Susquehanna River Basin Commission (SRBC)
Water Quality Advisory Committee (WQAC) Meeting Minutes

U.S. Geological Survey (USGS) Office
215 Limekiln Rd
New Cumberland, PA

October 13, 2010
10:00 a.m.

A. Introduction and Opening Remarks (Dave Heicher, SRBC)

Dave Heicher, SRBC, opened the meeting with introductions (see Participant List in Attachment A). The WQAC usually meets twice each year, in spring and fall.

B. Smallmouth Bass Intersex Condition and Disease Issues in the Susquehanna River (Vicki Blazer, USGS)

Vicki Blazer, National Fish Health Research Laboratory, USGS, gave an update on smallmouth bass intersex condition and disease issues in the Susquehanna River. USGS collaborates with the PA Fish and Boat Commission (PFBC), the PA Department of Environmental Protection (PADEP), and the U.S. Fish and Wildlife Service Lamar Fish Health Unit/Lab. Funding is provided by the Chesapeake Bay Priority Ecosystem program and the Toxic Substance Hydrology program.

USGS collected fish in the Delaware, Susquehanna, and Ohio River drainage areas for the Emerging Contaminants project in the summers of 2007 and 2008. In 2007, smallmouth bass, white suckers, and/or rock bass were collected at 11 sites in the Susquehanna and Delaware drainages. In 2008, smallmouth bass and redhorse sucker were collected in the Ohio drainage. USGS conducted fish health assessments including morphology (length, height, weight, etc.), gross lesion documentation, histopathology of major organs, culture for common bacteria and viruses, and plasma analyses.

USGS found a high indication of testicular oocytes (immature eggs within the testes), particularly in smallmouth bass in the Susquehanna River. The agency thinks the fish are still reproducing because of the amount of mature sperm cells found. USGS did not see a big difference in intersex prevalence between the two sampling sites on the mainstem Susquehanna River and the site on Swatara Creek; however, the agency did see a difference in severity of intersex so it has started documenting those instances. USGS also looked at Vitellogenin in male fish, which is another indicator of exposure to estrogenic compounds. USGS also looked at other sites, including the Schuylkill River (50 percent intersex prevalence/0.6 intersex severity), Juniata River (100 percent/2.6 severity), and Ohio River (11 percent/0.1 severity). The Lamar Fish Health Lab found largemouth bass virus (LMBV) in some of the adult fish from the three river drainages mentioned above. Staff did not observe any specific lesions associated with largemouth bass.

Vicki received fixed tissue samples of young-of-the-year (YOY) smallmouth bass collected during July and August 2007. She saw systemic diffuse granulomatous lesions in multiple organs (liver, muscle, eye, stomach). Numerous opportunistic pathogens and high parasite loads suggest that environmental stressors are leading to immunosuppression. She found a moderate to high prevalence of intersex in smallmouth bass at sites where fish kills have occurred and low to moderate prevalence at sites were kills have not occurred. She also found measurable levels of Vitellogenin in male smallmouth bass and white sucker, occasionally as high as that seen in females.

Contaminants of emerging concern may cause adverse effects at very low concentrations, and include pharmaceuticals, compounds in personal care products, plastics, flame retardants, pesticides/herbicides, and natural and synthetic hormones from humans and animals. There are a few complexities in dealing with wild fishes, including endocrine and immune system communication issues and multiple contaminant exposure routes (e.g., water, sediment, food).

Studies from 2009 through 2011 focus more on pathogens and parasites. Tissues were collected for contaminant analyses and passive samplers were deployed to attempt to identify candidate compounds of concern and use of in vitro cell-based assays to measure total estrogenicity. In 2010, USGS worked with PFBC to collect fish at five sites (57 overall, 31 with lesions). Cultures were taken from external lesions, internal organs were homogenized, and homogenates were plated onto bacterial media and tissue culture media for viruses. Staff found systemic infections in these cultures. LMBV is cultured in both healthy and unhealthy fish, and there is some indication that environmental stressors influence the response of largemouth bass to the virus, which could make fish more susceptible to opportunistic bacterial infections. There is no information on the effects of this virus on smallmouth bass. Overall, USGS is finding multiple bacterial and viral pathogens and multiple parasites. Staff thinks these are due to environmental stressors, chemical exposures, and immunosuppression.

