Management (BOGM) continuously evaluates the potential for hydraulic fracturing to impact fresh water resources. Information on the potential impacts of fracing is collected through permitting, inspections and complaint tracking – including a compilation of water supply impacts that is publically available on BOGM's Technical Advisory Board website. Information is shared among BOGM staff through bi-weekly conference calls with regional program managers and central office staff, quarterly meetings with all BOGM management,

These evaluations have resulted in several changes to the way BOGM implements the laws and regulations governing many aspects of fracing.
The potential impacts to fresh water from hydraulic fracturing activities include:

1) Pollution through diminution of water resources
2) Surface spills – during transport to the well site and container leaks/mishandling at the site
3) Leaking pits or tanks
4) Communication with an abandoned well during well stimulation
5) Fracturing coalbed methane wells with substances other than freshwater and sand

   (BOGM prohibits the use of chemicals to fracture CBM wells through the alternative methods approval process.)
6) Defective casing or cementing that permit hydraulic fracturing to occur in unintended zones or formations
7) Direct communication between the target formation and fresh groundwater

It is important to note that while BOGM recognizes the theoretical possibility that hydraulic fracturing under some remote circumstance could impact fresh water sources, BOGM is not aware of this event ever occurring. Additionally, the Bureau of Watershed Management has reviewed their complaint database and conducted interviews with regional staff that investigate

groundwater contamination related to oil and gas activities, and has concluded that no groundwater pollution or disruption of underground sources of drinking water have been attributed to hydraulic fracturing of deep gas formations.

In an effort to further evaluate the potential impacts of fracing on fresh water sources, BOGM will be engaging in a comprehensive evaluation of groundwater resources before, during and after well drilling and completion activities throughout Pennsylvania. This study will compliment a similar study currently being conducted by Penn State. This study is still in the early stages of development. A sampling protocol has been developed and test parameters have been identified. Sampling locations have yet to be determined.

Has the state developed standards to prevent the contamination of groundwater and surface water from hydraulic fracturing?

Yes. The standards related to spills, pits and tanks, and well construction are described in the appropriate sections below.

Hydraulic Fracturing Standards [X.2.1]

Describe how state standards for casing and cementing meet anticipated pressures associated with hydraulic fracturing to protect other resources and the environment.

Current BOGM standards for all well casing and cementing practices require that the operator conduct casing and cementing activities to accomplish the following:

(1) Allow effective control of the well at all times.

(2) Prevent the migration of gas or other fluids into sources of fresh groundwater.

(3) Prevent pollution or diminution of fresh groundwater.

(4) Prevent the migration of gas or other fluids into coal seams.

BOGM is in the process of revising its well casing and cementing standards that will add greater specificity to the narrative standards required above.

Following an Advanced Notice of Proposed Rulemaking ("ANPR") procedure and several meetings with BOGM's Technical Advisory Board, these regulations were approved by the DEP Environmental Quality Board as proposed rulemaking and were published for a second round of public comment on July 10. The comment period is 30 days and DEP will hold four public hearings across the state. After the comment period and public hearings are complete, BOGM will make appropriate revisions to the regulation and present the revisions to TAB at its August 2010 meeting.

Regarding well casing and cementing standards, the regulations propose several important revisions. The structural integrity of the well is essential to containing hydraulic fracturing fluid

within the well bore. To achieve this, operators will be required to develop and maintain on site a casing and cementing plan that describes the casing to be used the proposed depths to which it will be set, the proposed placement of centralizers (which are now required), the volume of cement to be used and the proposed cement additives.

As a companion to the casing and cementing plan, operators will also be required to maintain a cement job log that documents the actual procedures and specifications of the cementing operation. Cementing operations have also been modified to require a true 8 hour wait on cement time where the operator is not permitted to disturb the cement while it sets.

BOGM well casing regulations have also been significantly revised. The amendments will prohibit the use of surface casing as production casing and require an additional string of casing to be installed in a well unless the well is only used to produce oil that does not present a threat to groundwater or if the operator of a gas well demonstrates that all gas and fluids will be contained in the well. Additionally, new pressure testing requirements will apply to specified casing strings.

