

South River Science Team

Expert Panel Meeting

October 21-22, 2015

MINUTES

Summary of Major Work Stream in 2015

RCRA Status: Sagar Thakali, AECOM

- Human Health Risk Assessment is going through last revision and will be submitted to DEQ in November.
- Ecological Risk Assessment was approved in July and RFI is pending.
- RFI will show if there is unacceptable risk. Those risks will be addressed in CSM. RFI uses data from 37,000 samples collected from water, soil, sediment and biota.
- Interim measures will take longer in this case. Part of adaptive management process.
- Key Findings from RFI:
 - Greatest mercury sources occur primarily in the first 12 river miles (banks, facility outfalls and sediment).
 - Elevated tissue mercury downstream of RRM 12 and the upper segment of the South Fork Shenandoah.
 - In floodplain soils, THg decreases away from the banks and downstream, is highest in the 2 and 5 year floodplains and within forested areas and 93% of soil samples < 23 mg/kg.
 - In bank soils, THg varied spatially, but highest concentrations occurred between RRM 0 and 11.6.
 - In in-channel sediment, THg highly variable in the channel margin deposits and generally increased in interstitial sediment between RRM 0 and 8.7 and declined farther downstream.
 - In surface water under baseline conditions, particulate IHg generally increase immediately downstream of RRM 0, reach a maximum at RRM 5.2 and then remain relatively constant until ~RRM 12 and then decrease. Areas with the highest MeHg are widely dispersed, but generally highest between RRM 10 and 12. There is strong seasonality in MeHg concentrations and loadings, suggesting a role of methylation.
 - In biological tissue, MeHg is higher in higher trophic level species such as bass and relatively high tissue MeHg observed in areas beyond RRM 12.
- Ecological Risk Assessment Key Findings:
 - In aquatic receptors, there were no potential risks via direct contact pathways but there were potential risks via the bioaccumulation pathway (by invertebrates and fish).
 - In semi-aquatic receptors, uncertainties were generally biased toward overestimation of potential risks. Potential risks not ruled out for amphibians and piscivorous birds due to bioaccumulation and/or dietary exposures to methylmercury.

- In terrestrial receptors, uncertainties were generally biased toward overestimation of potential risks. Potential risks not ruled out for carnivorous birds, invertivorous songbirds and bats due to dietary exposures to methylmercury.
- Human Health Risk Assessment Key Findings:
 - Under current land uses, potential health hazards to mercury in floodplain soil identified in a few forested, agricultural or commercial/industrial areas where direct human contact is infrequent.
 - People should continue to not eat fish from the South River.
 - Waterfowl, game and other animals may be safely eaten to some degree over the course of a year.
 - Livestock and poultry (muscle tissue) and garden crops are safe to eat to some degree.
- RFI Key Findings:
 - Primary contributor to mercury loading via bank erosion is in the upper reaches RRM 0 to 12.
 - The key ecological concern is trophic transfer of MeHg up the aquatic and aquatic-terrestrial food webs.
 - The key human health concern is dietary exposure pathway primarily via fish consumption.
- Recommendations:
 - Follow an Enhanced Adaptive Management Framework because of magnitude, complexity and uniqueness. It will allow for ongoing refinement/revision of the conceptual site model and the flexibility and opportunity to learn and adapt.
 - A combination of corrective measures including bank management, fish advisory and community outreach and ecological/biota monitoring.
- Path Forward:
 - Implementation of Interim Measures
 - Development of Corrective Measures Study

Communication and Outreach: Mike Liberati, DuPont

- FYI - Mike was able to renew corporate DuPont rate with Hampton Inn.
- Community Involvement Plan developed for AOC4 the main goal of which is to communicate the fish consumption advisory. Communication tools in the plan include tools already in use by DuPont and SRST which include the SRST office, website, newsletter, bulletin boards located at river access points, and fact sheets. Mike asked if any other tools were needed and suggestions were made for social media such as Facebook, Twitter, etc.
 - Community Involvement Plan Activities:
 - Remedial Advisory Panel has been designed and organized. There are 12 members from the community and the group is facilitated by Dave Hirschman. Their second BMA meeting will occur on October 23 and include a floating tour of the proposed BMAs.