Both of the parasite types found–trematodes and myxozoans–have complex life cycles that require intermediate hosts. A snail is usually the intermediate host for the trematode, while a fish or bird is usually the final host. Myxozoans usually start with tubificid worms and work their way up through fish and birds.

Contaminants are a complex issue. Vicki mentioned a study done by Penn State University that considered 18 wetlands in the Midwest and 240 possible predictors of trematode infections. They found that Atrazine was the best predictor because it increases the richness and abundance of the snail hosts (gastropods). Atrazine is an herbicide that kills phytoplankton, which makes the water clearer. This enables more periphytic algae to grow, which is what the snails eat. Atrazine also increases the abundance of the trematode cercariae, which infect fish. Low doses of Atrazine have been shown to be immunosuppressive in frogs, fish, and salamanders. Fish and salamanders then have increased susceptibility to *A. hydrophila* and viral infections, respectively.

USGS deployed two kinds of passive water quality samplers: semi-permeable membrane devices (SPMDs), which accumulate hydrophobic compounds, and polar organic compound integrative samplers (POCIS), which accumulate hydrophilic compounds. Two passive samplers

have been deployed in the Susquehanna River, but staff does not have data yet. These samplers were deployed for approximately four to five weeks, and grab water samples were also taken at deployment and retrieval. USGS was able to purchase the samplers with funding from the Chesapeake Bay Priority Ecosystems.

USGS will be involved with ongoing and future studies. The agency will receive chemical analyses of passive sampler extracts and identify priority contaminants. It will also determine intermediate hosts of parasites and environmental factors that lead to their proliferation, as well as determine virulence factors in bacterial pathogens. USGS will also evaluate the role of water quality, particularly nutrients and water temperature.

C. Proposed Changes to the Pennsylvania Department of Environmental Protection's (PADEP's) Manure Management Manual (Jim Spontak, PADEP)

Jim Spontak, PADEP, gave a presentation on revisions to PADEP's Manure Management Manual (MMM). There are 63,136 farms in Pa., and 33,815 of them have livestock. The average farm size is 124 acres with approximately 75 percent under 200.

The Pa. Clean Streams Law regulates all farms producing or using manure. These farms must have a written manure management plan per PADEP Chapter 91 regulations. An Erosion & Sedimentation Control Plan is needed for disturbances of more than 5,000 square feet. Over 30,000 farms have Animal Operations (AOs), which are regulated by PADEP. Concentrated Animal Operations (CAOs) are based on animal density per available acreage for manure spreading, and are regulated by the PA State Conservation Commission (PA SCC). CAOs must have an approved nutrient management plan. There are approximately 1,050 CAOs in Pa. Concentrated Animal Feeding Operations (CAFOs) are regulated by PADEP (and by USEPA if there is a discharge). The PADEP Southcentral region has approximately 300 permits (out of approximately 340 statewide) for CAFOs.

Historically, larger animal operations have been regulated. Pa. has implemented the Nutrient and Management Act (NMA) on CAOs since 1997 and has implemented updated CAFO regulations since 2000. Each farm is inspected and must submit quarterly reports to PADEP. PADEP and USEPA believe that small farms can have a big impact on water quality as well. New requirements are being developed to address smaller farms generating or using manure.

Pa. farms produce over 26 million tons of manure a year. One dairy cow produces 6,000 gallons of manure a year. A pig produces 2,000 lbs of manure during its five-month lifespan. A chicken produces 3.42 lbs of manure in its 57-day lifespan, and a horse produces 16,000 lbs of manure a year.