Casing that is attached to a blow out preventer with a pressure rating of 3,000 psi must be pressure tested. Pressure testing will also be required for used as well as welded casing. A passing pressure test is defined as holding 120% of the maximum anticipated working pressure~~s~~ to which the casing will be exposed for 30 minutes with no more than a 10% decrease in pressure.

Discuss how the program identifies and, where deemed appropriate, manages risks associated with potential conduits for fluid migration in the area of hydraulic fracturing.

The program identifies and manages risk on an ongoing basis. Risk is identified through bi-weekly conference calls with regional managers, quarterly staff meetings and training sessions. Risk is managed on a case by case basis through well permit conditions and inspections. Risk is managed more broadly through permit forms and instruction revisions, technical guidance documents, and via development, implementation and enforcement of regulations.

Operators are required to identify potential risks and plan for the possibility of an accident occurring at the well site through a prevention, preparedness and contingency plan (PPC). As part of developing the PPC plan the operator must review its operations and identify all pollutional substance and wastes, both solid and liquid, that will be used or generated, and identify the methods for control and disposal of those substances or wastes. The second objective of a PPC plan involves recognizing that accidents and unexpected conditions do occur that would require an immediate response to mitigate any detrimental effects from those accidents or conditions, and planning the actions to be taken to prevent pollution substances from reaching the waters of the Commonwealth.

The operator also anticipates risk as part of developing a casing and cementing plan described above. The proposed regulations themselves embody the identification and management of risk by DEP. One of the unique features of the new regulations not previously discussed is the inclusion of a provision that allows BOGM to designate areas of alternative methods which require additional measures to be employed to drill a well in an environmentally protective

manner. This provision allows BOGM to react to conditions on the ground faster than the normal rulemaking procedure thus identifying and managing risk more appropriately and efficiently.

Describe program requirements that address actions to be taken in response to unanticipated operational or mechanical changes encountered during hydraulic fracturing that may cause concern.

As described above, the operator's PPC plan specifies the actions that must be taken if an accident or spill should occur. Regulations promulgated pursuant to Pennsylvania's Clean Streams Law require immediate notification to DEP if a discharge or spill threatens waters of the Commonwealth or has the potential to damage property.

Blow out preventers are required when well head pressures or natural open flows are anticipated at the well site that may result in a blow-out. This would include hydraulic fracturing and post frac cleanout operations as these operations occur under pressures at the surface. The proposed regulations require a second set of BOP actuators in instances where the pressure rating exceeds 3000 psi that are not associated with the rig hydraulic system to be located away from the rig so that the BOP can be operated if control of the well has been lost.

Briefly describe how surface controls associated with hydraulic fracturing, such as dikes, pits or tanks, meet Sections 5.5 and 5.9 of the guidelines.

BOGM regulations pertaining to pits and tanks have been subject to previous STRONGER reviews. BOGM regulations at 25 Pa. Code 78.56 and 57 specify the requirements for temporary storage of pollutional substances and wastes – including stimulation fluids and the associated flow back. These substances must be contained in pits or tanks that are structurally sound, protected from unauthorized acts and constructed and maintained with sufficient capacity to contain all pollutional substances and wastes which are used or produced during drilling, altering, completing and plugging the well.

Pits and open tanks must maintain 2 feet of freeboard. The subbase of any pit must be free of rocks or debris and the pit must be lined with an impermeable liner that is of sufficient strength and thickness to maintain the integrity of the liner. The liner shall be designed, constructed and maintained so that the physical and chemical characteristics of the liner are not adversely affected by the waste and the liner is resistant to physical, chemical and other failure during transportation, handling, installation and use.

Liners or secondary containment around tanks or other facilities storing pollutional substances are not required but are recommended practices.

Pits must be closed within 9 months of completion of well drilling. Free liquid must be removed from the pit and the chemical constituencies of any cuttings or residual waste that will be encapsulated in the pit must not exceed regulatory standards.

