20th Annual General Meeting and Conference

20 Years in the Making: Reflecting on Our Past and Working Towards a Greener Future

June 19th, 2015, Ottawa, ON

Laurentian SETAC
Laurentian Chapter of the Society of Environmental Toxicology and Chemistry
20 YEARS 1995-2015

CONFERENCE PROGRAM

Friday, June 19th, 2015

Time	Location	Schedule Item
8:00 – 8:30	**Desmarais Room 1130**	***Registration***
	Room 4101	*Poster set-up*
8:30 – 8:40	**Desmarais Room 1130**	***Opening Remarks***
8:40 –9:25	**Desmarais Room 1130**	***Neuroendocrine disruption: More than hormones are upset by environmental contaminants*** Dr. Vance L. Trudeau Department of Biology, University of Ottawa, Ottawa ON
9:25 - 10:10	**Desmarais Room 1130**	***Water Quality Then and Now: Experience from the past and new ideas guide integrated study design*** Dr. John Purdy Abacus Consulting Services Ltd. Campbellville, ON
10:10– 10:40	**Desmarais Room 4101**	***Posters*** *and Morning Break* *(Student poster judging)*
10:40 – 11:25	**Desmarais Room 1130**	***The last 20 Years of Ecological Risk Assessment: What have we learned and what do we need to learn?*** Mark Bonnell Ecological Assessment Division, Environment Canada, Gatineau, QC
11:25 - 12:00	**Desmarais Room 1130**	***Annual General Meeting*** & SETAC North America updates

CONFERENCE PROGRAM (cont'd)

Friday, June 19th, 2015

Time	Location	Schedule Item
12:00 - 1:00	**Desmarais Room 4101**	***Lunch***
1:00 - 2:30	**CAREG 20 Marie-Curie**	***Lab Tour: Center for Advanced Research in Environmental Genomics***
2:30- 2:50	**Desmarais Rooms 1130 & 3105**	***Concurrent Platform Presentations*** **Sessions A & B**
2:50 - 3:10		
3:10 - 3:50	**Desmarais Room 4101**	***Posters*** *and Afternoon Break* (Student poster judging)
3:50 - 4:00		***Book Draw***
4:00 - 4:20	**Desmarais Rooms 1130 & 3105**	***Concurrent Platform Presentations*** **Sessions C & D**
4:20 - 4:40		
4:40 – 5:00		
5:00- 6:00	**Desmarais Room 1130**	***Student Judges meet***
	Room 1401	*Take down posters*
6:00 - 9:00	**Café Nostalgica**	***Student Awards Social and Dinner***

Platform Presentations

Time	Session A: Environmental Protection Desmarais Room 1130
2:30 - 2:50	**Evaluating inorganic Water Quality Guidelines for aquatic risk assessments – Are they appropriate for amphibians?** Thackeray, Nicole[1], Ruth N. Hull[1], Christine Moore[2] & Lisa Marshall[2] [1]Intrinsik Environmental Sciences Inc., Mississauga, ON [2]Intrinsik Environmental Sciences Inc., Halifax, NS
2:50 - 3:10	**Reviewing the Pest Management Regulatory Agency's approach to protecting habitats from agricultural pesticide use** Crawford, Lindsay[1,2], Tim MacDonald[1], David Stubina[1] & Lars Juergensen[1] [1]Pest Management Regulatory Agency, Health Canada, Ottawa, ON [2]Science Policy Fellowship Program, Canadian Institutes of Health Research

Platform Presentations

Time	Session B: Human Exposure Desmarais Room 3105
2:30 - 2:50	**Particulate matters!** Lee, Derek, Henry Yee, Paul H. Cheung & Glenn Ferguson Intrinsik Environmental Sciences, Mississauga, ON
2:50 - 3:10	**Two layers of PUF needed in indoor fate models for organic chemicals** Webster, Eva M., Anna Krol & Miriam Diamond Department of Earth Sciences, University of Toronto, Toronto ON

Platform Presentations

Time	Session C: Organic Fate and Toxicity Desmarais Room 1130
4:00 - 4:20	**Updated aquatic hazard characterization of a POEA surfactant** Rodriguez-Gil, Jose Luis[1], Ryan Prosser[1], Kim Mahon[2], Gregory Hanta[1], David Poirier[2], Linda Lissemore[3], Mark Hanson[4] & Keith Solomon[1] [1]Centre for Toxicology, School of Environmental Sciences, University of Guelph, Guelph, ON; [2]Ontario Ministry of the Environment and Climate Change, Aquatic Toxicology Unit, Toronto, ON; [3]Laboratory Services Division, University of Guelph, Guelph, ON; [4]Department of Environment and Geography, University of Manitoba, Winnipeg, MB
4:20 - 4:40	**Determination of the genotoxicity of substituted phenylamine antioxidants using the single cell gel electrophoresis assay** Gilroy, Ève A.M.[1,2], Sheena D. Campbell[1], Vimal K. Balakrishnan[3], Patricia L. Gillis[3], Ryan S. Prosser[3] & Shane R. de Solla[2] [1]Green House Science, Burlington, ON; [2]Ecotoxicology and Wildlife Health Division, Environment Canada, Burlington, ON; [3]Aquatic Contaminants Research Division, Environment Canada, Burlington, ON
4:40 - 5:00	**Stopping migration of oily liquids in sediments: Oleophilic clay treatability testing on NAPL** Béchard, Karen, Matt Vanderkooy &Tom Krug Geosyntec Consultants, Inc., Guelph, ON