Farmers have three options for determining application rates of manure. They can use "book values" based on manure type and crop group, use nitrogen or phosphorus balance worksheets, or have a certified planner develop the rates using the PA Phosphorus Index. Except where the farmer uses the PA Phosphorus Index, a farmer may not mechanically apply manure

within the following setback areas regardless of the slope or ground cover within the following: 150 feet of a lake, pond, or top of bank of a perennial or intermittent stream; 100 feet of an existing open sink hole; 100 feet of a private or public drinking water source; or concentrated water flow areas where vegetation is not maintained. Farmers that use a certified nutrient management planner to develop their plan using the PA Phosphorus Index can have reduced setbacks. This means that the planner will establish certain Best Management Practices (BMPs) on the farm. An example of a BMP is placing a vegetated buffer along a stream, which may permit closer mechanical application of manure.

Manure is allowed to be spread in the winter on frozen and snow-covered ground as long as farmers abide by the winter spreading rules. The maximum application is 5,000 gallons of liquid manure or 20 tons per acre dry manure. An additional setback of 100 feet is required from an above-ground inlet to an agricultural drainage system if the drainage is towards the inlet. All fields must have at least a 40 percent crop residue or an established growing cover crop, hay, or pasture at time of application. Manure may not be applied on slopes greater than 15 percent. Application must be done according to an agricultural erosion and sediment pollution control plan.

Manure management must include a plan for storage. Manure storage facilities include structures such as earthen ponds, concrete tanks located outside or under the barn, above-ground steel tanks, and roofed stockpiling/stacking facilities. The plan must list all existing manure storage facilities and any planned additions. Farmers need to evaluate their storage quarterly for potential discharges, and address these discharges immediately. Liquid or semi-solid manure storage facilities built in the year 2000 or later must be designed by a registered Pa. Professional Engineer, and farmers must keep a copy of that registration on site.

Daily hauling operations may have one or more temporary stacking areas to deal with situations when application is unacceptable. Requirements include keeping all stockpiles or stacks 150 feet from sensitive areas and 100 feet from drinking water wells or open sinkholes. Stacking in the same field should be done no more than once every four years.

All pastures on farms must be included in the manure management plan. Pastures that are 150 feet from a lake or other surface water do not need detailed planning, as long as they also are composed of dense vegetation. If pastures do not meet these two requirements, the farmer must follow a more detailed pasture management approach using either nitrogen or phosphorus stocking rate tables or a pasture balance worksheet. ACAs are barnyards, feedlots, exercise/loafing lots, or other animal confinement areas that will not maintain the dense vegetation of a pasture. ACAs located within 150 feet of a perennial or intermittent stream, lake, pond, or other surface water need to be managed to do the following: divert clean water flow from upslope fields, pastures, driveways, barn roofs, etc. away from the ACA; direct polluted runoff from the ACA area into a storage facility or treatment system; limit animal access to surface waters to only properly implemented livestock crossings; minimize the size of denuded areas; and keep ACAs as far away from water as possible. Farmers must address ACAs in their Manure Management Plans. Theirs plan need to identify the BMPs currently being implemented and any assistance needed to develop and implement additional BMPs.

In conclusion, all farms using or generating manure must have a written Manure Management Plan and an agricultural Erosion & Sediment Plan. Small farms will see increased attention from regulating agencies in the future. Guidance for meeting the requirements of the plan is available from PADEP, conservation districts, and private sector planners. PADEP presented the draft document to the Agricultural Advisory Board in June 2010, and the formal document review started on August 14, 2010 as published in the PA Bulletin. Email Jim if you would like to include any comments during their 90-day comment period.

D. Pennsylvania's Expanded Water Quality Network and Water Quality Sonde Deployment (USGS and PADEP Staff)

Drew Reif, USGS, and Josh Lookenbill, PADEP, gave presentations on Pennsylvania's expanded water quality network and water quality sonde deployment, respectively. USGS and SRBC collect data, and PADEP manages the water quality network structure and does lab analysis (everything except sediment analysis, which USGS KY does). Data are stored in PADEP's database. Data collected by USGS are transferred quarterly to the USGS database and to USEPA's STORET and published in the USGS Annual Report.