Briefly describe how contingency planning and spill risk management procedures related to hydraulic fracturing meet Section 4.2.1 of the guidelines.

BOGM's contingency planning has been reviewed previously by STRONGER. As described above and per 25 Pa. Code § 78.55, prior to generation of waste, the well operator shall prepare and implement a PPC plan for the control and disposal of fluids, including top-hole water, brines, drilling fluids, additives, drilling muds, stimulation fluids, well servicing fluids, oil, production fluids and drill cuttings from the drilling, alteration, production, plugging or other activity associated with oil and gas wells.

Briefly discuss how hydraulic fracturing waste characterization requirements, including, as appropriate, testing of fracturing fluids, are consistent with Section 5.2 of the guidelines.

Hydraulic fracturing waste characterization requirements are provided through the Residual Waste Program implemented by the DEP Bureau of Waste Management. This Bureau provides a reporting mechanism for generators of waste hydraulic fracturing fluids via its Form 26R, *Chemical Analysis of Residual Waste, Annual Report by the Generator*. This form was recently modified to incorporate a comprehensive list of required analytical parameters for wastewater produced from the drilling, completion and production of Marcellus or other gas wells. For impoundments and tanks, the chemical analysis must represent the volume of wastewater stored in the impoundment or tank. If large volumes of water, wastewater or other fluids are added to an impoundment, a new chemical analysis must be performed that is representative of the impoundment.

Briefly describe how the waste management hierarchy contained in Section 5.3 of the guidelines (source reduction, recycling, treatment and disposal), including the provisions relating to toxicity reduction, are promoted for hydraulic fracturing.

The toxicity reduction policies of DEP have been previously reviewed by STRONGER and are equally applied to hydraulic fracturing activities. BOGM has been proactive in encouraging drilling operators and the generators of hydraulic fracturing fluid wastes, as well as other wastes associated with the drilling, completion and stimulation phases of well drilling, to develop and expand source reduction and recycling opportunities. Hydraulic fracturing fluids are being increasingly recycled for use at subsequent fracing operations at other wells, which reduces the amount of fresh water employed in the stimulation process. BOGM inspectors have instructed operators to improve, modify and/or better maintain their spill containment measures, which has reduced the amount of waste generated at the well pad.

Additionally, well servicing companies that perform hydraulic fracturing operations at well sites are developing more environmentally-friendly, or more "green" substitutes for certain additives employed in the fracing operation. This evolving process is supported by DEP.

Briefly describe how the tracking of hydraulic fracturing waste disposed at commercial or centralized facilities meets the requirements of Section 5.10.2.3 of the guidelines.

As a residual waste, hydraulic fracturing waste generation, transportation and disposal tracking requirements are integrated into DEP's Residual Waste regulations. 25 Pa Code Chapter 287 specifies the reporting, recordkeeping and waste stream analytical requirements for generators of hydraulic fracturing wastes. Form 26R, described above, provides the analytical and reporting requirements for generators of hydraulic fracturing wastes. This form also requires information on the processing or disposal facilities that will accept the waste. 25 Pa. Code Chapter 299 provides standards for transportation of residual waste to a commercial or centralized facility. These include requirements for transportation to permitted facilities, accident prevention and contingency planning, emergencies, wastes from accidents and spills, recordkeeping and reporting, and appropriate signage on transportation vehicles. Waste haulers are required to be permitted and are subject to the requirements of the Department's Waste Transportation and Safety Program.

Finally, records pertaining to waste volumes and the location of disposal or recycling facilities are submitted annually to BOGM as part of an operator's annual waste and production reporting responsibilities.

Briefly describe how procedures in place for receipt of complaints related to hydraulic fracturing are consistent with Section 4.1.2.1.

The DEP home page prominently features a link to "Report an Incident" that provides phone numbers for the public to call if they observe a pollution event occurring. These phone lines are staffed 24 hours per day and designated DEP staff are on call to respond to emergencies at all times. Complaint reports are generated and transmitted to the appropriate DEP office for follow up investigations. If an emergency related to an oil or gas well is reported, BOGM inspectors are dispatched immediately on site.