Platform Presentations

Time	Session D: Inorganic Fate and Toxicity Desmarais Room 3105
4:00 - 4:20	**Examining the historical trends in diet and contaminant exposure in a 4,000-year-old bat guano deposit from Jamaica** *Gallant, Lauren R.[1], Chris Grooms[2], Linda E. Kimpe[1], John P. Smol[2], Wieslaw Bogdanowicz[3], Stefan Stewart[4] & Jules M. Blais[1] [1]Department of Biology, University of Ottawa, Ottawa, ON; [2]Department of Biology, Queen's University, Kingston, ON; [3]Museum and Institute of Zoology, PAS Wilcza, Warsaw, Poland; [4]Jamaican Caves Organization, Ewarton, Jamaica
4:20 - 4:40	**Environmental fate of silver nanoparticles in boreal lake ecosystems** Furtado, Lindsay M.[1], Beth C. Norman[2], Marguerite A. Xenopoulos[2], Paul C. Frost[2], Chris D. Metcalfe[1] & Holger Hintelmann[1] [1]Water Quality Center, [2]Biology Department, Trent University, Peterborough, ON
4:40 - 5:00	**Nanosilver-mediated changes in human intestinal microbiota** Das, Pranab[1], Julie A. K. McDonald[2], Elaine O. Petrof[2], Emma Allen-Vercoe[3] & Virginia K. Walker[1,4] [1]Department of Biology, Queen's University, Kingston, ON; [2]Department of Medicine, Kingston General Hospital, Queen's University, Kingston, ON; [3]Department of Molecular and Cellular Biology, University of Guelph, Guelph, ON; [4]School of Environmental Studies, Queen's University, Kingston, ON

*** Student presentation**

List of Poster Presentations

Cyanobacteria north of 60º
*Alambo, Katherine[1], Shinjini Pal[1], Frances Pick[1] & John Chetelat[2]
[1]Department of Biology, University of Ottawa, Ottawa, ON
[2]National Wildlife Research Centre, Environment Canada, Ottawa, ON

Development of Groundwater and Soil Vapour Quality Guidelines adds to suite of Canadian Environmental Quality Guidelines for use at contaminated sites
Allaway, Chris
National Guidelines and Standards Office, Environment Canada, Gatineau, QC

Risk assessment of inorganic substances under the Chemicals Management Plan: Current and future initiatives
Bouwhuis, Rachel, Marie-Claude Sauvé, Joël Gauthier, Anne Gosselin & Olivier Marois
Ecological Assessment Division, Environment Canada, Gatineau, QC

Aquatic and terrestrial toxicity testing of Quinoline to generate data for Federal Environmental Quality Guideline development
El-Fityani, Tamzin[1], Pam Howes[2] & Tam Vo[2]
[1]National Guidelines and Standards Office, Environment Canada, Gatineau, QC
[2]Maxxam Analytics, Ecotoxicology Group, Burnaby, BC

Evaluating the effectiveness of PMRA's implementation of Virtual Elimination Policies for contaminants: Case study for hexachlorobenzene (HCB)
Philip Sangster, Michelle Kivi & Izadi, Vedad
Environmental Assessment Directorate, Pest Management Regulatory Agency, Health Canada, Ottawa, ON

Estimation of veterinary drug concentrations in Canadian soils: Do the PECs MEC Sense?
Andrew Belknap & Kullik, Sigrun
Environmental Impact Initiative Division, Health Canada, Ottawa, ON

Investigating adipogenic properties of short-chain chlorinated paraffins and pentachlorophenol in 3T3-L1 preadipocytes
Lam, Enoch & Laurie HM Chan
Department of Biology, University of Ottawa, Ottawa ON

*** Student presentation**

List of Poster Presentations (cont'd)

Planning the third phase of the Canadian Chemicals Management Plan
Lander, Lesley & Sarah Vanden Hoven
Ecological Assessment Division, Environment Canada, Gatineau, QC

Proteome expression analysis of generational effects of Bisphenol-A on rainbow trout
Laura Dindia[1], Oana Birceanu[1], Adam Masson[1], Mathilakath Vijayan[2] & McConkey, Brendan[1]
[1]Department of Biology, University of Waterloo, Waterloo, ON
[2]Department of Biological Sciences, University of Calgary, Calgary, AB

Assessing the toxicity of quantum dot nanoparticles in *Zea mays*
*Noguera-Oviedo, Katia , Zuqin Xue, Chris Milleville, Luis Colon, David Watson & Diana S. Aga
Department of Chemistry, University at Buffalo, Buffalo, NY

An examination of pesticide levels in Canadian groundwater and the tools used to predict their presence
P. Sangster, J. Villeneuve & Nwobu-Nnebe, Ogo
Environmental Assessment Directorate, Pest Management Regulatory Agency, Health Canada, Ottawa, ON

Effect of herbicide surfactant, polyethoxylated tallow amine, on oviposition and viability of eggs of rams-horn snail, *Planorbella pilsbryi*
Prosser, R.S.[1], J.L. Rodriguez-Gil[1], P.K. Sibley[1], K.R. Solomon[1] & D. Poirier[2]
[1]School of Environmental Sciences, University of Guelph, Guelph, ON
[2]Aquatic Toxicology Unit, Ontario Ministry of Environment, Toronto, ON

PCB toxicity of Lyons Creek sediments in comparison to historical trends
*Stevack, Kathleen[1], David Poirier[2] & Paul Sibley[1]
[1]University of Guelph, Guelph, ON
[2]Laboratory Services Branch, Ministry of the Environment & Climate Change, Toronto, ON

*** Student presentation**

Plenary Speakers

(Desmarais Room 1130)

The last 20 years of Ecological Risk Assessment: What have we learned and what do we need to learn?

