South River Science Team

Expert Panel Meeting

October 24-25, 2012

Minutes

Wednesday, October 24

Introductions, Welcome, Agenda Review: *Don Kain, VADEQ*

Sediment Remedies and their Effectiveness for Management of Mercury Contamination: *Danny Reible, University Texas*

- 3 sites on South River. Danny has been working on. Two of the sites (RRM 3.5 and 11.8) vary on annual basis in depositional beds size and location. Site RRM 0.1 depositional area is generally near shore.
- Contaminated Sediment Management Questions
  - What are the approaches to manage sediments?
  - What are appropriate goals for management?
  - Can we manage contaminants effectively in-situ?
    - What are the mechanisms and effectiveness of sediment capping and in-situ treatment?
    - What are technologies that can be employed to more effectively manage contaminants, e.g. sorbents or other amendments?
- Managing Risks: What are the options?
  - Monitored Natural Recovery
    - Insufficient in itself because little change over time noted
  - Dredging/Removal
    - Disruptive to the system and likely impossible to implement on the scale necessary to impact the problem
  - Capping (conventional or amended)
    - Effective but would require significant armoring or maintenance
  - In-situ treatment
    - Less effective than capping and river dynamics would likely require continued treatment
  - Floodplain management
    - Removal more feasible and capping/in0situ treatment require less maintenance
  - Bank Stabilization
    - Effective against bank erosion
  - In-stream treatment
    - Manages direct exposure
- Response to Remedial Approaches
  - Natural recovery takes a long time
  - Active remediation-dredging will increase contamination at first, but then decreases over time and faster than natural recovery.

        - Capping without maintenance causes an immediate decrease, but if not maintained or there is a breach could release contaminates in future and then take a longer recovery time then natural recovery.
- At RRM 11.8, near shore area shows surface deposition and methylation activity (recent deposits). Mid-river shows deeper deposits (>10 cm) and similarly deep methylation (legacy deposits?).
- Natural Recovery
    - Sediment bed likely a substantial contributor
        - Porewater substantially elevated relative to river in fine grained deposits between and below gravelly surface
        - Additional mercury from banks (dissolved and particulate)
    - Extremely slow recovery if stable
        - Likely dominated by erosion and redeposition
        - Migration downstream and redeposition
    - Emphasizes that it's a widely distributed problem
        - Not limited to small number of manageable "hot spots"
- Dredging
    - All dredges resuspend sediment
    - All dredging operations leave residual contamination
    - Field measurement methods are not consistent
    - Increased resuspension and residual
        - During debris removal and if significant debris present
        - With hardpan or bedrock
        - Poor operational controls
    - Fish concentrations increase for a period after dredging, above previous levels before decreasing.
    - Not implementable on large scales
    - Potentially 90% effective in areas dredged
        - After short-term resuspension impacts
        - After bioturbation and river dynamics have mixed residuals over surface layer
        - Relatively small area addressable suggests overall impact minimal
- Sediment In-situ Capping/Treatment
    - Reduce risk by
        - Stabilizing sediments
        - Physically isolating sediment contaminants
        - Reducing contaminant flux to benthos and water column
    - Sand surprisingly effective for strongly solid associated contaminants
    - "Active caps" for other situations (w/amendments)
    - Some amendments also appropriate for direct placement into sediments
- Capping
    - Conventional capping can be extremely effective in areas capped
    - Implementable on relatively large scale
    - Dynamics of river suggests substantial armoring and/or maintenance required to maintain benefits

- Potential for facilitated transport may reduce performance even in stable capped areas (such as groundwater upwelling)

- Goals: Sediment and Capping Amendments
  - Permeability Control: Discourage upwelling through contaminated sediment by diverting groundwater flow
  - Contaminant Migration Control: slow contaminant migration, typically through sorption related retardation
  - Contaminant Transformation/Degradation Aid: less well developed, contaminant specific but designed to encourage contaminant fate process. Primary problem-maintaining appropriate conditions
- Capping vs. In-Situ Treatment
  - Capping >90% effective in areas capped
  - In-situ treatment likely to be limited to 50-75% effectiveness in treated areas
  - Capping more effective than in-situ treatment: provides combination of cap and in-situ treatment benefits and likely less stable than in-situ treatment although both subject to erosive forces
  - Both likely require maintenance/replacement
  - Overall performance dependent upon area managed
- Bank Stabilization
  - Improvements noted with bank stabilization pilot
  - Widespread implementation requires identification of banks that might be significant contributors and effectively intervening in mode of action (dissolved? Particulate and bank erosion?)
  - As with other remedies-overall performance proportional to area managed.
- In-stream Treatment
  - How to implement?
  - Consider perfectly absorbing bottom layer in stream
    - How long would it have to be to remove 90% of water column mercury? About 2.4 miles
    - Using a relatively high estimate of bottom mass transfer coefficient (20cm/hr)
- Perspectives on Remedies
  - Overall performance (reductions in flux/concentration) proportional to area remediated
  - In-situ treatment and capping remedies assume amendment/cap remain in place or are replenished as needed
    - Remedy performance diminished in proportion to cap or amendments are lost due to erosion
    - Complete loss of cap/amendments unlikely although loss would increase over time
  - Remedy is likely to need to address specific mechanisms in particular areas and recognize that overall performance will be modest
    - Is 50% reduction possible in overall river?

Task Team Reports (ROP and Exposure task teams met on Tuesday, the day before SRST meeting)

- **Exposure:** *Annette Guiseppi-Elie, DuPont*
  - Key Objectives
    - Better identify potential exposure
    - Define potential risk and uncertainties
    - Communicate information to public
  - Currently evaluating dietary exposures and communicating to public
    - Domestic consumption: garden crops, beef and poultry
    - Hunting consumption: waterfowl, small game, deer
  - Floodplain soils: additional soil samples taken also fish samples from floodplain ponds.
    - Letters to landowners in review
  - Draft plan for livestock sampling in review
    - Hoping for late 2012/2013 implementation
  - Fact sheet on wildlife consumption in progress
    - Platform presentation at SETAC 2012
  - Fact Sheets Completed:
    - Fact Sheet 1 - General introduction to SRST
    - Fact Sheet 2 – Exposure summary (people, mercury and river)
    - Fact Sheet 3 – Soil sampling results
    - Fact Sheet 5 – Garden study results
    - Currently working on waterfowl consumption fact sheet and will created others when needed
  - Health survey was completed to address effectiveness of consumption advisory
  - Other Relevant Activities
    - Risk Report for Former DuPont Waynesboro facility
      - Evaluation of Risk
      - On and Off site for human and ecological receptors
    - Team
      - EPA: Quinn, Montgomery, Suedel (USACE)
      - DuPont: Stahl, Guiseppie-Elie
      - URS: Mancini, Flanders, McCue, Badner
    - Status: Preliminary Review Draft
      - Section 1, 2, 3 (partial), 4.1 in review