Reporting Associated with Hydraulic Fracturing [X.2.2]

Describe any required notification prior to, and reporting after completion of, hydraulic fracturing operations.

The Oil and Gas Act requires operators to notify DEP 24 hours prior to commencement of well drilling. The Department's proposed well construction regulations requires 24 hours notice prior to cementing the surface casing unless cementing will begin within 72 hours of drilling.

BOGM regulations currently require a completion report to be filed within 30 days of completion of well drilling. Information provided on this report includes: a perforation record, a stimulation record including fluid type and amount, propping agent information, average injection rate, open flow before and after treatment, rock pressure and well service company name. The proposed regulations will require a complete list of the chemicals used to frac the well along with the volume of recycled flowback water used. The Department is evaluating the need to require the exact proportions of the fracing chemicals as part of revisions to the proposed regulations.
There is no specific requirement for notification prior to fracing nor is this notice contemplated in the revised regulations.

Is notification sufficient to allow for the presence of field staff to monitor hydraulic fracturing activities?

While there is no mandated notification requirement, BOGM inspectors are aware of planned activities at the sites they inspect. BOGM welcomes any recommendation the STRONGER review team may have with this issue.

Describe reporting requirements for hydraulic fracturing activities and whether they include the identification of materials used, aggregate volumes of fracturing fluids and proppant used, and fracture pressures recorded.

BOGM regulations currently require a completion report to be filed within 30 days of completion of well drilling. Information provided on this report includes: a perforation record, a stimulation record including fluid type and amount, propping agent information, average injection rate, open flow before and after treatment, rock pressure and well service company name. The proposed regulations will require a complete list of the chemicals used to frac the well along with the volume of recycled flowback water used. DEP is evaluating the need to require the exact proportions of the fracing chemicals as part of revisions to the proposed regulations.

Describe any mechanisms for disclosure of information on chemical constituents used in hydraulic fracturing fluids to the state in the event of an investigation or to medical personnel in the event of a medical emergency.

BOGM regulations at 25 Pa. Code §§ 78.55 and 91.34 require operators to develop and implement a preparedness, prevention and contingency plan (PPC).

The first objective in preparing and implementing PPC plan is for the operator to review their operations and identify all pollutional substance and wastes, both solid and liquid, that will be

used or generated, and identify the methods for control and disposal of those substances or wastes.

As part of the PPC plan operators must list the chemicals or additives utilized and the different wastes generated during hydraulic fracturing. The PPC plan includes Material Safety Data Sheets, cleanup procedures, toxicological data and waste chemical characteristics. The approximate quantities of each material and the method of storage (sack, barrels, tanks, etc.) should be specified.

PPC plans should be available the well site and must be submitted to DEP upon request. When new operators apply for permits in Pennsylvania, BOGM staff request a copy of the operator's PPC plan prior to permit issuance as was the case with all Marcellus Shale well operators.
In addition, the Pennsylvania Worker and Community Right to Know Act, 35 P.S. §§ 7301-7320 provides: "Every employer shall make readily available, in every work area, the Material Safety Data Sheet for every hazardous substance or hazardous mixture to which the employees working in said work area may be exposed. The Material Safety Data Sheets shall be made available in such a manner and in such numbers as to give every employee in that work area easy and unhindered access to the Material Safety Data Sheets without permission or intervention of management or any supervisor."

Briefly describe how hydraulic fracturing information submitted that is of a confidential business nature, is treated consistent with Section 4.2.2 of the guidelines?

No confidential hydraulic fracturing is currently submitted to DEP. In the event that CBI is submitted, Pennsylvania's Right to Know Law contains provisions to protect this information.
The Right-to-Know Law, 65 P.S. §§ 67.101-67.3104 ("RTKL"), outlines when a Commonwealth agency must provide a "public record" to a person requesting a record under the RTKL. A "public record" is defined very broadly, with the two following relevant exceptions: (1) records that constitute or reveal a trade secret or confidential proprietary information, see 65 P.S. 67.102, 67.708(11); and (2) records exempt from being disclosed under any other Federal or State law or regulation, 65 P.S. 67.102.