Mark Bonnell

Ecological Assessment Division, Environment Canada, Gatineau, QC

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Not only is the Laurentian Chapter of SETAC now 20 years old, the field of ecological risk assessment is 20 years the wiser as well. During these years there have been some important developments in ecological risk assessment both to the way assessment is conducted and to the way we derive data for assessment. Over a decade ago in Canada and elsewhere such as the European Union, the public demanded quick action on toxic substances contained in domestic chemical inventories. The regulatory, academic and industrial communities responded by moving from detailed multi-year assessments on data-rich legacy contaminants to screening-level assessments for the multitude of lesser-studied chemicals or groups of chemicals. Interestingly, when one examines the inventory of industrial chemicals in commerce today (or pharmaceuticals or personal care products), most have little or no environmental data. The traditional approach of animal testing to fill data gaps, however, is not sustainable or viable given the large number of existing and new chemicals to be assessed, testing costs and the global push to reduce vertebrate animal testing. Alternative data strategies have thus arisen to meet the need for assessment data as well global expert groups on non-animal testing methods. All of these factors have had an impact on the way regulatory and non-regulatory risk assessment is conducted today and so it is useful to examine what has changed from the generally well-known baseline of ecological risk assessment and where we need to go next. Here we will focus on aspects of predictive bench-scale risk assessment, given there are far more data-poor risk assessments conducted globally from the desktop compared with those conducted at the site-specific level. However, in principle, this discussion applies to both scales.

Water Quality Then and Now: Experience from the past and new ideas guide integrated study design

Dr. John Purdy

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Water quality measurement has been a driving force in the evolution of analytical chemistry instrumentation. The science has sought ever more sensitive and reliable instruments and along the way many curious surprises were encountered. It's still happening and we still face both new and old challenges, in the lab and in field sampling methods. There is still the challenge of understanding results from grab samples collected after an ecological event, but there are also surprising new challenges with the latest instrumentation. I will talk about older methods and the false positives, detector drift etc., matrix effects, non-extractable substances and conjugates as an introduction. I will then talk about a modern study design and results, and the novel concept of using the risk quotient to set the limit of detection to avoid wasting resources by analyzing to the limit of the instrument capability. I'll touch on the use of the Druckrey-Kupfmuller equation in fish toxicity and bring it together into an integrated experimental design. Some old and new stories will be shared with some examples, and the challenge of communicating the results to people outside the world of analytical chemistry will be addressed.

Neuroendocrine Disruption: More than hormones are upset by environmental contaminants

Dr. Vance L. Trudeau

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Key Words: hormones, fish, neuroendocrine, neuroactivity, reproduction, stress

Industrial pollutants, agricultural pesticides, pharmaceuticals and other chemicals are now ubiquitously present in the environment. This includes contamination at all levels, from water to soil to air to animal and human tissues. We have proposed that the term 'neuroendocrine disruption' extends the concept of endocrine disruption to include the full breadth of integrative animal physiology. Disruption to homeostatic mechanisms by environmental pollutants can affect an animal's ability to undergo reproduction or develop normally, and may lead to transgenerational deficits. Complex effluents from pulp and paper processing contain an array of neuroactive phytochemicals that may lead to disrupted spawning, largely as a result of female-specific neuroendocrine effects. Antidepressants such as fluoxetine are environmental contaminants that disrupt reproduction, behaviour and metabolism in teleost fish, demonstrating the complex and pervasive effects of neuroactive pollutants. Together, these data indicate that waterborne pollutants have a range of effects on neuroendocrine systems that may not involve toxic responses. Much like endocrine disruption is very different from classical toxicology, neuroendocrine disruption is distinguishable from neurotoxicology. Neurotoxicologists may study chemical insults and mechanisms underlying subsequent neuronal cell death, which can eventually lead to the failure of key regulatory systems and then death to exposed individuals. However, the consequences of disrupting the complex neurohormonal brain-pituitary-target organ communication systems are within the domain of neuroendocrine disruption.

Supported by NSERC and University of Ottawa Research Chair program

Platform Presentations

(in alphabetical order by family name of presenter)

Stopping migration of oily liquids in sediments: oleophilic clay treatability testing on NAPL

Béchard, Karen, Matt Vanderkooy &Tom Krug

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Reviewing the Pest Management Regulatory Agency's approach to protecting habitats from agricultural pesticide use

Crawford, Lindsay[1,2], Tim MacDonald[1], David Stubina[1] & Lars Juergensen[1]

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Key Words: agro-ecosystems, best management practices, mitigation, spray drift

Before a pesticide product is approved for use in Canada, Health Canada's Pest Management Regulatory Agency (PMRA) assesses potential environmental risks to non-target organisms and their habitats from the use of that pesticide. When potential risks are identified, mitigation measures are required to reduce the risks to acceptable levels. Stakeholders have raised concerns, indicating that PMRA's current approach to protecting non-target habitats from the use of pesticides may unintentionally be acting as a disincentive to the protection of existing habitats and the creation of new habitats in agricultural landscapes. Since 2008, several initiatives have been aimed at improving PMRA's approach to protecting habitats.