- **ROPs:** *Nancy Grosso, DuPont*
  - SRST ROPs Scope
    - Identify, explore, evaluate and test engineering solutions for the SR system.
      - Use the conceptual pathway and exposure diagrams as a guide
      - Focus on the technical and scientific aspects of the possible solution
      - Explore and evaluate deployment methods of different technologies
      - Identify and define potential unintended consequences of a technology, and explore tradeoffs

    - Evaluate effectiveness of pilot tests in achieving goals, and determine feasibility of implementation on a larger scale
    - Recommend promising technologies for consideration in the remedial alternatives and develop a remedial approach
    - Communicate activities and progress to greater SRST
- Mercury Management
    - Remedial Action Vision (2008)
        - Reduce fish tissue Hg concentrations to levels that would allow consumption
        - Protect aquatic and terrestrial ecology with respect to Hg exposure
- Refining the Conceptual Site Model
    - Showed existing conceptual models of abiotic pathways to smallmouth bass
    - Refining CSM for Remediation
        - Using DGT probe to identify potential zone of methylation
        - Verify/refine UD bank loading model
        - 2013: UD will be measuring Hg and MeHg geochemical dynamics in transition zones (bank-surface water hyporheic)
- Remediation technology testing and deployment options
    - U Waterloo – ongoing laboratory studies
        - Characterize Hg speciation in soil and sediment
        - Test efficacy of potential treatment agents (Fe, carbon, etc) Cowboy Charcoal
        - Subject systems to varying environmental conditions
    - SERC bio-uptake studies
        - AC and biochar: both effective in reducing Hg/MeHg concentrations in *lumbriculus* but increase in MeHg in bulk amended sediment compared to control
        - Toolbox of unscreened and screened remedial technologies (evergreen)
        - 2013 W&M effects of biochar on biota
    - Bank Stabilization Pilot (separate presentation at expert panel meeting 2013)
    - Pond Biochar Amendment Pilot (separate presentation at expert panel meeting 2013)
    - Floodplain laboratory and field (separate presentation at expert panel meeting 2013)
    - 2013 JMU in river mesocosm studies
    - Possible 2013 particle tracking or shear evaluation for in-river technology deployment
    - Possible 2013 UT Austin InSitu Capping Simulator
- Activities to develop an overall remediation approach
    - Hg Management in the Aquatic Environment : Proposed Short-term Actions
        - Control plant site Hg loading
        - Refine Hg bank loading model estimates and validate with field program (RRM 0 – 10); prioritize reaches for bank stabilization

        - Continue evaluation of other potential sources on a reach basis
        - Develop a conceptual design for remediation on the first reach
        - Establish stakeholder group: review and refine designs
        - Test proposed actions using relative risk model for potential unintended consequences
        - Implement on first reach, monitor and reevaluate (adaptive management)
    - Proposed on-going/long-term actions
        - Continue to explore and test promising innovative approaches to reduce MeHg in the system
        - Continue to explore potential natural attenuation processes in the different environmental compartments
        - Continue remedial actions on a reach by reach basis
        - Incorporate information from remedial actions in CSM
        - Modify/improve remedial approach based on monitoring
        - Integrate remedial actions with overall watershed vision when possible
        - Test proposed actions using relative risk model for potential unintended consequences
    - Activities to develop an overall remediation approach
        - Enhance Adaptive Management Framework ((separate presentation at expert panel meeting 2013)
        - 2013 Remediation Proposal (NRDC obligation)
            - Integrate "Strawman" approach, EAM and Pilot results
            - Monitoring Design – short and long term
            - Draft timeline for implementation
- SRST ROPs Task Teams
    - Co-leads
    - Structure for advancing efforts at different levels of technology development
    - Allows us to move forward on remediation pilots while continuing to seek and assess innovative approaches
    - Co-leads will ensure appropriate progress on tasks/projects
    - Individual tasks or projects will continue to be led by project individual
    - Those interested can join project group in discussions on scope and progress (contact appropriate co-leads)
    - ROPs will continue to be a fully integrate work group
    - Laboratory and Field Monitoring
        - Solicit/review/consult on proposals
        - Vet new technologies
        - Track remediation case studies
        - Ensure communication with ROPs
    - Remediation Planning
        - Develop working approach and schedule for Phase 1
        - Develop NRDC "Remediation Proposal"

        - Adaptive Management Plan and Implementation
        - CSM updates as needed
        - Ensure communication with ROPs
    - Field Scale/Pilots
        - Track individual field pilot activities
        - Track site remediation activities and effects in river
        - Ensure pilot success criteria are "SMART"
        - Identify engineering challenges and solutions
        - Ensure communication with ROPs
- Slides shown from 2012 activities (shown in previous meetings)
- 2013 Proposed Activities
    - Laboratory/Desktop
        - Soil and sediment treatment testing cont (U. Waterloo)
        - Application of carbon to floodplain soils – Part 1
        - Effects of Biochar on biota (W&M)
        - FAQ – carbon amendments and biochar
        - UT Austin capping simulator
        - UD biogeochemistry at the bank/water transition
    - Field Characterization and Pilots
        - Application of carbon to floodplain soils – Part 2
        - Refinement of UD Bank Loading Model (cont.)
        - In Situ mesocosm testing of carbon (JMU)
        - Characterization of the near bank and hyporheic zone geochemistry (UD)
        - Deployment of treatments in the river – exploring the engineering challenges of in situ treatment and reactive capping
        - Testing AquaGate deployment feasibility
    - Remediation Planning and Implementation
        - Plant site remediation efforts and monitoring (cont.)
        - Enhanced Adaptive Management Framework (cont.)
        - Overall Remediation Approach and Remediation Proposal
        - Technical Approach
        - Proposed Schedule
        - Remediation Plan for first reach of the river
        - Remediation Proposal (NRDC)

