RISK ASSESSMENT CONTRIBUTIONS OF MITHE-RN PROJECTS: AQUATIC ECOSYSTEMS THEME[a]

Project[b]	**Direct Use**	**Support / Inferential Use**	**Confidence Building**	**General Comments**
A1 Pyle and Wood *Generation and Field Validation of Chronic BLMs for Fish*	Predicting bioavailability and toxicity	Potential mechanistic explanation for ecological field observations Contributes to understanding of gut uptake by humans of metals other than Hg	*Scientific:* Increased reliability / utility of the biotic ligand model (BLM) predictions Increased ecological relevance *Public:* Linkage between environmental risk assessment (ERA) and human health risk assessment (HHRA) – potential effects to humans in North depending on fish for sustenance;	These PIs are building on the BLM in three critical areas: chronic responses, gut BLM and chemosensory BLM. This research is expected to increase the utility and predictive power of the BLM for freshwater fish. It could be enhanced by extension to other fish species once this work is done; the linkage with HHRA could also be enhanced even though this research is primarily ecological

[a] Does not include A3 Chakrabarti Integrations of Geochemical Speciation, Chronic Toxicity Tests and In-Situ Field Bioassays for Predicting the Ecotoxicity of Mine Effluents Using BLM Approaches-Project terminated and did not provide information useful for ERA prior to termination.
[b] Project descriptions are available on the MITHE website under 'Research Activities'

			Development of chronic BLM so that effects can be determined before fish die	
A2 Wilkie *Multiple Metal Interactions with Fish Gills and with Natural Organic Matter*	Data on toxicity of individual metals and mixtures to a variety of freshwater fish species	Utility of additivity model for predicting metals toxicity Environmental factors mediating metals bioavailability in natural waters	*Scientific:* Empirical verification of metal sensitivity relative to water hardness Improved mechanistic understanding resulting in improved water quality guidelines	This PI is investigating toxic responses of fish to metal mixtures, but is restricting his work to Pb and Cd; inclusion of other metals and more than two metals in a mixture would be desirable in future. An interesting paradox in terms of BLM predictions relative to Cd and Pb binding to gills will be investigated.
A4 Dixon *ERA of Metals in Water and Sediment: Importance of Dietary Uptake and Water-Sediment Interactions to Hyalella azteca*	Toxicity data for uranium (U) and other metals Water and sediment quality guidelines for U	Relative importance of diet and water to invertebrate tissue metals and toxicity	*Scientific:* Improved understanding of metal toxicity mechanisms, which may result in revisions to water and sediment quality guidelines The modeling of multiple biotic sites provides a relatively high	This PI is determining sediment and water quality guidelines for U as well as determining the relative importance of dietary and waterborne metals uptake to aquatic invertebrates using a model organism. This work provides the basis for extending this work to different aquatic invertebrates; it would be particularly useful to extend this work to a sediment-dwelling organism (e.g., chironomids).

			degree of realism and may well provide better mechanistic information than single site modeling (e.g., the BLM).	
A5 Hare *Metal Transfer Along Aquatic Food Chains*	Improved BLM predictions for screening	Determination / explanation of taxonomic differences in metal bio-accumulation and sensitivity Predictions of food chain metals movements Relative importance of food versus water exposures. Improvements to current models used to calculate metal speciation (e.g., WHAM).	*Scientific:* Mechanistic understanding / quantification of metals uptake and movement along food chains Basic information relevant to water quality criteria *Public:* Food-chain information links ERA & HHRA	This team is conducting very sophisticated food chain metals uptake research including subcellular partitioning of metals. Effectively this research is investigating not just bioavailability but also bioreactivity (i.e., mobility / availability of metals in organisms). The food chain being used includes algae, invertebrates and fish. This work is focused on four metals: Cd, Ni, Se, Tl.
A6 Hontela *Impact of Selenium on the Aquatic Biota in the Prairie Ecosystems*	Acute toxicity data for different fish species Se concentrations in and from different sources for both ERA	Mechanistic understanding of differences in fish species sensitivities to Se Importance of	*Scientific:* Basic research into Se sources and potential effects *Public:* Food-	This PI is conducting an ambitious program into Se exposure, potential effects and potential impacts in various areas. The research has good potential but more focus is needed; getting a handle on what has been proposed is going to be enough in the next couple of years without

	and HHRA	irrigation as a source of Se to aquatic ecosystems	chain information links ERA & HHRA	additional work
A7 Petrie *Food-Chain Transfer and Effects of Selenium in Waterfowl*	Concentrations of Se and other contaminants in Great Lakes invertebrates and waterfowl	Food chain linkages between Se in invertebrates and waterfowl	*Scientific:* Regional / continental study of potential contamination effects (migratory waterfowl) Determination whether or not waterfowl declines are due to Se uptake via zebra mussels	This is interesting research as the key issue regarding Se uptake by adult waterfowl is the potential for reproductive effects to developing embryos in eggs. The team is encouraged to consider and determine the exposure and chemical speciation of selenium taken up from zebra mussels and other dietary sources.
A8 McGeer and Vigneault *Applicability of BLM and Critical Residue Approaches to Canadian Shield Condition*	Species sensitivity data for Canadian Shield species (low hardness waters) Toxicity (BLM) predictions for low hardness waters	Mechanistic understanding of metals uptake and toxicity in low hardness waters Data for non-standard test species (i.e., increased potential site-specific relevance)	*Scientific:* Better understanding the breadth of applicability of the BLM. If hypotheses supported, increased support for world-wide use of the BLM	These PIs are filling a major data gap, specifically metals uptake and effects in waters of low hardness. They are working on the Canadian Shield but this is not the only area with low hardness waters (e.g., NWT, Nunavut; northern Europe). Studies will focus on Cu, Cd and possibly Ni. This research is just being initiated so it is too early to suggest what else might be done if this work goes well.
A9 Wilkinson *Is the BLM an Appropriate Model for Multiple Metal Stressors?*	Application of BLM to metal mixtures in soft waters.	Relationships between bio-accumulation and toxicity Predictions of bio-	*Scientific:* Better understanding of how to apply the BLM to mixtures of metals with	This research complements the work of McGeer and Vigneault by assessing metals in combination rather than singly. This research, which is just beginning, will initially focus on Cd or Ni. As per A8, this research is too new to

		accumulation in low hardness waters	either similar or different modes of action.	suggest what else might be done if this work goes well.