- Riverfest was utilized this year for public outreach. Along with the macroinvertebrate tank and table of SRST information that Scott Gregory and Calvin Jordan set up every year, there was also a table this year manned by Nancy Grosso with information pertaining to the proposed BMAs and Interim Measures. Being a free community event that attracts all types of area residents, Riverfest presents itself as a great opportunity to a wide audience.
- There have been several meetings between City of Waynesboro, DGIF, DEQ and DuPont in regards to BMA plans. The preliminary design continues to evolve and a 30% engineering design package is under review. The City of Waynesboro is the first of many landowners that will need to be contacted. A strategy to engage private landowners is under development.
- The contract with JMU to continue with the Promotores de Salud Program has been renewed for another 2 years. The current project manager, Deb Foy, will be leaving October 30th and Carmen Moreno has been hired as her replacement and begins October 26th.
 - Highlights from 2015 include attending 6 health fairs, Zumba con Amigas, Arabic and Kurdish Workshops, Back to School Fun Night at Waterman Elementary, Hispanic Festival and monthly meetings.
 - Outreach includes adding social media (Facebook and Instagram page for Promotores), a fall training (13 participants, 9 graduates, 346 general contacts and 70 FA contacts). Continued contacts since May equal 140.
 - Plans for 2016 include reinitiating PDS Jr. in Waynesboro public schools, training and attending health fairs and continuing education monthly meetings.

Poultry Study and Livestock Factsheet: Tim Bingman, DuPont

- Draft of Fact Sheet #7 displayed. Comments from multiple reviewers on the first draft were similar, indicating a need to talk about risk to both adults and children, the fact sheet needs to get to the point sooner, and there are allowable consumption limits that should be demonstrated through both table and graph.
- Tim also brought to the SRST's attention the idea of creating portable "story boards" for communications. Each board could have a theme such as history, response, SRST, investigation, remedy, etc. Maybe one for what BMAs would look like in the future.

Floodplain Soil Pilot and In Situ Earthworm Study: Ceil Mancini, AECOM

- Phase II (Field Pilot) of the Floodplain Soil Pilot was conducted this summer. Objectives were to test effectiveness of the carbon amendments and evaluate for potential unintended consequences. To do this, mixtures of soil and carbon (5 and 10%) were placed in perforated mesocosms and dug into ground and earthworms were added. (See presentation for design

details). Mesocosms were to be deployed for 8 weeks, but were removed at 7 weeks due to a storm event that threatened flooding the experimental area.

- Preliminary Observations:
 - Low earthworm abundance (started with 15 in each mesocosm, few were left in any; theory on low abundance is worms escaped, however there was nothing obvious as to why abundance was low. Worm density at site was also low.)
 - Juvenile abundance and size varied among treatments.
 - Adult abundance and size were similar among treatments.
- Summary:
 - Phase II sampling complete
 - Earthworms to be analyzed as composited samples per amendment type
 - Soil analysis pending earthworm results
 - Soil geochemistry data to be incorporated as part of evaluation