Section 102 defines confidential proprietary information ("CPI") and trade secret as follows:

> "Confidential proprietary information." as "[c]ommerical of financial information received by an agency: (1) which is privileged or confidential; and (2) the disclosure of which would cause substantial harm to the competitive position of the person that submitted the information."
>
> "Trade Secret." Information, including a formula, drawing, pattern, compilation, including a customer list, program, device, method, technique or process that: (1) derives independent economic value, actual or potential, from not being generally known to and not being readily ascertainable by proper means by other persons who can obtain economic value from its disclosure or use; or (2) is the subject of efforts that are reasonable under the circumstances to maintain its secrecy.

Section 707(b) of the RTKL outlines the procedure for production of records containing CPI or a trade secret. Under this section, a party that submits a record to a Commonwealth agency may include a written statement indicating that the record contains CPI or a trade secret. If the party has submitted a written statement with the record stating that it contains CPI or a trade secret, when a requester seeks that record the agency shall notify the party of the request. The party claiming CPI or a trade secret may then provide input on the release of the record. The agency then either denies the request or releases the record and must notify the party claiming CPI or a trade secret of its decision. If the Commonwealth agency denies the request for a record containing CPI or a trade secret, it bears the burden of demonstrating that the record is exempt from public access by the preponderance of the evidence.

Staffing and Training [X.2.3]

Briefly discuss if, in addition to the personnel and funding recommendations found in Section 4.3 of the guidelines, state staffing levels sufficient to receive, record and respond to complaints of human health impacts and environmental damage resulting from hydraulic fracturing.

In 2009, BOGM increased its well permit fees for the first time since the Oil and Gas Act was enacted in 1984. Pennsylvania's oil and gas program is now completely funded by well permit fees. The increase in permit fees also allowed DEP to increase the size of its permitting, compliance and enforcement staff. Additionally, BOGM's orphan and abandoned well plugging program continues to be completely funded by a surcharge on operator's well permit fees. BOGM added 37 oil and gas staff in 2009 and opened a new Oil and Gas Office in Williamsport to serve the needs of a region that has and will continue to see increased Marcellus Shale activity over the next few years. In addition, in 2010 the Governor directed BOGM to hire an additional 68 staff in response to the continued dramatic growth of the Marcellus Shale development. This year BOGM also opened a new office in Scranton dedicated to oversight of oil and gas drilling in the northeastern counties.

The total complement of staff regulating oil and gas well development in Pennsylvania is 196 people. This number includes administrative and legal staff in addition to inspectors, permitting and management staff.

Describe staff training to stay current with new and developing hydraulic fracturing technology.

With the recent increase in staffing and the recognition that Marcellus Shale well development relies on techniques not traditionally used in Pennsylvania, training program have been developed to provide for ongoing training of new and veteran inspectors. Recent training to BOGM staff has been provided as follows:

1. **June 1-2, 2010 Ramada Inn, State College, PA: DEP technical services staff and inspectors.**
Conducted by Range Resources and Chesapeake Energy. Topics included well stimulation techniques, frac fluid composition/additives, frac operations and frac equipment.

2. **May 19-20, 2010, DEP Southwest Regional Office, Pittsburgh, PA: DEP technical services staff.**
Conducted by Schlumberger and Universal Well Services. Topics included (a) vertical and horizontal cement evaluation techniques; (b) an overview of vertical and horizontal logging solutions in the Marcellus - from open hole evaluation to hydraulic frac monitoring (both by Schlumberger); and (c) Marcellus fracs (Universal Well Services).

3**. February 10-12, 2010, Universal Well Services, Meadville, PA: DEP technical services staff and inspectors.**
Conducted by Universal Well Services and Eastern Reservoir Services. Topics included frac design, fluids, and operations, flowback operations and fluids, water disposal issues, and training on pressure and forces.

Training programs tailored to well construction and completion practices, along with other training programs on safety, well site inspection, well plugging, etc. is also being developed and will be offered on an ongoing basis.