There are three objectives of the water quality network: to monitor temporal water quality trends in major streams and rivers throughout Pa., monitor temporal water quality trends in selected reference streams, and monitor the trends of nutrients and sediment loads entering the Chesapeake Bay. There are 90 standard sites for 2011; these sites are sampled six times a year for chemistry and once every other year for macroinvertebrate (biological) sampling. Seventeen of these sites are sampled monthly for chemistry and once every other month for biological. The 29 Chesapeake Bay Load Sites are sampled monthly for chemistry along with eight storm samples throughout the year. The 26 reference sites are also sampled monthly and once a year for macroinvertebrates.

Thirty-three of the standard sites are located in the Susquehanna/Chesapeake Bay basin. These sites are sampled six times a year for chemistry and every other year for macroinvertebrates. The 29 Chesapeake Bay Load Sites and 14 reference sites are sampled monthly for chemistry, and once every other year and once a year, respectively, for macroinvertebrates. All sites are sampled for the following chemical parameters: field parameters, discharge, total nutrients (P, $P_{(O)}$, N, ammonia, NO_3, NO_2), total metals (Al, Cu, Fe, Mn, Ni, Pb, Zn), ions (Ca, Mg, Cl, Sulfate), and solids (TSS, TDS). Reference sites are also sampled for dissolved metals (Al, Ar, Ba, Cd, Cu, Fe, Mn, Ni, Pb, Zn), fluoride, phenols, BOD, fecal coliform, and osmotic pressure. The Chesapeake Bay Loading Sites are also sampled for dissolved nutrients (P, $P_{(O)}$, N, ammonia, NO_3, NO_2), total organic carbon, and suspended sediment during the eight storm events. All Standard, Standard Monthly, and Chesapeake Bay Loading sites have macroinvertebrate samples collected every other year, while reference sites are sampled annually.

Drew mentioned several changes to the program in 2011. The number of Standard Monthly sites increased from eight to 17. Ten new sampling sites have been added and two gaging stations installed. Two sites were converted from standard to Chesapeake Bay Loading

sites, and 26 new reference sites were placed. Ten real-time water quality sondes are being installed.

Josh explained the water quality sonde deployments, which focus primarily on conductivity. The 10 USGS sondes will be deployed long-term. PADEP has 12 sondes deployed across Pa. (only four are located in the Susquehanna basin because of SRBC's RWQMN network). Real-time and grab sample baseline data are being collected, which will be helpful to determine normal water quality conditions before water quantity projects are started, as well as potential impacts (or lack thereof) later.

E. Lunch

F. Marcellus Shale Related Research (Richard Hammack, U.S. Department of Energy)

Richard Hammack, U.S. Department of Energy (DOE), gave a presentation on Marcellus shale related research. DOE supports research and develops technology to ensure a long-term abundant supply of domestic energy. DOE has both extramural and intramural programs. Extramural programs include working with private companies and universities on various water management and frac flowback and produced water treatment programs. Some of the technologies developed in the Barnett Shale can be transferred to the Marcellus. DOE's intramural programs include characterization of Marcellus flowback and produced waters. This includes inorganics, organic compounds, isotopic characterization, and microbial ecology of pits.

DOE has programs that simulate weathering of drill cuttings and monitor air emissions. Its mobile air monitoring laboratory is currently in the Alleghany National Forest, but will be redeployed in Washington County, Pa., because Range Resources is permitting them to operate the lab on a well pad site. DOE considers ecological impacts of access roads and drill pads. One program at Penn State University collects and measure sediment, while a West Virginia University (WVU) program is studying impacts on sensitive bird species, and Clarion University is studying impacts on streams and aquatic life.