PITT: *Mike Liberati, DuPont*

- RCRA – CA, TMDLs, NRDC, NRDA and SRST all share a similar outcome which is the remediation of South River
- Programs have unique processes and schedules
    - Desire a common, agreed upon remedial approach
    - Develop documents that serve to satisfy requirements of all programs
    - Need to identify administrative vehicle (permit, consent order, etc.) for planning, design, implementation
    - Final "EcoStudy" submitted Sept. 2012
    - "Remediation Proposal" due Sept. 2013

Communications and Outreach: *Mike Liberati, DuPont*

- SRST Newsletter
- Promotores de Salud
    - Program to train Hispanics to be community based health promoters
    - 40 hour training program educates the Promotores (mostly Spanish speaking) about a variety of important health topics, including fish consumption advisory
    - Promotores then share their new knowledge with others by performing health encounters, or interactions with friends, family and other community members
    - Over 6000 contacts some through the following events: Harrisonburg International Festival, Virginia Organizing Convivio, Mexican, Honduran and Salvadoran Consulate visits, Bienvenida Comunidad Latina, Dismantling Racism Workshop, Free Mobile Eye Clinic, Salvadoran Cultural Festival, African American Festival, Rockingham Memorial Hospital Family Health Fair, Virginia Poultry Growers Health Fair, National Coach Health Fair, Waynesboro Riverfest, Augusta County Fair
    - Partnerships developed through the following groups: Waynesboro, Staunton, Harrisonburg, Woodstock and Winchester Health Clinics, Gus Bus Reading Show, Migrant education employee packets, Healthy Families Page County, The Learning Center (Waynesboro), Skyline Literacy, Augusta, Rockingham, Page, Warren, Waynesboro, Staunton and Harrisonburg Public Schools, Nazarene Church Food Bank, Harrisonburg Community Resource Center, Virginia Organizing, Walmart, Kmart, Harrisonburg Community Health Center
    - 2013 Activities
        - Complete training of Waynesboro-area group of Promotores
        - Continue outreach efforts, Waynesboro-focus
        - Media campaign
        - Considering poster contest, video resource
        - Possible expansion into other communities (ethnic/immigrant)
- Website Redesign
- Communications Task Team
    - Early recognition of importance
    - Main focus has been fish consumption advisory and SRST activities
    - Increased, new efforts for remediation planning and implementation
    - Commence formal Task Team

Watershed Approaches: *Brad Kreps, TNC/Clinch Valley Program*

- The Clinch-Powell Clean Rivers Initiative consist of group of stake holders including universities, state and federal agencies, citizen groups and industries that have a common interest in a clean Clinch/Powell watershed.
- Their mission: Restore and maintain the propagation and growth of a balanced, indigenous population of aquatic life, *including native m*ussels, **in that portion of the Clinch and Powell River system found upstream of Norris Lake, TN**. CPCRI will accomplish this by fostering a *shared commitment* and *effective partnerships* among

government agencies, conservation organizations, research scientists, and private industries working in both Virginia and Tennessee.

- Their organization is headed by TNC and is similar in makeup to the SRST. For more information, see presentation or go to website: http://vwrrc.vt.edu/cpcri/default.asp

Bird Feeding Study: *Claire Ramos, William and Mary*

- Dosing study completed
- Measured same endpoints as in South River
    - Reproductive success, behavior, hormones and immunity
    - Reproductive loss most pronounced during nesting stage
    - Preliminary conclusions:
        - Memory – severe disruption
        - Flight – possible effect
        - Molt – earlier
        - Song – lower pitch/simpler
        - Parenting – no effect
        - Testosterone – no effect
        - Corticosterone – suppression
        - PHA immune response – no effect
        - B-cell immune response – delayed
        - There appears to be genetic variation in response
        - See presentation for graphs
- Depuration Study
    - Flight and immune measures
    - Organs collected
    - Removed from mercury in June
    - Full molt +5 month
    - Re-measured
    - Sacrifices began yesterday
- Ongoing Dosing Studies
    - Outdoor Breeding
        - Adult exposed
        - More challenging
        - Ends next week (week after SRST meeting)
    - Developmentally Exposed
        - Replicating original study
        - Ends June
- Dan finishing up "point count" survey report (due in December)
    - Conducted in June 2011 and 2012
    - 950 pts surveyed, 12,000 birds detected of 75 species
    - Can predict which and how many songbirds will occur in any site/habitat.

Amphibians and Reptiles: *Bill Hopkins, Virginia Tech*

- Gave overview of toad studies. Studies investigated the following:
    - Hg bioaccumulation and maternal transfer
    - Effects of maternal Hg exposure on female reproductive success

- Latent effects of maternal Hg (with and without predators
- Individual and interactive effects of maternal and dietary Hg
- Even more latent effects – terrestrial pens
- This was all directed through a conceptual and functional framework; model driving data
- Emphasize attacking this framework with a pluralistic approach using filed work, lab work, mesocosms and modeling.
    - Get 50% decrease in survival at metamorphosis when tadpole comes from contaminated mother that lays eggs in contaminated pond. Tadpole is then getting Hg from maternal transfer and diet. Theory is that when tadpole is going through metamorphosis and the body is absorbing tail, it is getting very heavy dose of Hg. If tadpole is only getting Hg from diet (clean mother, contaminated pond) or tadpole only getting Hg from maternal transfer (contaminated mother, clean pool) there is no significant effect in survival.
    - When plugged into population model, adding 5% adult mortality, which is probably conservative and not unreasonable, increases probability of extinction to > 95%. This suggests that these contaminated sites could serve as sinks and we need to start thinking about things on the landscape scale.
- This population data then can be used to predict metapopulation dynamics.
- Lifecycle of toad and use of ephemeral wetlands are key.
- You can then use size of "sink" wetland and distance between wetlands to come up with all sorts of scenarios.