Current efforts build upon previous work. Following a policy analysis framework, the main issues regarding PMRA's current approach to protecting habitats from pesticides were identified. An issue analysis was conducted and used to identify a number of potentially suitable policy instruments. The recommended next steps include focusing efforts on clarification and establishing crucial baseline information to better inform future option development. The development of new publications and tools, along with the establishment of capacity-building programs will help ensure the successful delivery and implementation of any new initiatives.

Nanosilver-mediated changes in human intestinal microbiota

Das, Pranab[1], Julie A. K. McDonald[2], Elaine O. Petrof[2], Emma Allen-Vercoe[3] & Virginia K. Walker[1,4]

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Key Words: nanosilver, intestinal microbiota, 454-pyrosequencing, fatty acid methyl esters

The implications of the widespread use of nanosilver particles (AgNPs) on species found at various trophic levels have been explored. However, little is known about their impact on the microbiota of organisms. Here we have investigated the effects of AgNPs on a defined bacterial community established from the collected stool of a healthy human donor. The anaerobic consortium was exposed to several concentrations of AgNPs (10 nm) at concentrations ranging from 0 – 200 mg/L for 48 h. Nanosilver had a negative impact on bacterial respiration, as evidenced by a significant reduction (~22%) at the highest AgNP concentration compared to control cultures, as well as significant ($p < 0.05$) changes in fatty acid methyl ester profiles even at the lowest AgNP concentration tested (25 mg/L). DNA analysis confirmed these observations; cluster analysis of PCR-denaturing gradient gel electrophoresis profiles revealed differences in bacterial diversity between AgNP and control treatments. DNA sequencing further revealed that the bacterial phylogenetic assemblage was significantly ($p < 0.01$) affected after 48 h incubation with AgNPs. Ionic silver was also antibacterial, but all four toxicity profiles were distinct from those obtained with AgNPs, indicating that a component of the impact was nano size-dependent. Currently we are investigating interactions with antibiotics. Although these are *in vitro* experiments, we nevertheless worry that nanosilver ingestion, either deliberate or inadvertent, could have a negative impact on our intestinal microbiota, with an unknown effect on our overall health.

Environmental fate of silver nanoparticles in boreal lake ecosystems

Furtado, Lindsay M.[1+], Beth C. Norman[2++], Marguerite A. Xenopoulos[2], Paul C. Frost[2], Chris D. Metcalfe[1] & Holger Hintelmann[1]

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Key Words: nanomaterials, silver, mesocosms, fate

Silver nanoparticles (AgNPs) are currently the most commonly used nanoparticles in consumer products, yet their environmental fate in natural waters is poorly understood. In the present study, we investigated the persistence, transformations and distribution of polyvinylpyrrolidone-coated (PVP) and citrate-coated (CT) AgNPs in boreal lake mesocosms dosed with a 6-week chronic regimen. Total Ag (TAg) concentrations reached ~40% of target concentrations by the end of the experiment. Sediments and periphyton on the mesocosm walls were important sinks for Ag. We found little effect of AgNP loading or surface coating on the persistence of TAg. There were also no differences between treatments in the degree of agglomeration of AgNPs, as indicated by the accumulation and distribution of Ag in the particulate and colloidal fractions. The low ionic strength and relatively high dissolved organic carbon concentrations in the lake water likely contributed to the relative stability of AgNP in the water column. The low concentrations of dissolved Ag ion (<1 µg L^{-1}) in the size fraction < 3 kDA reflect the importance of natural ligands in controlling the concentrations of Ag ions released by dissolution of AgNPs. Overall, these data indicate that AgNPs are relatively stable in our tested lake environment and appear to result in quantities of highly toxic ionic Ag^{+} that are below our limit of detection.

Examining the historical trends in diet and contaminant exposure in a 4,000-year-old bat guano deposit from Jamaica

Gallant, Lauren R.[1], Chris Grooms[2], Linda E. Kimpe[1], John P. Smol[2], Wieslaw Bogdanowicz[3], Stefan Stewart[4] & Jules M. Blais[1]

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Key Words: bats, stable isotopes, metals, historical trends

Bats are excellent ecological indicators owing to their long life span, global distribution, and predictable responses to environmental stressors. Bats play important roles in pollination, seed dispersal, and insect population control and thus it is important to understand how bats are affected by contaminants. This information may be used for biomonitoring and chemical regulation programs. Bat guano deposits are of particular use as they may serve as environmental archives; the cave environment preserves stable isotopes and metals, allowing for the reconstruction of historical dietary and contaminant exposure trends. Our research provides the rare opportunity to examine a 4,000-year-old bat guano deposit from Jamaica, one of the few remaining guano deposits unaltered by human exploration or exploitation. We present a triple isotopic approach to determining long-term dietary trends in bat guano. Preliminary results suggest that this 4,000-year-old bat guano core is tracking a change in stable isotopes associated with the agricultural history of Jamaica. We also present the long-term changes in metals and Pb isotope composition within this bat guano deposit associated with contaminant exposure in relation to the timing of different anthropogenic activities. Periods of increased atmospheric emissions of metals resulted in an increase in metal concentrations within this bat guano deposit. For example, lead increased in the guano deposit during the Industrial Revolution and increased exponentially with the introduction of leaded gasoline.