Developing the SRST Database: Christine Wallace, AECOM

- There have been ongoing discussions about the need/want of a central repository of all the data collected for South River. This database is becoming more of a reality. Objectives for this database are as follows:
 - Repository for all project data including analytical, spatial and documents.
 - Accessible to multiple stakeholders
 - Flexible security (read only, read/write, etc.)
- Currently a majority of tabular analytical data is stored by AECOM in Locus EIM, with some other data maintained by stakeholders. Spatial data resides among different stakeholders that use GIS (AECOM maintains extensive spatial datasets in GIS).
- An extensive list of publications and project documents reside at www.southriverscienceteam.org
- There is also a Retrospective Data Quality Assessment (RDQA) completed with project narratives.
- Going forward, future data collection efforts will go into EIM and currently flat-files are being migrated to EIM. EIM will be used for point data display and key spatial layers (static). Data will be linked to documents and DuPont SharePoint system or existing SRST website will be used for document repository. The database will be linked through common portal hosted on SRST website.
- Stakeholder needs can be incorporated during testing period. Stakeholders include agencies, DuPont and study teams. Training can be done by webinar. See presentation for EIM schedule.
- Action Items:
 - Dates for training (this and other models), locations, how, etc?
 - Jen Badner (AECOM) is actively contacting researchers for data. If she hasn't contacted you, please consider pulling your data and reports together to submit to her.

Conceptual Model and Loading Analysis Update: Jim Dyer, DuPont

- Lots of models have been developed and refined. See presentation for explanation of models and refinements.
- Key Points:
 - We know there is a surplus of IHg and only a small fraction of that is taken up by MeHg and not all is bioavailable.
 - All models to date suggest that advective Hg flux due to bank leaching contributes <15% of total unfiltered Hg load to the river.
 - During a flood event, >90% of infiltration and inundation water drains downward, exiting through the more highly transmissive basal gravel/sand layer at the base of a bank.
 - GW velocities used in water-saturated soil columns at U. Waterloo agree well with drainage /seepage velocities predicted by Aquanty (positive implications for proposed biochar treatment layer).
 - Aquanty predicts that drainage of bank storage water through the basal gravel/sand layer occurs over 1 week to 1 month, meaning that bank leaching may partially contribute to Hg load during baseline flow.
 - Under this scenario, % contribution advective flux to baseline UTHg and FTHg load also <15%.
 - So several models/scenarios still agree loading from bank leaching is 5-15%.
- Topic for next ROPs meeting is a review of Texas Tech model results, including significance of potential diffusive flux contribution to bank leaching under baseline flow conditions.

Plant Site Activities and Monitoring Results Overview: Mike Liberati, DuPont

- RCRA Facility Investigation (RFI) was conducted from 2001 – 2010 and approved in 2015.
- Summary of findings:
 - Hg found in former structures (SWMU's 1 and 4)
 - Sources have impacted storm sewer – outfall discharges
 - Impacted groundwater contained on site by pumping of production well
- Actions completed to date include Interim Measures (2010), Sewer Investigation (2010) and Railroad Ave. Interim Measures (2014). These measures/investigations included the isolation and lining of sewers and removal of mercury and impacted mercury sediment in sewer lines.
- After sewer cleanout in 2010, mercury concentrations/loadings increased, especially in Outfall 001. Concentrations/loadings have decreased, but Railroad Ave IM sewer cleanout did not produce dramatic decreases.
- 2015 activities included submitting CMS, conducting monthly outfall monitoring and semiannual groundwater monitoring.
- Future activities include Corrective Measures Implementation (CMI). Proposed measures include:
 - Source area removals in SWMU1

- Maintain pumping to control gradient at SWMU1
- Capping, drainage control at SWMU4
- Institutional controls for SWMU7 groundwater

Continued Work for 2015 and New Work for 2016

Remedial Design and Stakeholder Engagement: Clay Patmont: Anchor QEA

- Objectives for South River Remedy include: Reduce mercury loading, improve habitat and minimize disruption.
- There has been an evolution in both terminology and design of BMAs due to more concentrated soil sampling, more detailed loading analysis and continued discussions with stakeholders (mainly DEQ, DGIF and City of Waynesboro).
- 30% engineering plans have been provided to stakeholders for Constitution Park and North Park BMAs (City owned property).
- See presentation for more design detail.
- Schedule and Next Steps:
 - November – City and VADEQ review of draft Phase 1A preliminary design report
 - December – Phase 1A permit applications
 - Early 2016 – Phase 1A final design, access agreements and permits
 - Spring 2016 – begin Phase 1A construction