- Conclusions:
    - Small sinks are important to population dynamics and productivity of the wetland network.
    - Wetland size and distance within the network are important.
    - Mercury can influence the viability of subpopulations as both sources and as sinks (i. e., Hg in one population can affect viability of other populations).
    - Effects of Hg contamination at the landscape scale can be partially ameliorated by adjacent uncontaminated wetlands (assuming appropriate proximity and size).
- How can our findings regarding individual and population level effects of Hg be used to inform restoration?
    - Implications for South River Restoration
        - Framework for maximizing impact of restoration and gauging success.
        - Constructed wetlands augment existing populations through dispersal
        - Creating viable wetland networks magnify landscape-scale productivity.
    - Applying Spatial Modeling to South River Restoration
        - Use Surveys and Models to:
            - Assess status of amphibian populations at proposed restoration sites
            - Guide wetland creation
                - Size, placement in landscape, hydroperiod
            - Guide management of uplands
                - Critical upland habitat, dispersal corridors

    - Assess potential for natural colonization or need for translocation
- Scenario: Maximizing Value of Newly Acquired Land for Amphibians
    - Guide wetland creation and upland management to:
        - Minimize extinction risk
        - Maximize diversity of amphibian communities
        - Maximize productivity (ecosystem services)
        - Encourage natural colonization (esp. rare species)
    - Estimate value as mitigation for impacted areas.
- Gauging success: Metrics
    - Restoration should have quantifiable benefits
        - Successful colonization and establishment of viable amphibian populations in constructed wetlands
        - Establishment of viable "sink" populations in wetlands that were previously too small or degraded to support populations.
        - Increased population size and productivity in existing wetlands and uplands through augmentation from constructed wetlands.
        - Establishment of additional populations of rare species (marbled and tiger salamanders).
- Gauging Success: Methods
    - Monitoring
        - Pre and post restoration of existing and constructed wetlands
        - Comparison of restored vs. unrestored wetland networks.
    - Wetland characteristics (hydroperiod, flooding frequency)
    - Amphibian characteristics
        - Community composition (occupancy)
        - Population monitoring (breeding adults, larvae, metamorphs)
        - Dispersal (cohort marking, genetics)
- Scenario 2: Guiding Restoration of Contaminated Floodplain Habitats
    - Estimate loss of amphibians to Hg contamination
    - Guide wetland creation to:
        - Encourage use of constructed wetlands by adult amphibians inhabiting the floodplain (minimizing interactive effects of maternal and dietary Hg).
        - Maximize augmentation of populations in existing wetlands.
        - Improve landscape-scale amphibian productivity.
        - Minimize Hg effects at the population and metapopulation scales.

Relative Risk Model Update: *Wayne Landis, Western Washington University*

- Patterns of Risk in the South River and Shenandoah

    - Six Risk Regions delineated within the boundary of the watershed.
        - Geospatial data used are from a number of sources.
    - Focused on Bayesian Network and Relative Risk Model
    - Bayesian Network Model Construction
        - Each node has up to 4 potential states or ranks
        - Define the ranks for each input node
        - Determine the probability distributions for each input node from available data
        - Develop conditional probability tables that define the relationship between input and child nodes.
        - There are individual models for the biotic endpoints-ecological risk.
    - Bayesian networks used to estimate risk (smallmouth bass network example shown).
        - Each model summarizes what is known about the casual pathway (model only as good as data entered).
        - The conditional probability tables are based on data-bass ecological risk assessment.
- Monitoring and Adaptive Management
    - South River assessment is amendable to Adaptive Management
        - Assess issue or opportunity
        - Design a management experiment
        - Implement
        - Monitor system response
        - Evaluate outcomes and learn
        - Adapt future decisions
- Summary
    - Patterns of risk can be calculated for the South River that summarizes the current state of knowledge.
    - CPTs help us understand in a quantitative fashion what we do and do not know.
    - The outputs are distributions, not single values and remediation will be the shifting of these distributions.
    - Changes due to management changes or alterations in the environment can be estimated.
- Nest Steps
    - Summarize the risk analysis so that it will be useful for making remediation decisions.
    - Support the Adaptive Management Effort for future monitoring and restoration efforts.
    - Publish

Plant site/RCRA: *Ron Wesley, URS*

- RCRA Corrective Action Programs
    - Plant RCRA Facility Investigation (RFI)
    - Corrective Measures Study (CMS)
    - Groundwater Monitoring Program
    - Stormwater (Outfall) Monitoring
    - Sewer Investigation

- Interim Measures (IM)
- Hg Inspection and Abatement Program

- Completed Activities
  - Timeline
    - RFI – 2009
      - Report revised Aug 2012
      - Final approval pending
    - Sewer Investigation – 2010
    - Interim Measures – 2010
    - NE Area Supplemental Drilling – 2011
  - RCRA Facility Investigation
    - Investigated 20 SWMUs and 2 AOCs
    - Identified 3 SWMUs (1, 4 and 7) for Corrective Measures Study
    - Recommended continued GW monitoring and sewer remediation
  - Sewer Investigation
    - Three phase program – mapping, CCTV, sampling and cleanout
    - Sampled 85 structures, cleaned 1,967 ft of sewer, removed 27 cu yards of sediment
    - Removed approximately 521 kg (1,148 lbs) of Hg from sewer system
    - Recommended abandonment, cleaning or re-routing impacted sections
  - Interim Measures
    - Removed and abandoned Hg sources connected to sewers
    - Re-routed roof drainage that flushed through impacted trenches
  - NE Area Supplemental Drilling – 2011
    - Objective – Determine if Hg was concentrating in bottom of structural depression
    - Scope – Replace old wells with new specifically designed wells
    - Results and Conclusions
      - Encountered hard quartzite at 51 ft
      - GW is adequately characterized
      - Hg is not accumulating or migrating
- Ongoing Activities
  - Outfall Monitoring
    - Quarterly baseflow sampling
    - Semiannual storm events
  - Groundwater Monitoring
    - Annual site wide sampling
    - Semiannual sampling in source areas
  - Hg inspection and Abatement
- Next Steps
  - Proceed with CMS
  - Streamlined Process
- Potential Remedies
  - Soil – removal, containment, institutional controls
  - Groundwater – institutional controls, diversions, gradient control, monitoring
  - Sewers – Abandonment, cleanout, re-route, monitoring