Determination of the genotoxicity of substituted phenylamine antioxidants using the single cell gel electrophoresis assay

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Key Words: comet assay, freshwater mussel, genotoxicity, substituted phenylamine antioxidants

Substituted phenylamine antioxidants (SPAs) are high volume chemicals with a variety of uses, including: dye formulations, photosensitizers, lubricant antioxidants, viscosity improvers, dispersants, generating scale disposition preventers, and generating adhesives. SPAs are considered persistent, bioaccumulative and inherently toxic, and hence are under evaluation by Environment Canada's Chemicals Management Plan (CMP) to assess the environmental risks associated with their commerce in Canada.

The single cell gel electrophoresis (or "comet") assay is used to visualize and quantify cellular DNA strand breaks. Under alkaline conditions, damage to DNA causes supercoils to relax and migrate towards the anode, while undamaged DNA, due to its large size and lack of free ends, do not. In the present study, the comet assay was used to assess the *in vitro* genotoxicity of SPAs in the haemolymph of the freshwater mussel *Elliptio dilatata*. The haemolymph was exposed to a control, solvent control, and 0.00005 to 50 mg/L of N-phenyl-1-naphthylamine, N-(1,3-dimethylbutyl)-N-phenyl-1,4-phenyldiamine, and 4-4'-methylene-bis[N-sec-butylaniline] in duplicate for four hours. Following exposure, total haemocyte count and cell viability were quantified by flow cytometry, and for each compound, three concentrations below those causing cell mortality were selected and processed using the comet assay. Fifty cells were digitized per replicate and processed. The percent DNA damage in the tail was calculated. Preliminary results indicate that *in vitro* exposure to all three SPAs caused significant increases in DNA strand breaks at concentrations varying between 0.05 and 5 mg/L. Studies are under way to determine whether chronic, whole-organism exposure to these compounds induces similar DNA damage in the haemolymph of freshwater mussels.

Particulate matters!

Lee, Derek, Henry Yee, Paul H. Cheung & Glenn Ferguson

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Key Words: particulate matter, emissions, ultrafine particles, human health

Our understanding of human health effects from the inhalation of particulate matter has evolved from only evaluating total suspended particulate (TSP) to evaluating potential health effects from smaller particulate matter. With improved understanding of particulate matter toxicity, there has been greater focus on the overall health effects associated with the inhalation of smaller particles with diameters of 10 and 2.5 micrometres (*i.e.,* PM_{10} and $PM_{2.5}$). Many health and environmental regulatory agencies have recognized that these finer airborne particulates are detrimental to human health. As such, air quality standards and regulations have been implemented to monitor concentrations in ambient air from sources such as vehicles, industrial processes, or combustion activities. However, with the increasing concern for ultrafine particles (UFPs), our focus should again be shifted to evaluate even smaller particles. UFPs, which are small airborne particles with a diameter of 0.1 micrometres or less, are primarily emitted from motor vehicles. Currently, there are no air quality standards from health or environmental regulatory agencies aimed at regulating UFP concentrations in ambient air. A review of toxicological studies was conducted to understand the current knowledge of human health effects associated with the inhalation of UFPs and to identify data gaps. This review suggested that more exposure studies should be conducted and that there is an apparent need for continual research on UFPs in order to provide a basis for the discussion of future air quality standards.

Updated aquatic hazard characterization of a POEA surfactant

Rodriguez-Gil, Jose Luis[1], Ryan Prosser[1], Kim Mahon[2], Gregory Hanta[1], David Poirier[2], Linda Lissemore[3], Mark Hanson[4] & Keith Solomon[1]

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Keywords: MON0818, POEA, exposure, toxicity, hazard

Mixtures of polyoxyethylene tallow amines (POEA) are commonly used as adjuvants in commercial herbicide formulations containing glyphosate, such us Roundup®. Since the 1980s they have been understood as the main driver for the toxicity of these formulated products to aquatic organisms, leading to the prohibition of their use on over-water applications. In this study, newly developed analytical methods were used in order to update the characterization of the actual hazard posed by these mixtures to aquatic systems. A species sensitivity distribution was created from standard acute toxicity tests with 15 species of aquatic invertebrates, fish, and primary producers. For the first time, concentrations of POEA in the exposure solutions were confirmed. The results from this SSD showed that under a worst-case exposure scenario, up to 30% of the species could be exposed to POEA concentrations equal to or higher than their EC50s. A mesocosm dissipation study was also carried out, for the first time, to evaluate the fate of POEA in aquatic environments. Water-column half-life of POEA was estimated to be between 3.2 and 5.3 h. Concentrations of POEA increased in sediment shortly after application and decreased over the study period with a half-life of 5.8 – 71.2 d. Results suggest that aquatic organisms are unlikely to be exposed to POEAs in the aqueous phase for periods of more than a few hours, which questions the validity of traditional 48-96 h toxicity tests for the assessment of the effects posed by this surfactants. Taking into account these considerations, two series of toxicity tests were carried out, one in the presence of sediment and one under an exposure-recovery set-up. These tests showed that sediment provides significant protection to organisms, and that the organisms are able to recover from short exposures to worst-case scenario concentrations.

Evaluating inorganic Water Quality Guidelines for aquatic risk assessments – Are they appropriate for amphibians?