Monitoring: Josh Collins, AECOM

- Summary of Short-term Monitoring:
 - All 2015 data have been collected
 - Elevated Hg concentrations in sediment and porewater adjacent/downstream of Primary BMAs
 - Average Hg concentrations in Sed/PW lower than Pilot Bank baseline data
 - Elevated Hg concentrations in near-bank periphyton and clams compared to mid-channel
- Summary of Long-term Monitoring:
 - Fall bass monitoring – conditional approval for non-lethal sampling methods and THg only analysis. Coordinating with VDGIF fall community surveys. Sampling delayed due to elevated flows.
 - Waterfowl to be sampled using sharpshooting/net cannons and thermal imaging, coordinating with USFWS/VDGIF and to take place winter 2015/2016.
 - Terrestrial monitoring – sampling done within 50' of river and co-located (earthworm, spider and Carolina Wren). THg and MeHg samples collected except for wrens, only THg samples collected.

- Conclusions – increased sampling efficiencies and sustainable sampling locations. Data consisted with 2014 baseline and historical data (more in-site variation observed around “hump”) Wren data evaluation on-going. Continued monitoring will improve understanding of relationship to historical trends in biotic media.

Mercury Cycling Model: Reed Harris

- Reed is working on mechanistic mercury model for South River that will help predict benefits of bank stabilization help interpret monitoring data, integrate multi-disciplinary studies, help address uncertainty and provide another line of support for decisions (EAM). For more details on model, see presentation.
- Currently, model is running for water and sediments for RRM 0-19. Being entered now are cells to RRM 27, food web and site specific conditions so results are not yet realistic. Full simulations will be available in November.
- Still sorting out hydrology (surface water vs. groundwater inputs, and bank leaching), particles (estimating particle fluxes), model setup (where is dividing line between sediments and banks?), duration and simulation (could we do a long term simulation that spans the period of Hg releases?).
- Would be valuable to do long term historical simulation, but lacking information on loading rates over time.

Enhanced Adaptive Management Model: Christy Foran, USACE

- Christy used example of morning commute to explain EAM process.
- The South River EAM will have two functions:
 - Archive the predictions and uncertainty expected from each remedial alternative
 - Provide a way to visualize how different alternatives perform for different objectives and when trade-offs between objectives add value.
- “Decision models” provide transparency, support communication and learning, but do not make decisions.
- In Phase 1, EAM is likely to be used in the following ways:
 - BMA location and design to be considered for approval based on loading, landowner objectives and regulatory approval.
 - There may be alternatives under consideration, including issues such as what activities should occur concurrently.
 - The reason behind the decisions should be captured in a prediction of the outcome.
- Effects Analysis
 - Models can be used to anticipate short and long term impacts.
 - Noted are when specific impacts are unknown or uncertain.
 - Anticipated values for implementation metrics should be recorded, as these are critical factors not predicted by models.
 - Update models with monitoring when they were not predictive
 - Characterize impacts that were unknown

- Adjust anticipated values for implementation metrics with actual values
- Likely Future Use:
 - BMA location and design still likely to be considered for approval based on loading, landowner objectives and regulatory approval.
 - Better prediction of the likely outcomes based on refined models.
 - Potential for alternative design and/or smoother implementation based on enhanced understanding.
- Final Steps:
 - Criteria and Metrics to be finalized
 - Correct/edit the macros
 - Provide necessary documentation/manuals
 - Distribute

The World of Biochar and Treatability Studies: Rich Landis, DuPont

- Rich went over history of biochar studies on South River and the people and organizations that have contributed to the research.
- Current understanding of biochar so far:
 - Not all biochars are created equal.
 - Cowboy Charcoal is quite effective in removing THg and MeHg from leached soil and sediment.
 - Treatment of Hg by Cowboy Charcoal appears to be robust.
 - Impact of Cowboy Charcoal on the benthic community appears to be minimal.
 - Field results have been mixed due to environmental factors.
- Potential next steps include:
 - Continue to investigate:
 - New biochar product lines
 - New means to enhance Cowboy Charcoal's effectiveness
 - Potential use of calcium polysulfide (possible earthworm lab and field studies)
 - Continue to refine Cowboy Charcoal design parameters.

