VCU

Virginia Commonwealth University

**James River CHLa Study**
**Second Meeting of Science Advisory Panel**
**October 14, 2011**
**Virginia Commonwealth University**
**Trani Life Sciences Building**

Agenda

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| 10:00 am | Opening Remarks by Paul Bukaveckas |
| 10:15 | Data Needs for the Upper James River (Paul Bukaveckas) |
| 10:45 | Panel Discussion |
| 11:15 | Data Needs for the Lower James River (Ken Moore) |
| 11:45 | Panel Discussion |
| 12:15 | Lunch Break |
| 1:00 | Modeling Needs for the James (Clifton Bell) |
| 1:30 | Panel Discussion |
| 2:00 | Continuation of Panel Discussion or Meeting Time for Sub-Groups |
| 2:45 | Meeting Summary and Future Plans |
| 3:15 | Adjourn Meeting |

Dr. Paul Bukaveckas (VCU) welcomed the members of the Science Advisory Panel and guests to the VCU Trani Life Sciences Building and provided an overview of the meeting agenda. The purpose of the meeting was to present and discuss the data and modeling needs for evaluating numeric CHLa criteria for the James River Estuary. Presentations were given by Dr. Bukaveckas (Upper James River), Ken Moore (VIMS, Lower James River) and Clifton Bell (MPI, Modeling Needs). Each presentation was followed by questions and discussion among panel members.

Presentations on data needs for the Upper and Lower James River Estuary focused on two broad objectives: (1) characterizing the spatial and temporal dynamics of algal blooms, and (2) identifying and quantifying impairments to designated uses associated with algal blooms. For each of these objectives, a proposed a list of tasks was presented to address these needs. The Upper Estuary (tidal-freshwater segment) is characterized by chronic algal blooms in the region near Hopewell, VA (river miles 69-75). CHLa is persistently elevated during May –October due to proximal nutrient inputs from riverine (upper James watershed) and local point sources. In late summer, these blooms are dominated by cyanobacteria (blue-green algae) including harmful species capable of producing cyanotoxins. Data needs for this segment of the Estuary include some additional efforts characterizing the occurrence of algal blooms but focus principally on assessing impairments to designated uses, and particularly, the effects of cyanotoxins on humans and living resources. The Lower James River Estuary (inclusive of the oligo-, meso- and poly-haline regions) experiences algal blooms that are more ephemeral in time and place. Given the larger spatial area of the Lower James, and the sporadic incidence of algal blooms, a greater proportion of data collection activities must be allocated to characterizing the frequency and extent of blooms. Advanced technologies including continuous, fixed-station monitoring and continuous on-board monitoring will be needed to map their spatial extent and identify zones of

bloom initiation. Assessing impairments in the Lower James is also challenging because the blooms are typically comprised of dinoflagellates which are known to cause harmful effects, though these are not linked to the occurrence of specific toxins.

A number of questions were addressed during the panel discussion of the proposed workplans.

1. There was a question regarding the deployment of continuous CHLa monitoring sondes in the Upper James (near-shore vs. main channel, surface vs. depth, recording or real-time). Dr. Bukaveckas noted that the Upper James was well-mixed both vertically and laterally due to strong tidal forces. Previous monitoring has not detected consistent differences in CHLa or water quality parameters (temperature, conductivity) either laterally or with depth. Therefore, the plan was to deploy the sondes in main channel, near-surface locations. Supplementary data will also be available from a near-shore monitoring location at the VCU Rice Pier.

2. Another question concerned the spatial density of CHLa measurement locations and whether these would be adequate to characterize spatially variability. Dr. Bukaveckas explained that in comparison to the Lower James Estuary, the proposed sampling density was higher due to the small surface area of the tidal freshwater zone. Discussion followed and the use of satellite imagery as a mapping tool was raised. It was suggested that the surface area was not large enough to warrant satellite mapping however Dr. Garman said he would talk to VCU collaborators at the Corp of Engineers about the issue. Ken Moore indicated that there were historical data collected during Dataflow runs during 2008 that could be used to compare how measurements vary spatially in relation to the fixed monitoring locations. Harold Marshall asked about temporal extent of monitoring and Dr. Bukaveckas replied that this would be seasonal – May through October.