Thackeray, Nicole[1], Ruth N. Hull[1], Christine Moore[2] & Lisa Marshall[2]

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Key Words: Aquatic risk assessment, amphibians, Water Quality Guidelines, inorganics

Ecological risk assessments have traditionally focused on terrestrial and aquatic species (i.e., plants, invertebrates, mammals, birds, and fish) but have often excluded explicit consideration of amphibians. Many aquatic and wetland habitats are important for amphibians, and it is well documented that amphibians may be susceptible to effects from chemical contamination during the early stages of development in their aquatic phase. An ERA for aquatic life has been assumed to be adequate to address amphibians. An initial step in any aquatic ERA is to compare chemical concentrations in water to Water Quality Guidelines (WQGs). Many WQGs developed for inorganic parameters are dependent on modifying factors, such as pH and hardness, and therefore will vary significantly from site to site. Several of the WQGs for inorganic parameters include little or no amphibian toxicity data. This presentation will discuss the derivation of several inorganic WQGs as to whether they included amphibian toxicity data, will compare the toxicity data used to available amphibian toxicity data, and will evaluate whether the WQG would change with the incorporation of amphibian toxicity data. It will conclude with a discussion of the level of protection offered to amphibian species native to Canada by current WQGs.

Two layers of PUF needed in indoor fate models for organic chemicals

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Key Words: SVOCs, domestic furnishings, flame retardants, exposure

Models of organic chemicals in indoor environments are in their infancy relative to multimedia models of chemical fate in outdoor environments. Polyurethane foam (PUF) is a standard collection medium used in both outdoor and indoor sampling regimes for volatile and semi-volatile organic compounds. PUF is also a key component of soft furnishings such as those found in home and office environments. Models of indoor environments explicitly including PUF were developed to address its important role in the movement of organic chemicals with high octanol-air partition coefficients. Now, in response to experimental evidence of a concentration differential across PUF depths, the previously developed Multimedia Indoor Model has been revised to account for this evidence. The new model, in addition to air, an oily surface film and vinyl and/or carpet compartments, has been modified to include two distinct layers of PUF. This allows chemical exchange between air and the outer layer and exchange between the outer and inner layers of PUF. The effect of this modification is demonstrated using a series of hypothetical chemicals and considering different layer thicknesses. This model will be used to analyze and better understand the semi-volatile organic compound (SVOC) concentration data currently being gathered in 51 Ontario homes in Toronto and Ottawa. This will contribute to improved exposure estimation as part of a broader study of plasticizer and flame retardant exposure and effects by University of Toronto, Cancer Care Ontario and Health Canada.

Poster Presentations

(in alphabetical order by family name of presenter)

Cyanobacteria north of 60º

Alambo, Katherine[1], Shinjini Pal[1], Frances Pick[1] & John Chetelat[2]

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Key Words: cyanobacteria, microcystin, Great Slave Lake (NWT), Yellowknife

Evidence of likely cyanobacterial blooms such as those reported for the waters of Yellowknife Bay, Great Slave Lake in the North West Territories (NWT), has sparked a growing concern over the occurrence of toxic, microcystin producing blooms at high latitudes as a consequence of climate change. These blooms, though common in temperate and tropical waters, are less common at elevated latitudes, with their presence defying existing knowledge of cyanobacterial blooms in Polar Regions.

This study aims to investigate incidences of cyanobacterial bloom formation in the north and to identify whether toxigenic microcystin producing taxa are present. Planktonic and benthic species assemblages will be assessed in order to establish the occurrence and history of blooms in Yellowknife Bay and nearby lakes in NWT. The presence of toxic genes (*mcy*D and *mcy*E) and potential toxic taxa (16S RNA specific to *Anabaena* and *Microcystis*) will be tested for using PCR and qPRC. Planktonic assemblages will be investigated using light microscopy, while microcystin concentrations will be assessed using an ELISA.

To date, a number of sediment core and whole water samples have been analyzed. Results of these investigations have indicated the presence of toxic genes in top core sediments from Great Slave Lake as well as low numbers of potentially toxic cyanobacteria in the water column. It is hypothesized that as a consequence of climate change and/or eutrophication, planktonic, bloom-forming cyanobacteria are becoming more abundant in northern surface waters and an increase in such taxa will be seen over time.

Development of Groundwater and Soil Vapour Quality Guidelines adds to suite of Canadian Environmental Quality Guidelines for use at contaminated sites

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Key Words: soil, groundwater, soil vapour, environmental quality guideline

The Canadian Council of Ministers of the Environment (CCME) has recently published two new protocols for the derivation of Canadian Groundwater Quality Guidelines and Canadian Soil Vapour Quality Guidelines for use at contaminated sites. The pathways and receptors, models, and guiding principles in these two new protocols are based on the existing 2006 protocol for Canadian Soil Quality Guidelines (CSQGs). These new additions to the 2006 protocol consider additional exposure pathways (e.g., outdoor air), address uncertainties involved in partitioning between media, and provide guidelines for comparison with more types of field-collected samples. Future CSQG factsheets will include soil vapour and groundwater guidelines, in addition to soil. Guidelines for all three media provide protection of human and environmental receptors at contaminated sites.