Ecological Study: *Ralph Stahl, DuPont*

- Ecological Study Timeline
    - June 2005: Consent Decree between DuPont and NRDC; Presents framework for Ecological Study
    - March 2006: Field work begins
    - December 2011: Field Work completed
    - May 2012: Draft Ecological Study report sent to NRDC
    - July 2012: Consultation with NRDC
    - July – August 2012: Comments from other stakeholders
    - September 28, 2012: Final report submitted to NRDC
    - **September 28, 2013: Remediation proposal required**
- Objectives of the Ecological Study- Answer 4 questions posed in the Consent Decree:
    1. Why has mercury remained higher than previously predicted in fish tissue in certain areas?
    2. How is bioavailable mercury getting to the river ecosystem?
    3. How is mercury getting into the tissue of fish and aquatic animals?
    4. Are there specific mercury pathways that significantly contribute to mercury levels in fish tissue?
- Ecological Study Report Contents
    - Environmental Setting/Phase 1 Findings
    - Chemistry
    - Biology
    - Data Integration
    - Findings
    - Uncertainties
    - Conclusions
- Chemistry
    - Mercury in surface water, sediment and pore water increase between RRM 0 and RRM 10, then level off or decline until RRM 25.
    - The majority of mercury is loaded in the upstream reach (RRM 0-10)
    - Floodplain soil THg concentration generally decline with distance (horizontally and vertically) from Site
    - River banks have high THg; some are eroding
    - Although most THg in soil and sediment is strongly bound, a substantial portion in soil is extractable with river water and other reagents and likely bioavailable.
    - Mercury methylation data collected in the range of sediment environments in the South River suggest that a wide variety of sediment environments are capable of methylating mercury and that the South River may contain several types of methylating bacteria.
- Biology
    - MeHg concentrations in biota generally increase with distance downstream (gradients of THg and MeHg concentrations in biota from the South River exist and vary spatially as well as seasonally)
    - Uptake rates of biota vary by trophic position and feeding behavior
    - From this study at least, little or no evidence that mercury exposure affects benthic invertebrate or fish communities.
- Data Integration

    - Statistical Models
    - Invertebrate and Fish Responses to Mercury
        - Sediment Quality Triad
        - Field (in situ) Microcosm Study
        - Integrated Assessment of Invertebrate and Fish Response to Mercury
    - Conceptual System Model
    - Relative Risk Model
- Findings
    - Why has mercury remained higher than previously predicted in fish tissue in certain areas?
        - Inputs of inorganic mercury have not been mitigated by natural attenuation:
            - Geomorphic constraints
            - Low sedimentation rates
        - Original assessments may not have understood that small amounts of inorganic mercury in a system can support high concentrations of methylmercury in fish.
    - How is bioavailable mercury getting to the river ecosystem?
        - Erosion of bank soils
        - Transport of mercury from particle-associated mercury stored in sediment.
        - Small, but continued input from former facility.
    - How is mercury getting into the tissue of fish and aquatic animals?
        - Input of inorganic mercury from soil.
        - Methylation of inorganic mercury:
            - Widespread
            - Diverse microbial community
        - Biomagnification
    - Are there specific mercury pathways that significantly contribute to mercury levels in fish tissue?
        - Dietary uptake is important, particularly for high trophic level fish.
        - At the base of the food web, aqueous exposure and consumption of particles is important for methylmercury uptake.
- Uncertainties
    - Climate change
    - Landscape alteration
    - Regulatory changes
    - Advances in science and technology
- Conclusions
    - There may be remedial options that are safe, effective and reasonably necessary.
        - A remediation proposal will be provided by September 28, 2013.
    - An adaptive management approach will be used to address contamination.
        - Structured and iterative process
        - Combines moderate scale pilot studies with monitoring
        - Future actions based on results of pilot studies.

The critical role of monitoring: *Will Clements, Colorado State University*

- National Long-term Monitoring Programs
    - Assess long-term status and trends
        - EPA's EMAP
        - USGS NAQWA
    - Basic ecological research
        - NSF LTER
- Programs to Quantify Remediation Effectiveness
    - U.S. EPA 2005. Remedial Action and Long-Term Monitoring. In Contaminated Sediment Remediation Guidance for Hazardous Waste Sites. U.S. EPA EPA-540-R-05-012
    - Framework for Long-Term Monitoring of Hazardous Substances at Sediment Sites, 2009. Association of State and Territorial Solid Waste Management Officials.
    - Long-Term Monitoring Strategies For Contaminated Sediment Management. 2010. Space and Naval Warfare Systems Center Pacific and ENVIRON International Corporation.
- Criticism of Descriptive Studies
    - "We speak piously of taking small measurements and making small studies that will add another brick to the temple of science. However, most of these bricks simply lie around the brickyard." J.R. Platt, 1964
- Criticisms of Long-term Monitoring Programs
    - Average duration of "long-term" monitoring in aquatic ecosystems is 9 y (Jackson & Füreder 2006)
    - Meta-Analysis: Failure to observe recovery attributed to short duration of monitoring (Jones & Schmitz, 2009)
    - Assessment of restoration progress not possible with the *piecemeal* information currently available (Bernhardt 2005)
    - Insufficient post-remediation data (NRC 2008)
- Inability to quantify restoration effectiveness due to:
    - Failure to set monitoring goals as **testable** hypotheses (e.g., remediation will reduce Hg in fish)
    - Inadequate characterization of baseline conditions → cannot employ inferential statistics (BACI design)
    - Failure to establish specific decision rules→ if …then statements indicating when to stop or modify
    - Failure to integrate physical, chemical and biological measures→ weight of evidence approaches
- **How do we avoid making these same mistakes?**
    - **A few basic questions:**
        - What is the purpose of the monitoring program? → **hypothesis driven**
        - What are the specific variables to be measured?
        - How often should monitoring take place, and how long should it continue?
        - What factors, in addition to remediation, will influence the results?
        - What are the most appropriate statistical methods for analyzing the data?

        - Who is responsible for reviewing the data and what are the triggers for identifying important trends?
        - How will the results be communicated to the public and who is responsible for doing this? (searchable, electronic databases?)
- A Long-Term, Multitrophic Level Study to Assess Pulp and Paper Mill Effluent Effects on Aquatic Communities in Four Receiving Waters: Background and Status. Hall et al, 2009.
    - Series of 8 papers published in IEAM in 2009
    - 8 year study of 4 watersheds (OR, PA, MS)
    - Goals: assess current status and quantify responses to pulp mill process change→ experiment
    - Hypothesis driven (ecological risk assessment framework)
    - Adaptive management process
    - Integrated field assessments with short term lab experiments
- Quantifying restoration success and recovery in a metal-polluted stream: a 17-year assessment of physicochemical and biological responses. Clements et al, 2010.
    - Long-term (1989-2012) record of chemical, physical, biological data
    - All data collected by same investigator →consistent methods
    - Evaluated response to restoration treatments (BACI)
    - Influence of long-term climatic changes
- Shows data from long term monitoring
- Will shows DEQ 100 Monitoring Plan.
- Questions for SRST (in the year 2062)
    - What is the overall health of the South River?
    - Have Hg levels in fish decreased over time?
    - Was remediation effective in reducing Hg levels?
    - What was the influence of other factors?
- Will then goes into DEQ QAPP, summarizing what is in document and asking more questions (Are these sampling sites appropriate? Too many? Too few? Sampling Frequency? Etc.)
- Background Information Available
    - Comprehensive inventory of Hg in <u>many</u> compartments
    - Conceptual model of Hg distribution & transport→ aquatic and terrestrial pathways
    - Excellent understanding of geomorphology & hydrology
    - Reasonable understanding of South River ecology→ population and community studies
    - Preliminary results of several remediation projects
    - Excellent record of communication
- Potential Sources of Uncertainty
    - Longitudinal & lateral extent of contamination
    - Dynamics of contaminant transport
    - Adequacy of source control
    - Future sedimentation rates & hydrologic conditions
    - Background contaminants and ecological stressors
    - Changes to site use & impacts on Hg transport
    - Remedy effectiveness & remedy impacts
    - Other factors (e.g., climate change, dam removal, hydrologic modification)

