

Hydroqual Proposal Refinement of Conceptual System Model

N.R. Grosso, DuPont
South River Science Team Meeting
November 10, 2004

Conceptual System Model (CSM)



- CSM is a representation of potential:

- contaminant sources
- contaminant migration pathways
- exposure routes
- receptors

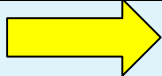

- How is it used?

- To provide a framework for identifying potential sources and significant processes
- To guide problem formulation
- To resolve conflicting data
- To define management objectives
- To identify sources of uncertainty in analysis
- To guide remedial planning

CSM for a River System includes complexities:

- **The environmental setting, sediment type and hydrology/hydraulics**
- **Constituents of potential concern**
- **Potential receptors and endpoints of concern**
- **Potential pathways of contaminant migration and potential routes of exposure**
- **Potential contaminant sources and sinks**
- **Nature and spatial extent of contamination**
- **Likely sediment erosion and sediment deposition areas**
- **Chemical, physical and biological processes relevant to contaminant fate and transport**
- **Relevant mechanisms for contaminant flux** (diffusion, advection, resuspension and desorption)
- **Bioaccessibility of contaminants**
- **Fraction of the contaminants that are bioavailable**
- **Temporal variations of the system**
- **Bioaccumulation potential of the contaminants**
- **Degree of interaction with the broader surface water setting and watershed**
- **Potential sources outside of the defined site that will confound the site problem**

Summary CSM - South River

| Potential Primary And Secondary Sources |  Release/transport Mechanisms | Potential Sources/ Exposure Media |  Exposure Routes | Potential Receptor |
|---|--|---|---|--|
| <p>Waynesboro Plant Hg Recovery Unit (1929-1950)</p> <p>Soil, Storm Sewers, River Bank Soils, Groundwater, Permitted Outfalls</p> <p>Municipal Landfill, WTP, Sewage Disposal</p> <p>Other Industry Atmospheric (ambient)</p> | <p>Spills, Combustion</p> <p>Leaching, Stormwater Runoff, Surface water flow, Sediment movement, Storm events, Biogeo-Chemical changes</p> | <p>Soils</p> <p>Surface Water, Sediments, Wetland areas, Mill Ponds, Isolated Pools, Floodplain Soils, Upland Soils</p> | <p>Direct: Ingestion, Inhalation, Dermal</p> <p>Indirect: Food (fish) Bioaccumulation</p> <p>Direct: Ingestion, Inhalation, Dermal</p> | <p>Workers</p> <p>Recreational Users, Residents, Livestock, Ecological: aquatic; terrestrial</p> |

Programs on the South River to characterize complexities (ongoing or proposed)

- Source Evaluation
 - Hg in Surface Sediments
 - Water Column Hg
 - Soil/Sediment Cores
 - Floodplain Studies
 - Corbicula Studies
 - Storm water investigation
 - Atmospheric Deposition
- Exposure Pathways
 - Fish tissue
 - Fish Diet
 - Land use survey
 - Vegetable Uptake Studies
- Contaminant Migration/Processes
 - Geomorphology
 - Major cation/anions
 - Flow and TSS analysis
 - Shake and Bake
 - Hg speciation in media
- Receptor Analysis
 - Creel Study
 - Bird Exposure Study

Objectives of Proposed Hydroqual Work

- Integrate historic and current data
- Refine the current Conceptual System Model with respect to:
 - water and sediment balance in the South River
 - mass and distribution of mercury in the system
- Identify Critical Data Gaps and Recommend actions to fill critical data gaps

Scope of Hydroqual's Proposed Work

- Refine current CSM
- Work closely with other experts on the team to effectively integrate data and knowledge into a refined CSM (***Conceptual System Model Task Team***)
- Recommend actions to focus our understanding of significant pathways
- Consult on TMDL development issues

Hydroqual's Proposal

- Phase I - Refine Conceptual System Model
- Phase II - (need TBD) Detailed Model of Mercury fate, transport and bioaccumulation

Note that efforts will not be redundant with the TMDL modeling process. The intent is to work closely with USGS and VA DEQ.

Hydroqual's Proposal

- Phase I - Refine Conceptual System Model
 - Task 1: Data Review and Analysis
 - Task 2: Review current hypotheses of Potential Source through Receptor Pathways
 - Task 3: Evaluate Potential Source through Receptor Pathways using a simple analysis framework (analytical analysis)
 - Task 4: Identify Data Gaps and Recommend Data Needs

Process will be iterative and interactive for Tasks 2, 3 and 4

Tentative Schedule

- 1Q 2005 GIS Database Completed
- 2Q 2005 CSM refinement begins
 - Hydroqual Data Review
 - Meet with Hydroqual to review current Working Hypotheses and ongoing work and discuss data
- 3Q 2005
 - First draft CSM refinement
 - Critical Data Gaps Identified
 - Outline a (phased) workplan for filling data gaps (3Q or 4 Q)