Project Work Plan Memo

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SUBJECT: Project Work Plan: Statewide Atmospheric Deposition Review

Tracker Code: 15-041

Problem Description

Under the current water quality standards (WAC173-201A, section 420) Ecology may issue a *variance* to allow for a modification of water quality criteria applicable to an individual discharger or stretch of water. The decision to grant a variance can be informed by information on pollutant sources, including an assessment of sources that cannot be controlled under Clean Water Act (CWA) regulatory programs. Atmospheric deposition is one such source. Information about atmospheric deposition of pollutants can help determine whether CWA-driven pollution controls would be likely to improve water quality. This information can also help define realistic expectations about how CWA-regulated pollution controls affects levels of pollutants entering waterbodies. Currently, we do not know the extent to which atmospheric deposition of toxics contributes to the contamination of state waters.

The goals of this project are to:

- Review and assess the state-of-the-science for atmospheric deposition of toxic chemicals in Washington.
- Broadly outline the necessary scope to quantify atmospheric deposition at the local, regional, and statewide scale with enough certainty that results could be used to help support a variance of the water quality standards.

Study Objectives

In order to review the role of atmospheric deposition of toxics in the contamination of state waters, the initial objective is to establish a list of chemicals or chemical groups of interest for regulatory and scientific purposes.

Specific objectives are defined by each geographic scale of interest:

1. Local (e.g., urban sites with an NPDES permit)
    - Create a conceptual model that describes the pathway of toxics from the atmosphere to the discharge point.
    - Summarize available data for Washington.
    - Determine if modeling approaches are available and could be used.
    - Describe the level of uncertainty associated with the use of pre-existing local monitoring data for this objective; discuss levels of data availability that would reduce uncertainty by varying amounts.

2. Regional
    - Create a conceptual model that describes the pathway of toxics from the atmosphere to surface waters across multiple land-use watersheds.
    - Summarize available data for Washington.
    - Determine if modeling approaches are available and could be used.
    - Describe the level of monitoring data necessary to constrain an estimate of toxics deposition at a regional scale.
    - Evaluate the usefulness of a regional-scale estimate in the context of a total maximum daily load study (TMDL).

3. Statewide
    - Summarize the predominant weather and wind movements over a typical year.
    - Summarize available data for Washington.
    - Evaluate if modeling approaches are available and could be used.
    - Determine whether existing information is adequate to differentiate between in-state sources and out-of-state sources of pollutants.
    - Describe the level of monitoring data necessary to constrain an estimate of toxics deposition for regions of the state. Summarize existing monitoring networks and assess the likelihood of working with other state and federal agencies and universities.

Scope-of-Work

There are five main aspects to the project: project framing, data mining and analysis, modeling assessment, data gaps, and recommendations. Each is summarized below with the necessary scope-of-work.

Project framing
The initial desk study of this project will lead to a conceptual framework for each geographic unit of interest. We will use the scientific literature to generate conceptual models of contaminant pathways for the local and watershed scale units. We will summarize the chemicals or chemical groups of interest to Ecology. For this we will use the list of persistent, bioaccumulative toxics (PBTs) and the list of regulated chemicals under Washington State's Water Quality Standards for Surface Waters for the protection of human health and aquatic life (WAC173-201A section 240). In addition, we will assess importance of the chemicals, based on 303(d) listings and those chemicals predominant in discharge effluent of NPDES permit holders.

Data mining and analysis
Many projects and existing databases can provide meaningful data on atmospheric deposition of toxics to Washington waters. Some of these include:

- Mercury Deposition Network (Washington/BC have 4 sites; only 1 is active)
- King County's Air deposition project (Bulk deposition in the Seattle region; Colton et al., 2013)
- Ecology's EIM system (data on fish and sediments from lakes in undeveloped watersheds)
- Western Airborne Contaminant Assessment Project (Landers et al., 2008)
- Ecology's PBT Monitoring Program: Contaminants in Sediment Cores
- Internal memo (Era-Miller, 2011) on the atmospheric deposition of polychlorinated biphenyls (PCBs), polybrominated diphenyl ethers (PBDEs), dioxin/furans (PCDD/Fs) and mercury

In assessing the available data, we will use statistical techniques to summarize the variability and accuracy of local air deposition measurements, to determine the utility of this data towards a variance in the water quality standards.

Modeling assessment
A variety of environmental models could be useful, should this project proceed past the Phase 1 scoping efforts. Models include:

- Atmospheric: local emissions and transport models for known urban emissions; back-trajectory cluster analysis modeling for source regions, e.g., Landers et al. (2008).
- Hydrodynamic and load models: these models are complex frameworks describing entire watersheds, e.g., EPA's Hydrologic Simulation Program (Bicknell et al. 1997) and Ecology's QUAL2K (Pelletier et al., 2006).
- Contaminant transport and fate: generally simple spreadsheet box models or mass budget models for fate and transport of chemicals in lakes or estuaries, e.g. Davis (2004).

Currently, no known single model describes the deposition of toxics from the atmosphere, through the landscape, and into surface waters. The utility of modeling will therefore depend on the ability to combine and link various models described above, to predict and simulate the pathway from atmosphere to water. We will consult with internal and external modeling groups who can recommend modeling possibilities for future consideration.

Data gaps
An ambitious field program will be necessary for properly characterizing different scales of atmospheric deposition. Each geographic scale (local, regional, and statewide) will likely require a tailored approach to assess temporal and spatial variability of atmospheric deposition. In addition, different techniques, e.g., passive samplers or large volume samplers, may be more applicable to certain toxics. This portion of the review will identify the current data gaps and suggestions for appropriate collection and sampling programs.

We will consult with external groups on existing monitoring programs and the scientific literature, to generate a broad outline of the necessary field program. We will also explore potential collaboration and resource cost-sharing. Sufficient detail will be included to allow for the fieldwork to be incorporated into an EAP Project Request.

Recommendations
This review will conclude with recommendations as to whether atmospheric deposition can be quantified with enough certainty to be applicable at these levels:

- Local level (relevant to variances applied to an NPDES permit).
- Regional level (relevant to assessing atmospheric deposition in the context of a TMDL).
- Statewide level (relevant to assessing regional depositional patterns and in-state vs. out-of-state contributions of toxics).

Schedule

Product

Final Report		
Product lead	Will Hobbs	
Schedule		
Draft due to supervisor	April 2015	
Draft due to client	May 2015	
Final report	June 2015	

References

Bicknell, B.R., J.C. Imhoff, J.L. Kittle, Jr., A.S. Donigian, Jr., and R.C. Johanson. 1997. Hydrological Simulation Program--Fortran, User's manual for version 11: U.S. Environmental Protection Agency, National Exposure Research Laboratory, Athens, Ga., EPA/600/R-97/080, 755 p.

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