- Discussion on building framework for long-term monitoring of South River
- Other Considerations
    - VA DEQ primarily responsible for monitoring
    - Will there be sufficient coordination among state, federal and private contractors?
    - Will there be an assessment of ecological effects? Need to develop detailed, specific methods
    - Is an adaptive management plan in place?
- Will ask group to come prepared to discuss the following questions related to developing a long-term monitoring plan for the South River watershed
    - What are the long-term monitoring objectives & hypotheses?
    - What should be monitored?
        - Hg in water, sediments, fish → models(total and methyl Hg?)
        - Ecological effects? (surveys, toxicity tests, microcosm expts.)
        - Both aquatic and terrestrial resources?
        - **Note**: Physical & chemical endpoints are often less expensive, less variable and more easily measured; however, we are generally more interested in biology!
    - What frequency, duration, & spatial extent?
        - Should we consider multiple spatiotemporal scales? Specific remediation project → entire watershed
        - Any consideration of seasonality?
        - How do we know when we are done?
        - Are the current sampling sites appropriate to answer the question?
    - Are the current sampling, analytical & statistical methods appropriate and sufficiently detailed?
    - What are the primary sources of uncertainty?

Thursday, October 25

Pilot Projects and other on the ground trials for 2013:

- **Pond:** *J. R. Flanders, URS*
    - Summary of Results
    - Surface Water
        - Trend of lower surface water FIHg and FMeHg concentrations in amendment cell, especially FMeHg (significant difference at all weeks)
        - Effects on both IHg and MeHg; MeHg very strong effects – wasn't expected
        - Lost effect on IHg after a breach in barrier
        - Breaching occurred on several occasions after initial failure of barrier beginning Jan 2012.
        - MeHg still lower in amended side after winter.
        - Concentrations bounced back but were lower, tough to separate from interannual variation
        - Unintended consequences not apparent
    - Snails
        - Snail tissue IHg and % MeHg generally lower in amended cell.

        - Snail MeHg concentrations significantly lower in amended cell for all post-amendment monitoring events.
        - Snails generally found attached to vegetation; associated with surface water exposure
        - Consistent differences in MeHg and %MeHg; effect seen also seen in second spring
    - MeHg Benthic Invertebrates
        - *Caenis* tissue MeHg concentrations are generally significantly lower in the amended cell
        - Chironomid tissue MeHg results less consistent
        - Lower MeHg in *Caenis* tissue prior to the amendment and that has remained through time
        - *Caenis* was associated with surface water and sediment exposures; they tended to be more associated with sediment during colder temperatures
        - Chironomids which are closely associated with sediment didn't really show much change; this mirrors what we saw in the bulk phase sediment.
    - Wood Frog Tadpoles
        - IHg – no significant difference between cells at Week 43
        - MeHg and % MeHg – significantly lower in amended cell at Week 43
        - Difference for IHg, but significantly lower MeHg and %MeHg
        - Not comparable to American toad tadpoles
    - Bluegill
        - IHg and %MeHg – no statistical difference between cells at Week 50
        - MeHg – amendment cell statistically lower than control cell at Week 50
    - Summary – Other Endpoints
        - Caenis, Chironomid and snail tissue IHg concentrations are generally lower in the amendment cell.
        - Consistent overall trends in sediment THg and MeHg concentrations between cells are not evident, although the amendment cell was significantly lower on a few occasions.
        - Pore water IHg and MeHg concentrations are generally lower in the amendment cell, however differences are variable and rarely significant.
        - Benthic invertebrate community structure generally does not differ between cells.
        - Surface water TOC and DOC are generally lower in the amendment cell, while sediment TOC and black carbon are generally greater in the amendment cell.
        - Sediment core profiles show that the carbon was forming a "cap" rather than being mixed in with the sediment
        - Particle size is an important consideration for potential efficacy (bioturbation, surface area) and application.
        - Addition of carbon amendments reduced Hg concentrations in biota greater than 50% more often than not.
        - The effect does not appear to be as strong this year.
    - Path Forward

        - Monitor surface water depth
        - Two sampling events planned for 2013
- **Bank Stabilization:** *J. R. Flanders, URS*
    - Physical
        - Pilot bank is stable
        - Majority of changes to channel form within wetted channel
        - Desired slumping of FES lifts covering most erosion pins along pilot bank
    - Biological
        - Increased growth of planted stock during Year-3
        - Replacement plantings thriving
        - Invasive species continue to impact community composition
        - EPA rapid bioassessment protocol scores have increased for vegetative protection
    - Chemical
        - Sediment
            - Decreased THg concentration on average; not statistically significant
            - Maximum THg concentrations have decreased vs. pre-stabilization
            - Decreased range of concentrations over time
        - Pore water
            - Similar overall trends as sediment
            - Weak decreasing trend in concentrations over time
            - Reduced variability observed in 2012
        - Asiatic Clam Tissue
            - After significant declines in 2010; increased IHg uptake in 2011 and 2012
            - No consistent pattern in MeHg over time in mid-channel environments
            - Typically higher MeHg concentrations in near-bank samples
    - Summary
        - Pilot bank is stable; sustained a near 10-year storm in 2011
        - Vegetative communities are well established
        - Hg concentrations in sediment and pore ware less than pre-stabilization
        - Significant increases in both IHg and MeHg in biota
    - Key Learnings
        - Incorporate monitoring locations and regime into remedial design
        - Asiatic clams are a sensitive monitoring tool
        - Consider and understand upstream loads
        - Groundwater/surface water interactions
        - Scale of impact – local vs. reach scale
    - Planned Activities 2012-2013
        - 2012
            - 3Q and 4Q monitoring events
            - Post-storm monitoring as applicable
        - 2013
            - Additional physical and biological tissue monitoring