Risk assessment of inorganic substances under the Chemicals Management Plan: Current and future initiatives

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Key Words: Environment Canada, Chemicals Management Plan, risk assessment, inorganic

Under the Canadian Environmental Protection Act (1999), Environment Canada and Health Canada assess and manage, where appropriate, risks of chemical substances to the environment and to human health. The first phase of the Chemicals Management Plan (2006-2011) focused on individual assessments of approximately 200 substances identified as the highest priorities from the categorization process. In the second phase (2011-2016), assessments focused on groups of substances with structural or functional similarities, providing advantages in assessment efficiencies, management processes and supporting decisions related to substitution.

Three of the nine assessment groupings from the second phase of the Chemicals Management Plan can be characterized as inorganic: cobalt-containing substances, selenium-containing substances, and boron-containing substances. Ecological assessments of inorganic substances may be distinguished from organic assessments due to the particular tools and approaches available which provide more relevant characterization of effects and environmental exposure. This includes the consideration of modifying factors and changes to chemical speciation in the environment that can affect bioavailability and toxicity.

This presentation is focused on the risk assessment of inorganic substances, and in particular, the innovative approaches and tools used in the second phase of the Chemicals Management Plan, and the types of data necessary to support future assessments of remaining inorganic priorities under the upcoming third phase.

Aquatic and terrestrial toxicity testing of quinoline to generate data for federal Environmental Quality Guideline development

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Key Words: quinoline, toxicity, Environmental Quality Guideline

Quinoline (CAS 91-22-5) is a nitrogen-substituted polycyclic aromatic hydrocarbon. It was found to be toxic under the *Canadian Environmental Protection Act, 1999* (CEPA 1999) in November, 2011. To help manage quinoline under CEPA 1999, the development of an effects-based Federal Environmental Quality Guideline (FEQG) was recommended. FEQGs provide benchmarks for the quality of the environment and where the FEQG is met there is little probability of adverse effects on the protected receptor (e.g. aquatic or soil organisms). They are based on toxicological effects or hazard of specific substances. Environment Canada commissioned aquatic and soil ecotoxicity testing with quinoline in order to produce high-quality effects data to fill the minimum data requirements for FEQG derivation. Chronic toxicity testing with *Ceriodaphnia dubia, Hyalella azteca*, fathead minnow, bluegill sunfish, red clover and northern wheatgrass was conducted following standard methods of Environment Canada (RM/21, RM/33, RM/22, RM/45) and OECD (204). Aquatic tests were conducted under static renewal conditions with test durations ranging from 6 to 21 days. Static soil tests assessing emergence and growth of terrestrial plants ranged from 14 to 21 days. Toxicological endpoints for each species were calculated using CETIS statistical software. The most sensitive endpoints for aquatic tests (based on nominal concentrations for *C. dubia* and fathead, and measured concentrations for *H. azteca* and bluegill) were: EC_{10} of 8.2 mg/L for reproduction (*C. dubia*); EC_{10} of 12.8 mg/L for biomass (fathead); EC_{20} of 0.84 mg/L for dry weight (*H. azteca*); and LC_{10} of 1.44 mg/L (bluegill). For soil tests, the most sensitive effect was root dry mass with an IC_{10} of 1.36 mg/L for red clover and 1.52 mg/L for northern wheatgrass based on measured concentrations.

Evaluating the effectiveness of PMRA's implementation of Virtual Elimination Policies for contaminants: Case study for hexachlorobenzene (HCB)

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Key Words: risk management, unintentionally produced contaminants, pesticides, hexachlorobenzene

The Toxic Substances Management Policy (TSMP) is a federal government policy under the Canadian Environmental Protection Act (CEPA) (1995) which was developed to provide direction on the management of substances that have been found to be persistent, bio-accumulative, and toxic (PBT). Health Canada's Pest Management Regulatory Agency uses this preventative and precautionary approach to assess and manage substances in pesticides that could harm human health or the environment. This policy also calls for the virtual elimination of the most hazardous substances. The PMRA works in partnership with pesticide registrants to reduce contaminant levels, adopt the use of best available manufacturing technology, and/or minimize releases where feasible. Reduction efforts focus on contaminants where pesticides are considered a major environmental source and on specific pesticides with the highest releases.

This approach has been applied to hexachlorobenzene (HCB), a PBT environmental pollutant that has contaminated water and food-chain sources globally, presenting significant risks to both human health and the environment. There are various sources of this pollutant including as an unintentionally produced contaminant in some pesticide products. The objective of this project was to examine PMRA's progress towards reducing the total national release of HCB from agricultural pesticides. The results showed a significant reduction in releases from 2008 to 2010 (41.7 kg to 13.6 kg) which is attributed to the implementation of reduction strategies, the phase-out of certain pesticides and the market shift toward newer/cleaner chemistries. The PMRA approach to implementing and tracking reduction efforts by targeting the major contributors has proven to be effective and thus, successfully assists in diminishing releases of HCB that could harm human health or the environment. Similar reduction measures could be applied to other substances slated for virtual elimination found as contaminants in pesticides and other consumer products.

Estimation of veterinary drug concentrations in Canadian soils: Do the PECs MEC Sense?