In addition to formal training sessions, bi-weekly conference calls and quarterly management meetings offer the opportunity to share information between regional staff on a more timely basis.

Public Information [X.2.4]

Briefly describe how the state agency provides for dissemination of educational information regarding well construction and hydraulic fracturing to bridge the knowledge gap between experts and the public as provided in Section 4.2.2.2 of the guidelines. This is especially important in areas where development has not occurred historically and in areas where high volume water use for hydraulic fracturing is occurring.

Given the enormous interest in the development of the Marcellus Shale, opportunities for dissemination of educational information regarding well construction and hydraulic fracturing have been significant. Testimony has been given to the Pennsylvania Legislature on these subjects several times by Secretary Hanger, Deputy Secretaries Roberts and Hines as wells as by Bureau Directors Perry and Aunkst. Public speaking events and conferences attended by the above as wells as regional program managers and other BOGM staff have allowed for dozens of further engagement opportunities. Correspondence by letter, email and phone has been prolific and BOGM staff has answered all inquiries.

The well construction and TDS regulation developments described above have also provided an opportunity for DEP to receive and respond to thousands of comments by the public. Finally, BOGM maintains a website that has provided information regarding the chemicals used at Marcellus wells since 2007. This list has recently been updated and a description of the fracing process has also been added.

Water and Waste Management Associated with Hydraulic Fracturing [X.3]

Fundamental differences exist from state to state, and between regions within a state, in terms of geology and hydrology. Describe how the state evaluated and addressed, where necessary, the availability of water for hydraulic fracturing in the context of all competing uses and potential environmental impacts resulting from the volume of water used for hydraulic fracturing.

Fracing can require large volumes of fresh water. Withdrawal of water from surface and groundwater sources has the potential to reduce stream flow to the point that thermal or other sources of pollution can occur. In 2002 the Water Resources Planning Act was enacted and required entities withdrawing more than 300,000 gallons over a 30 day period to register their water withdrawal. By registering water use, DEP began the process of tracking this activity outside the Susquehanna and Delaware River basins.

As a result of the development of the Marcellus Shale, in 2008 BOGM began requiring water management plans to identify where water would be withdrawn and the volumes of withdrawal. The purpose of this inquiry was to ensure that water quality standards are maintained and protected. By law, DEP cannot issue permits for an activity that will violate the laws it administers. Because large volume withdraws on surface water can, individually or cumulatively, impact water quality DEP must assure that excessive withdraws do not occur.
DEP follows water withdrawal guidance promulgated by the Susquehanna River Basin Commission to ensure uniform statewide evaluation of water withdrawals. The Delaware River Basin Commission also has a role in evaluating impacts within that river basin. The DRBC is in the process of promulgating regulations to address Marcellus Shale well drilling within its jurisdiction.

Describe how the availability and use of alternative water sources for hydraulic fracturing, including recycled water, is encouraged.

Unfortunately, Pennsylvania has many water sources that are impacted by acid mine drainage. Use of this water for hydraulic fracturing purposes is encouraged by DEP. DEP provides funding to watershed groups that treat AMD impacted water and DEP promotes the sale of this water for fracing purposes so that additional AMD impacted water resources can be restored.
Studies are underway by Pennsylvania Universities, such as the University of Pittsburgh, that are attempting to provide for the greater use of AMD impacted water for fracing and BOGM staff are participating in these endeavors. BOGM welcomes any recommendation the STRONGER review team may have with this issue.

Briefly describe how waste associated with hydraulic fracturing is managed consistent with Section 4.1.1. and Section 7 of the guidelines.

Wastewater generated by hydraulic fracturing operations is managed four different ways in Pennsylvania: 1) Treatment and discharge to surface water; 2) Underground injection wells; 3) Reused to frac additional wells and; 4) Transported to out of state facilities.

The vast majority of the wastewater generated by traditional well drillers is treated at centralized waste treatment facilities that discharge to surface waters and have been operating in Pennsylvania for many years. A small percentage of this wastewater can be taken to Class II UIC wells. However, Pennsylvania only has 8 such wells and only 1 of those is a commercial disposal well.