- Continue evaluation of bank stabilization as a potential remedial option

Floodplain Study; Biochars for Soil Remediation: *Bill Bertie, DuPont*

- Biochars – What are they?
  - Pyrolysis - Stable, carbon-rich charcoal produced by thermal decomposition of organic material under low/no oxygen at relatively low temperatures (300 - 700 °C)
  - Hydrothermal Carbonization (HTC) - Stable carbon from heating biomass in a weak acid at temperatures between 180 - 300 °C) and elevated pressure (<20 Bar).
- Potential/Alleged Benefits
  - Tool for environmental management
    - Sequester contaminants, reducing the bioavailability of metals, pesticides, PCBs, dioxins, furans, etc.
    - Improve soil health and fertility, soil structure, nutrient availability, and soil-water retention capacity
    - High affinity of nutrients/pesticides can address soil degradation, food production, and water pollution.
    - Biomass waste management
  - Generate renewable energy
  - Address climate change/GHG through long-term C sequestration
  - Experimental test show Hg removal over 90% in short period of time.
- Uncertainties and Barriers
  - Technical barriers
    - Production technology
    - Biochar in soil applications
      - Studies needed to understand long-term effectiveness and mechanisms
      - Site-specific conditions affect benefits; BMP being developed
      - Biochars are not all the same; how best to evaluate?
        - International Biochar Initiative (IBI) guidance document
  - Economic barriers
    - Market value uncertainty of biochar products and services
  - Policy barriers
    - Something “new”
- Biochars for terrestrial ecosystems
  - Three Study Components
    - Lab/greenhouse
    - Field pilot
    - Field demonstration
- Primary Objectives

    - Assess the value of biochars to reduce the bioavailability of mercury in the terrestrial and surface water ecosystems by reducing the amount of methyl mercury (MHg) in the biosphere.
        - Evaluate biochar types, application rates and methods of incorporation, timing of application, and other parameters to significant reduce mercury bioavailability (sequestration) alone or in combination with other soil amendments in laboratory, field pilot, and / or field demonstrations.
    - Do no harm
- Secondary Objectives
    - Partner with experts and stakeholders to evaluate biochars to:
        - Reduce inorganic nutrient, bacteria, and pesticide loadings into surface and ground waters
        - Improve soil productivity for plant growth
        - Manage animal manures and other biomass from local sources, especially those being applied to floodplain soils to recycle nutrients and carbon and as a waste disposal option.
        - Sequester carbon in soils.
        - Determine sequestration mechanisms by characterizing biochars using appropriate methods.
        - Determine the longevity of biochar treatments.
- Lab phase 1 – Ongoing
    - Soil containing 40 µg Hg/g.
        - Characterize using soil testing methods
    - Screen biochars
        - Assess biochars properties based on IBI guidance
            - Cat. A: pH, TOC, H:TOC, TN, EC, particle size, moisture, ash, carbonate
            - Cat. B: earthworm avoidance, germination assay, *dioxane/furan, PAH, PCB, trace elements (14)*
            - *Cat C: NH_4-N, NO_3-N, P&K, Surface area*
        - Assess biochars to reduce soil Hg bioavailability to soil organisms (i.e., earthworms, predatory mite, collembolans, enchytraeid worms).
- Lab phase ii/Field Pilot Studies 2013-2018
    - Studies of longer duration using results of Lab phase I
        - Hg sequestration
            - Soil organisms, including earthworms
        - Soil productivity (plant production)
        - Treatment longevity
        - Sequestration mechanisms
    - Develop agronomic knowledge base

        - Examine treatments in small field plots
        - Use BMP provided by Virginia Tech to help fill knowledge gaps
- Field pilot study 2013-2018
    - Three to five-year field experiment to assess the effect of biochars in sequestering soil Hg, enhancing soil productivity, improving the management of nutrients and locally-produced biomass, and sequestering carbon in soil.
    - A field pilot study is outlined in the following steps:
        - Select a continuous half-hectare area that can be devoted to the pilot study.
        - Biochar selection and application rates and methods based on results from lab studies, char characterization data, and BMP for agronomic crop production.
- Field demonstration 2015 (or longer)
    - Farm-scale implementation
    - Availability/quantities/qualities of local materials to char
    - Charring facilities
    - Acceptance
    - Barriers to and difficulties in implementation
- Field study/demonstration endpoints
    - THg and MHg in soil and biota
    - Invertebrates and plants
    - Soil chemical and physical characteristics as needed
    - Agronomic considerations
    - Microbial community structure
    - Water quality (Hg, pH, TOC/DOC, plant nutrients, pesticides, etc.) in run-off and deep percolation
    - Carbon sequestration and treatment longevity.
    - Life Cycle Assessment.
    - Other . . .
- Path forward
    - Select / produce chars (done)
    - Identify field site(s) (done)
    - Collect soil(s) (done)
    - Char characterization and initiate studies (done)
    - Develop Hg-specific FAQs on carbon amendments, esp. chars (working on)
    - Identify partners (working on)
    - To provide guidance on the production, characterization, evaluation, use, and acceptance of biochars in soil remediation
    - Universities, NGOs, USDA, US EPA, VA DEQ
    - To provide chars
    - To provide soils and sites for studies

Roundtable Discussion – Monitoring Now and in the Future: *Will Clements, Colorado State University*

Discussion focused on questions posed previous day:

- What are the long-term monitoring objectives & hypotheses?
- What should be monitored?
  - Hg in water, sediments, fish → models(total and methyl Hg?)
  - Ecological effects? (surveys, toxicity tests, microcosm expts.)
  - Both aquatic and terrestrial resources?
  - **Note**: Physical & chemical endpoints are often less expensive, less variable and more easily measured; however, we are generally more interested in biology!
- What frequency, duration, & spatial extent?
  - Should we consider multiple spatiotemporal scales? Specific remediation project → entire watershed
  - Any consideration of seasonality?
  - How do we know when we are done?
  - Are the current sampling sites appropriate to answer the question?
- Are the current sampling, analytical & statistical methods appropriate and sufficiently detailed?
- What are the primary sources of uncertainty?