DOE is looking at new treatment options for Marcellus-produced flowback waters. One treatment being developed with WVU looks at microbial fuel cells and capacitive deionization. Microbial fuel cells will degrade carbon in the ponds, which will generate electricity to power a capacitive deionization system that will remove some of the salts from the water. Another approach (again partnered with WVU) is forward osmosis with a novel draw solution. This approach uses magnetic nanoparticles coated with a hydrophilic coating to draw the water through a membrane (which are similar to Gore-Tex rainwear). DOE is also working with Sandia National Lab on a membrane distillation treatment option. Richard said that this approach is perfect for the Marcellus shale because power plants are a source of low-grade heat, and there are many power plants in our local area. The membrane distillation method treats water that is high in total dissolved solids (TDS) using a low-grade heat and a hydrophobic membrane.

DOE has an agreement with Range Resources to establish a baseline monitoring project in Pa. Range has agreed not to drill a few specific sites until DOE has gotten its baseline monitoring information. The Northeast PA Consortium will most likely assist DOE with this project in Lycoming County.

G. Update on SRBC Remote Water Quality Monitoring Network (Andrew Gavin, SRBC)

Andrew Gavin, SRBC, gave an update on SRBC's Remote Water Quality Monitoring Network (RWQMN). The project started in fall 2009 and network deployment began in January 2010. East Resources Inc. contributed $750,000 to help fund this project, and SRBC contributed $250,000. Expansion into New York began in May 2010 even though there is no drilling there presently. The NYS Energy Research and Development Authority (NYSERDA) contributed $200,000 and SRBC agreed to spend $180,000 for this expansion. There has also been a plan developed for the expansion of the network into Pa. Department of Conservation and Natural Resources (PADCNR) state forest lands that started in September 2010. Fifty monitoring stations will be operational by spring 2011.

SRBC is measuring five basic water quality parameters with the network stations: conductance, temperature, dissolved oxygen, turbidity, and pH. Each station is anchored with PVC pipe and considered semi-permanent. SRBC is coordinating with other agencies in order not to duplicate monitoring efforts. Site considerations include watershed size, channel morphology and flow ranges, seasonal conditions (i.e., summer low flows), land use, and property access. The real-time data are available on SRBC's web site at http://www.srbc.net/programs/remotenetwork.htm. SRBC also has been pairing up with the operators of water supply intakes in areas of concern.

SRBC is collecting routine "grab" samples along with streamflow measurements in addition to the online data. These samples will be taken six times a year to monitor the following parameters: acidity/alkalinity, chloride, barium, bromide, strontium, TDS, sulfate, total organic carbon, and the five field parameters previously mentioned above. Also, the following parameters will be sampled four times a year: calcium, magnesium, sodium, potassium, nitrate, carbonate alkalinity, bicarbonate alkalinity, and carbonate. SRBC might also consider collecting macroinvertebrate and habitat information at some stations as well. Staff receives "alarm" emails if any parameters deviate too far from their baselines. Data on the web site are not filtered and are available for public access. SRBC will incorporate all data (real-time and grab sample) into annual data reports.

H. Update on Maryland's Stormwater Management and Erosion/Sediment Control Programs (Ken Pensyl, Maryland Department of the Environment)

Ken Pensyl, MDE, gave an update on Maryland's stormwater management and erosion/sediment control programs. Ken is the program manager for Maryland's Stormwater, Sediment Control, and Dam Safety Program. The Stormwater Management Act of 2007 requires

implementation of Environmental Site Design (ESD) to the maximum extent possible. Further stormwater regulation changes in 2009 now require stormwater planning during concept design. Approvals are required during three phases of project design. Small-scale ESD practices are required for a minimum of one inch of rainfall. Redevelopment projects must also provide for water quality considerations such as impervious area reductions and BMPs. The local soil conservation districts and planners have started to work together with developers on ESD planning techniques from concept phases to final design/approval phases.