3. There was discussion regarding the component of the project dealing with top-down controls on algal blooms. Specifically, there was a question as to why zooplankton were not included among potentially important grazers. Dr. Bukaveckas explained that recent work has shown that they are a minor component of grazing accounting for less than 5% of CHLa removal per day, though some effort could be made to re-visit this issue. There was also the suggestion that benthic filter-feeders such as *Corbicula* should be considered. Dr. Bukaveckas indicated that he would review data from benthic surveys in the James to determine which species should be candidates for consideration of their grazing effects and for their potential exposure to cyanotoxins (Microcystin)

4. There was discussion about the monitoring of cyanotoxins and specifically whether there was a need to measure forms of Microcystin other than those detected by the standard ELISA assay which only measures the unbound portion. It was also suggested that blue crabs be added to the list of species monitored for Microcystin accumulation.

5. Lastly, there was discussion of the challenges to defining impairments associated with algal blooms in the Lower James in the absence of specific toxins. The panel members considered the benefits of using alternative algal metrics (e.g., diagnostic pigments) and toxicity testing to track the occurrences of HABs and assess effects on living resources.

The modeling presentation addressed the need to develop quantitative linkages between nutrient inputs, the occurrence of algal blooms and the incidence of impairments to designated

uses. These relationships provide the basis for establishing CHLa criteria that protect designated uses and for relating CHLa to nutrient loads. Quantitative relationships may take the form of complex, deterministic models (e.g., to predict CHLa under various nutrient loading scenarios) or simpler, statistical relationships relating CHLa to the probability of harmful algal blooms and impairments. It is anticipated that these relationships will be derived in part from existing data resources (e.g., long-term monitoring conducted by DEQ for the CBP) and from new data collected as part of this study. Of particular importance is the need to simulate the occurrence of algal blooms under various nutrient loading scenarios. It is anticipated that these simulations will be performed using a deterministic model that predicts CHLa on the basis of underwater light conditions, nutrient availability, water residence time and other factors that influence algal growth and mortality. An existing model developed for Chesapeake Bay is currently used for this purpose. The model was calibrated for large-scale applicability (e.g., the Bay and its tributaries) though local optimization would improve its reliability for predicting CHLa in the James under various loading scenarios. Thus a minimum requirement in the modeling effort is to improve site-specific calibrations for the existing CHLa model. Additional effort may be warranted to develop an alternative CHLa model for the James, and/or to enhance model capabilities by improving spatial resolution, or by including additional modeling parameters that are linked to impairment of designated uses (e.g., prediction of cyanobacterial and dinoflagellate blooms). The modeling sub-group recommended that a model review should be conducted to assess costs and benefits of various approaches.

A number of questions were addressed relating to the proposed modeling activities.

1. It was suggested that model simulations of hydrodynamics and CHLa in the Upper James would benefit by the availability of data on current speeds in this segment of the river. These data could potentially be obtained by deploying ADP sensors alongside the proposed continuous monitoring sondes.

2. There was an extended discussion about the importance of accurately articulating the needs for various modeling activities. It was agreed that there was a need to develop a deterministic CHLa model that could be used to simulate CHLa under various loading scenarios. Peter Tango noted that the group needs to explicitly state that the resulting model will be compared to EPA's and show that the one developed by this group is 'better'.

Concluding remarks: Dr. Bukaveckas will be in contact with individuals and groups for additional information as needed to finalize the work plan which is due by November 15$^{th}$. DEQ staff will provide further information on the process for evaluating and awarding contracts to address the data and modeling needs identified by the panel. It is anticipated that the next SAP meeting will be held in the Spring of 2012 by which time it is hoped that contracts will be in place for data collection and modeling activities to be carried out in the first year of the project. The purpose of the meeting will be to discuss and coordinate these activities to ensure that the necessary work is underway

Attending: **Panel Members**
Will Hundley
Brian Benham
Rebecca LePrell
Clair Buchanan
Peter Tango
Kimberly Reese
Margie Mulholland
Harold Marshall
Kenneth Moore
Paul Bukaveckas
Greg Garman
Harry Wang
Clifton Bell
Eileen Hoffman
Harold Marshall

**Also Attending, Affiliation**
David Whitehurst, VA-DEQ
Alex Barron, VA-DEQ
Jian Shen, VIMS
Victor Bierman, LimnoTech
Ellen Snyder, Altria
Rick Hoffman, VA-DEQ
Melanie Davenport, VA-DEQ
Adrienne Kotula, James River Assoc.
Michelle Kokolis, James River Assoc.
Ann Jurczyk, Chesapeake Bay Foundation
Cathy Viverette, VCU
Will Isenberg, VCU