Too much "discussion" to document. Monitoring task team formed and will be meeting in January to discuss further.

Enhanced Adaptive Management: *Christy Foran, ERDC*

- Bottom Line Up Front
  - Goal is to develop a conceptual approach (simple model) that can be implemented and modified (played with).
  - Realistic model (or series of models) can be developed from this by adding enough complexity that the predictions are as expected using existing results.
  - The outputs can show how different priorities are reflected in the choice of management alternatives, develop monitoring plans and anticipate benefits of incremental approaches.
- Challenges in Managing Contaminated Sites
  - Contaminated sites are highly complex, modeling and monitoring data have high uncertainty
  - Remediation presents uncertain benefits and potentially unintended consequences
  - Remedial plans can produce changes at many scales across many landscapes
- Benefits of Adaptive Management
  - Focuses data collection and research on decision-making factors
  - Encourages preferred action under uncertainty
  - Provides a framework on which to learn from current actions
  - Focuses monitoring and research needs on the reduction of uncertainty

    - Allows development of anticipated effects in time under phased implementation
- Critiques and Challenges
    - "Adaptive Management" approach: Revise plan if underperforms
        - detected through monitoring ("trial and error" approach, no learning)
    - Plan based on recorded conditions:
        - currently successful species
        - current sea level, storm severity patterns
    - Overall approach struggles to:
        - Justify and evaluate robust plans and designs
        - Illustrate clear nexus between adaptive management plans and resource management needs
        - Implement process for scientific feedback to affect management decisions
        - Prioritize monitoring needs given limited resources
        - Execute framework for integrated learning
    - AM plans
        - Assume static overall context
            - i.e., sea levels will remain constant, storm frequencies will follow historic patterns
        - Often lack a decision framework to identify ahead of time the feasible scope of options for revising management actions
- EAM is the development and periodic utilization of a quantitative decision model for adaptive management which incorporates the conceptual site model (and/or other models), possible management alternatives and the objectives and priorities of the project team and stakeholders*.*
- Christy then goes into how AM model can be made for South River
- Next Steps
    - Flesh out decision model
    - Parameterize model inputs
    - Conduct uncertainty analysis
    - Conduct sensitivity analysis on model inputs
    - Present EAM monitoring and analysis framework
    - Illustrate the decision making process by running example decision model and decision analysis to rank remedial alternatives
    - Determine if decision model is an adequate representation of the system
    - Present EAM framework and recommendations

Wrap Up/Discussion

The following questions were placed on the screen and discussion followed. General responses/comments were recorded and later sent out to SRST. The comments will be attached to these minutes.

Are there other technologies or approaches to remediation that we may not have considered?

Are there issues with monitoring that we need to consider that we have not discussed during this meeting?

Should we form a "monitoring" task team or sub-team under the ROPs program?

Are there concerns with how the ROPs team plans to move forward in 2013? Have we missed something that we should have considered?

Are all current sources of mercury entering the system being explored and addressed?

Are there other data gaps or areas of uncertainty that we have not covered in this meeting that we need to put back on our radar?

South River Science Team Meeting

October 25, 2012

Open Discussion Comments:

- Dredging of the riverbed of the South River should be removed from the list of possible remediation options. Ecological impacts from dredging would be severe and recovery would take many decades.
- Long-term habitat monitoring is needed to ensure that remediation practices do not destroy or degrade habitat and cause further impairment of aquatic and terrestrial communities.
- Bank stabilization, soil/sediment amendment (carbon, biochar, etc.) practices, and reductions at the plant site are viewed as being viable for pilot studies or implementation in the near future. Other options seem to be much lower on our priority list, but need to be fully explored. Which options are rate-controlling?
- How do we segregate the different mercury sources? Important to be able to treat and monitor each source separately in a manner that allows measurable progress to be quantified.
- Elimination of the continuing releases of mercury from the former DuPont plant site to the South River should be a top priority. The plant site is not just a legacy source, but continues to release mercury to the river. The effectiveness of other remedial measures along channel margins/banks and floodplain cannot be clearly measured if mercury continues to enter the river from the plant site.
- Can the adaptive management model help predict which sources are creating impacts in different areas?
- Remedies such as capping and dredging can be very destructive. We should take advantage of every tool and the most complete knowledge to ensure that we don't "kill the patient to cure it." Remedial measures may disrupt the ecosystem, and we should make every effort to enhance, rather than degrade, the local habitats and communities. We need "no regret" options.
- We need to come up with a simple list of remedies that everyone can agree on.

- We should employ high-resolution maps and aerial images to identify target areas for different remedial strategies. [Reply - GIS maps are in place and are being used on this project, but have not yet had layers developed for remediation.]
- SRST members should coordinate with NRCS and SWCD local offices to encourage farmers to apply for cost-share funds and implement BMPs.
- The "tea bag" approach and similar technologies, using biochar or other carbon-based materials with an affinity for mercury, should be employed where possible. These technologies may be less physically disruptive than others (bank stabilization, soil amendments) and allow the contaminated media to be removed and renewed. "Aqua-Block" was also mentioned as a technology for consideration.
- Is mercury directly affecting the biological populations in the river? These issues are being addressed through the NRDA process.
- Can technology allow us to achieve our target of 0.3 ppm Hg in fish? Unknown, but it is likely to take reductions from all 3 sources: floodplain/banks/channel margins, river sediments, and plant site. Note – the goal of 0.3 ppm Hg in fish tissue is much more achievable in the South Fork of the Shenandoah River than in the South River. Achieving this goal in the S. Fork Shenandoah River would release 100 miles of river from the consumption advisory.
- A Monitoring Task Team is needed. Effective long-term monitoring is needed to evaluate the effectiveness of remediation and restoration. Will Clements will coordinate this effort. We are looking for volunteers for this team (contact Ralph Stahl or Don Kain if you are interested).
- Are there other technologies we should revisit? In early discussions among SRST members many technologies were discussed. We should revisit those discussions and be open-minded to innovative approaches.
- More knowledge is needed about methylation and de-methylation. Can we influence the methylation process without causing harm elsewhere?
- Land-use and ownership remain as challenges. Much of the floodplain is in private ownership, so we may not have free reign to apply remedial technologies where we think they might be most effective.
- Meeting Format. The meeting format (invited speakers, progress updates, proposals for next steps, and open discussion) came out of discussions from last year's October meeting. Was this format effective?
- Recommendation to call next year's meeting a "program review," rather than "expert panel" meeting.