Day 2

XRF (X-Ray Fluorescence) Technology and Application to South River Soils: Robert Brent, JMU

- Robert and students are investigating whether a hand-held XRF can provide a low-cost real-time measure of Hg with sufficient accuracy and precision.
- XRF is an instrument that produces x-rays that hit elements in the sample and expel inner shell electrons. Outer shell electrons fill the void in the inner shell. The drop in energy level releases a photon of energy in the x-ray spectrum. Each element has a characteristic energy level of photons released. Artax software is used to analyze spectra.
- XRF was used to analyze soil samples of known concentrations. Conclusions include the following:

- Cost – only labor; no lab or shipping cost
- Turnaround time – 60 – 100 seconds
- Detection Limit – 7.4 ppm @ 60 sec, 3.4 ppm @ 100 sec; this is below thresholds for determining bank management areas
- Accuracy – Acceptable; median recovery = 96%; avoids errors from sample handling
- Precision – Acceptable; Mean RSD = 23%; precision identical to Method 7471A
- Interference – Moisture not a significant interference
- Future Work:
 - Additional Lab Validation (spiked samples)
 - Field Validation
 - Comparison of:
 - In situ XRF field measurement before sampling
 - XRF field measurement on collected sample
 - XRF lab measurement on collected sample
 - Method 7471A lab measurement on collected sample
 - Analysis of banks in next 2 miles of river (RRM 2 -4)
 - Hg measurement and mapping using XRF and GPS

Real Time Mercury Measurements, Biochar, Angler Survey: Ralph Stahl, DuPont

- Ralph has been investigating an optically-based technique for collecting real-time mercury data and has been used successfully in San Francisco Estuary, Florida Everglades and Berry's Creek Superfund site in New Jersey. Ralph is interested in pilot testing on South River. Technique involves deployment of multiple optically-based sensors, along with ancillary water quality sensors, to collect synchronous data that are associated with chemicals in surface water. The measurements are correlated to analytically derived chemical data to calibrate a statistical model to reliably predict chemical concentrations over time. The instrument is not directly measuring mercury. Locations to be selected in November or December and instruments will be deployed in the spring.
- Biochar: Looking into using old Pioneer seed and spent grain for biochar source (DuPont owns Pioneer). Think they can tailor biochar for specific applications. Several variations have been sent to U. Waterloo. Hoping for a high quality, consistent product.
- Angler Study: Study is a requirement under the consent decree with NRDC. Next survey scheduled for Spring/Summer of 2016. Working collaboratively with DGIF (Paul Bugas). The surveys are conducted every 3-5 years or less frequently if needed (last one done in 2011).

The “Advisory Panel” was given a list of questions about the ongoing South River work and was asked to present answers, concerns, etc. back to the team. The panel consisted of Ralph Turner, Will Clements and Dave Hirschman. Questions and responses listed below:

- **What are the strengths and weaknesses of the Phase 1 remedial design?**
 - Strengths:

- Directly addresses the primary source of Hg input based on detailed conceptual model
 - Primary and secondary banks identified based on Hg and potential for erosion
 - Reducing sediment input should improve in-stream habitat regardless of effects on Hg input
 - Specific and achievable
 - Stepwise approach allows for revisions (adaptive method)
 - Early engagement with key stakeholder is allowing revision of design
 - Concerns
 - Success is highly dependent on significant cooperation with stakeholders
 - Very ambitious schedule
 - Will we learn enough and in sufficient time from Phase 1 to inform subsequent remediation activities? And to inform adaptive management framework?
 - Have not made use of excellent talent in SRST orbit to help with review of design?
 - Importance of erosion and sediment control during construction – use biochar in coffer dams? May be missed opportunity to focus on E&S to see how to minimize fugitive releases. Shouldn't this be part of adaptive management process – how can we learn from the Phase 1 experience?
 - Concern about quick schedule – why construct in spring when you want to minimize releases? Fall better?
 - May take a longer time to complete and see responses higher in food chain than if more bank length were addressed at one time.
- **Are there any critical data gaps or uncertainty concerning Phase 1 of the remedy? What data gaps need to be filled and what preparatory steps need to be taken to prepare the stage for actions beyond Phase 1?**
 - How much reduction in fish Hg can we expect from a given reduction in Hg input?
 - Statistical models do NOT indicate how much time will be required before these decreases will be observed.
 - Would be useful to have a few more moderate-scale studies before full-scale implementation.
 - Uncertainty about universal effectiveness of biochar, especially when blended with soil – should possibly look again at earlier rejected options, new technologies and S-amended biochar?
 - Biochar – for Phase 1 using approach to encapsulate in soil behind bank, which may not be as effective. Biochar exposed as reactive layer could be more effective, but hard to deploy and maintain. Is it even reasonable? How can we increase effectiveness in encapsulated approach?
 - It would be useful to know approximately how long it will take to see a response (positive or otherwise) to the Phase 1 work.
 - Can this be modeled?

- One modeling effort (TMDL) suggested target water Hg of 5 ng/L to achieve fish Hg <0.3 mg/kg. Was there a time course prediction?
- Will the Reed Harris model provide a time course prediction?

- **Are the key monitoring elements in place to measure success and inform the adaptive management process? How can we improve the adaptive management approach for the river remedy?**
 - Must be ready to adapt to changing conditions!
 - Have a very detailed and robust short-term (2-10 year) and long-term (>10 year) monitoring plan.
 - Information from monitoring, modeling and experimental approaches has provided critical information.
 - Target field studies:
 - Quantify Hg leaching during rain events
 - Bank stabilization - ~95% reduction in pore water Hg
 - Conclusions from statistical models:
 - Significant decreases in fish Hg will be observed and can be detected with reasonable sample sizes.
 - But models do not indicate how much time will be required before these decreases will be observed.
 - Is this sufficient?
 - How can we reduce the potential for unintended adverse effects to the ecosystem?
 - What is unacceptable risk?
 - Consistent finding: Negative effects of Biochar should be evaluated within the context of benefits associated with reduced contaminant bioavailability.
 - Would be useful to have a few more moderate-scale studies before full-scale implementation. However, we often must make decisions with incomplete scientific information!
 - Continue to integrate monitoring with experiments. Evaluate unintended adverse consequences with EAM.
 - Do we know enough about the potential unintended adverse effects to proceed with Phase 1?

- **In what areas is stakeholder acceptance at risk and how is this addressed?**
 - Good job with Phase 1 engagement – real changes to design
 - Need acronym guide and definitions: CMS, CSM, CMI, etc.
 - Stakeholders “patience” for a long-term solution?
 - What is process for resolving potential conflicts between regulatory requirements and stakeholder acceptance (Phase 2 and beyond)?
 - Possible inherent conflict between Hg remediation and habitat protection, since higher Hg levels are found in forested areas. Hope for more “Constitution Parks”.

- “Contiguous” landowner acceptance
- **How can we reduce the potential for unintended adverse effects to the ecosystem?**
 - Seems likely to be effective.
 - More explicit indication of how unexpected outcomes from the adaptive management approach will be used to inform Phase 2.
 - Integrate Relative Risk and other models.
 - Anticipate regulatory uncertainty in meshing remedial actions/monitoring with regulatory outcomes. Right now, it is collaborative, but regulatory process also demands particular outcomes. What is the end game?
 - Anticipate that chasing down later increments of reduction will be more difficult/expensive.

SRST Charter: No revisions made to charter. The charter can be found on the SRST website.

SRST Proposed Future Meetings

- January – web meeting January 20
15th Anniversary of SRST will be Feb. 14, 2016
- March – field season
- June
- August – Construction
- October
- December