Wastewater generated by Marcellus Shale operators can be taken to some (but not all) of these same facilities. Increasingly however, flowback is being reused to frac additional wells. Per the Susquehanna River Basin Commission:

The average recovery of fluids injected is 13.5%. Of the amount recovered, approximately 60% was reused and 40% was disposed of for treatment. The disposal quantity represents approximately 4% of the total amount withdrawn for hydraulic fracturing operations. Operators that reuse the flowback water employ various forms of onsite treatment ranging from filtering out sediment to removing barium and strontium.

The wastewater that must be disposed can only be taken to facilities that are approved to receive it. These facilities and include POTW's and centralized treatment facilities. Newer centralized treatment facilities have no discharge and instead sell the treated water back to operators. DEPs new Total Dissolved Solids (TDS) rule will further promote reuse and effective treatment of this wastewater.

TDS are comprised of inorganic salts, organic matter and other dissolved materials in water. They can be naturally present in water or the result of runoff, mining practices, oil and gas practices or industrial or municipal uses and treatment of water. TDS discharges contain minerals and organic molecules that can provide benefits such as nutrients, when moderately present, but also may contain contaminants such as toxic metals and organic pollutants. It is the inorganic TDS that are of concern and oil and gas wastewater is exceptionally contaminated with TDS.
Pursuant to this new regulation, new and expanded facilities (net TDS load increase) that take oil and gas wastewater for treatment must meet strict discharge limits of 500 mg/l for TDS, 250 mg/l for chlorides, 10 mg/l for barium and 10 mg/l for strontium on a monthly average.

The problem of TDS is a very real threat to Pennsylvania's waterways. In 2008 and 2009, TDS levels exceeded drinking water standards along the Monongahela River which is a major source of drinking water. In early September 2009, excessive levels of TDS primarily from mining discharges were a primary factor in the environmental disaster in Dunkard Creek that wiped out 26 miles of the stream in Greene County. High TDS concentrations led to the death of at least 16 species of freshwater mussels and 18 species of fish. These concentrations, coupled with other factors such as temperature and nutrient concentrations, lead to colonization and growth of golden algae and an inhospitable environment for aquatic life. These algae released toxins to the water column that literally wiped out aquatic life, including endangered mussels. Dunkard Creek is an example of what can happen if TDS is not controlled, and the loss of this important public resource was an environmental and economic tragedy.

Recognizing the importance of addressing the TDS issue, the department took action and issued the Permitting Strategy for High TDS Wastewater Discharges on April 11, 2009. This strategy

presented an approach that allowed the department, until the proposed regulation is finalized and approved, to effectively deal with the increasing demand for assimilative capacity in the surface waters to accept increasing new loads of TDS from current and new facilities. As a major part of this strategy, the department proposed revisions to its 25 Pa Code Chapter 95 Wastewater Treatment Requirements to eventually codify key treatment discharge limitations. This regulation was approved as a final regulation at the Environmental Quality Board's May 17, 2010 meeting and approved at the June 17, 2010 meeting.

Discuss how the state encourages the efficient development of adequate capacity and infrastructure for the management of hydraulic fracturing fluids, including the transportation, recycling, treatment and disposal of source water and hydraulic fracturing wastes.

The new TDS rule described above will promote the development of new treatment capacity for non-discharge treatment systems or treatment systems that discharge water that meets Safe Drinking Water Act standards for TDS. Treatment costs for these technologies are expected to decline as competition increases to provide services now that uncertainty regarding the passage of the rule has been lifted.

DEP fully supports complete reuse of flowback and produced water to frac additional wells. There are no additional permit requirements needed to re-use flowback at another well site and transportation of recycled water – either by truck or by pipeline - is not subject to permitting requirements beyond those already established for stream crossings and waste transporters.
BOGM welcomes any recommendation the STRONGER review team may have with this issue.

13308 N. MacArthur Blvd, Oklahoma City, OK 73142 phone: 405.516.4972 fax: 405.516.4973
www.strongerinc.org