Site mapping is an important part of project planning. If streams and slopes are mapped, good buffers can be created. This also helps avoid highly erodible soils. One way to minimize imperviousness is to cluster development (such as housing developments) together with a cul-de-sac island and shared driveways. Other ways include using permeable pavers in residential and commercial development, impervious cover reduction (e.g., green roofs), and rooftop disconnections from impervious surfaces. Landscape planters and rain gardens also are useful tools for reducing runoff in residential and commercial areas.

Proposed redevelopment project designs shall reduce existing impervious area by 50 percent and/or implement ESD to provide water quality treatment for 50 percent of the existing area. Alternative stormwater management measures include structural stormwater BMPs, off-site BMPs, or any combination of impervious area reduction, ESD implementation, structural practices, or off-site treatment. Redevelopment policies and requirements need to be flexible and provide incentives to local government and developers. An approving agency may develop policies that include retrofitting existing structural BMPs; stream restoration; watershed management plans; trading policies that involve other pollution control programs; fees paid in an amount specified by the approving agency; or other practices.

Maryland published documents in 2010 to assist with stormwater management, the ESD process, and E&S control. These documents and more information are available on Maryland's web site at www.mde.state.md.us.

I. Proposed Sugar Creek Ecosystem Study (Jennifer Hoffman, SRBC)

Jennifer Hoffman, SRBC, gave an update on the ecosystem-based study for potential impacts from natural gas development (known internally as the Sugar Creek Ecosystem Study). SRBC is developing an internal research program, and the Sugar Creek study is a potential project for it.

Marcellus shale underlies approximately 72 percent of the Susquehanna basin. Both water quantity and quality issues are related to natural gas development. SRBC deals primarily with water quantity issues, and staff considers headwater streams, special protection streams, impacts to sensitive taxa, cumulative impacts, and water supply. Water quality issues include all of the previously mentioned plus groundwater, total dissolved solids (TDS), and erosion and stormwater issues. Landscape issues include all of the quantity and quality issues plus wetland impacts, roads, pipelines, and forest fragmentation.

SRBC's monitoring programs have existed throughout most of the agency's history. Staff has been performing water quality, biological, and habitat monitoring for core programs since the early 1980s. SRBC assists member jurisdictions with targeted needs, such as source water protection and total maximum daily loads (TMDLs), and assists watershed groups with various issues. One of the newest projects is the RWQMN previously mentioned in Andrew Gavin's earlier presentation.

SRBC designed a three-tiered approach to consider these issues. Staff will look at the following large-scale areas first: Sugar Creek in Bradford County, Pa., Snake Creek in Susquehanna County, Pa., and Upper Tioughnioga River in Cortland County, N.Y. Staff will then focus on mid-scale areas like the subwatersheds of the large-scale streams: Tomjack Creek, Silver Creek, and Trout Brook. The third approach would look at headwaters and assess drilling impacts. SRBC is scoping this as a five-year project.

Phase 1 of this project will involve background data collection. SRBC will coordinate with existing research and pull all existing watershed data from county, state, federal, university, industry, and watershed groups together. Phase 2 would be new data collection. Staff would coordinate with existing monitoring efforts such as the RWQMN, Binghamton University (on Sugar Creek), and the rest of SRBC's monitoring programs, such as interstate streams, subbasin surveys, and aquatic resource surveys (ARS). Data collection would be modeled after the ARS protocol, which includes monitoring for ecology (periphyton, mussels, fish, and macroinvertebrates), water quality, discharge measurements, habitat, aquatic invasives, and groundwater. SRBC would complete reports in Phase 3 of this project. Staff will report on the status of the watersheds during the first year and document any changes the following year. A full report documenting findings would be published in the fifth and final year. This project will assist SRBC with BMP development and recommendations as well as water resource management implications.

J. Activities of Others and Open Discussion (All)

Dave Heicher is accepting ideas for a topic for the spring 2011 WQAC meeting. SRBC will prepare the meeting minutes and send them out to the committee.

Attachment A

Participant List

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