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Key Words: veterinary drugs, predicted soil concentrations, validation, environmental assessment

Veterinary drugs administered to food animals primarily enter ecosystems through the application of livestock waste to agricultural land. A means to predict environmental concentrations of veterinary drugs in soil (PEC_{soil}) is an important component of a directed testing approach for environmental assessment of veterinary medicinal ingredients (VMIs). A science-based and transparent methodology to calculate PEC_{soil} values for Canada, based on an approach used by the European Medicines Agency under VICH, has recently been developed. To validate the conceptual basis of the PEC_{soil} approach and the newly developed Canadian production categories and defaults, measured environmental concentrations (MECs) of VMIs in agricultural soils from 24 North American and European studies were compared with PEC_{soil} values calculated with the appropriate defaults for the respective region. A total of 51 MECs for 16 different VMIs commonly used in pig, poultry and cattle production were included in this analysis.

PEC_{soil} values were refined and compared to a subset of MECs from North American agricultural soils that had received applications of pig manure. Refinements took into account target animal metabolism, degradation during manure storage and pork production practices. Comparison of PEC_{soil} values with MECs demonstrates that the Canadian and European PEC_{soil} models provide conservative screening level estimates for environmental exposure assessments of VMIs. The results of this study will be presented in the context of differences in production systems and manure management practices for cattle, swine and poultry in Canada and internationally.

Investigating adipogenic properties of short-chain chlorinated paraffins and pentachlorophenol in 3T3-L1 preadipocytes

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Key Words: adipocytes, pentachlorophenol, short-chain chlorinated paraffins, persistent

Persistent organic pollutants (POPs) are compounds with environmental and human health concerns associated to their bioaccumulative and hydrophobic properties. Previously studied POPs including poly-chlorinated biphenyls (PCBs) have been shown to alter the development of adipocytes in human and murine models. We are studying the effects of pentachlorophenol (PCP) and short-chain chlorinated paraffins (SCCPs) in adipocytes. PCP is used as a wood preservative, while SCCPs have applications as flame retardants. Both are present in significant concentrations in the environment and have previously shown toxicity and accumulation in adipose tissue.

The objective of this study was to evaluate the adipogenic effects of PCP and SCCPs in the 3T3-L1 preadipocyte murine cell model at environmental concentrations. Cultured 3T3-L1 cells were individually exposed during the induction of differentiation through the use of isobutylmethylxanthine, dexamethasone and insulin with PCP (0.442 – 4420 nM), the SCCP mixture tetrachlorodecane (0.357 - 3570 nM), and monomer 1,2,5,6,9,0-hexachlorodecane (0.287 - 2870 nM) in DMSO. Lipid accumulation was evaluated through the use of oil red o staining.

Significant increases in lipid accumulation were identified for PCP at 4420 nM, at 35.7 and 3570 nM for tetrachlorodecane, and at 28.7, 287 and 2870 nM for 1,2,5,6,9,0-hexachlorodecane. PCP exposure resulted in a 75% increase in lipids when compared to differentiated controls and 25-50% increases were observed for all significant concentrations of tetrachlorodecane and 1,2,5,6,9,0-hexachlorodecane.

This study shows preliminary data that indicate pentachlorophenol and short-chain chlorinated paraffins can potentially alter the adipogenesis of adipocytes. Further studies are required to confirm the adipogenic properties of PCP and SCCPs.

Planning the third phase of the Canadian Chemicals Management Plan

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Key Words: risk assessment, Chemicals Management Plan

As prescribed under the *Canadian Environmental Protection Act (1999)*, Environment Canada (EC) and Health Canada (HC) must conduct ecological and human health risk assessments of about 4,300 chemical substances that are considered as priorities, based on the results of Categorization, and new information received during the first two phases of the Chemicals Management Plan (CMP). In December 2006, Canada committed to addressing these priority substances by 2020 in support of an international framework, the Strategic Approach to International Chemicals Management, which has an overall objective of achieving the sound management of chemicals throughout their life cycle.

In the first two phases of the CMP, several assessment approaches have been developed to tailor the assessment to the appropriate level of complexity. In the first phase of CMP (2006-2011), the risks of the 200 highest priority substances were assessed individually (in most cases), more than 500 substances of low concern were assessed with the Rapid Screening approach, and a sector-based approach was initiated for petroleum substances. In the second phase of the CMP (2011-2016), the above approaches continue to be used, and approximately 1,500 substances have been grouped into 9 groupings based on structural or functional similarities, for a more efficient approach. In the next phase of the CMP (2016-2020), approximately 1,500 substances remain to be addressed. To meet the 2020 goal, the Government of Canada will continue to build on approaches developed to date. Information will be provided on the proposed assessment framework, as well as preliminary groupings for the remaining priority substances.

Proteome expression analysis of generational effects of bisphenol-A on rainbow trout

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Key Words: Bisphenol-A, rainbow trout, intergenerational effects, proteomics

Bisphenol-A (BPA) has been widely used as a plasticizer in consumer products including beverage containers, and low levels of BPA have been found in food, surface waters, and municipal effluents. BPA has been previously linked to endocrine-disrupting effects and poses a potential environmental risk, with fish species being particularly susceptible. It was recently shown (Birceanu et al, 2015) that oocyte exposure to BPA has subsequent effects on larval development and impacts growth hormone/insulin-like growth factor function. In the present study, we mimic maternal transfer by exposure of oocytes to 0, 3 or 30 mg/L BPA, and identify changes in the hepatic proteome profile of juvenile rainbow trout in F1 and F2 generations following F1 oocyte exposure. Quantitative proteomics analysis was performed using iTRAQ (isobaric tags for relative and absolute quantitation), which provided broad proteome coverage and identified changes in protein expression following F1 oocyte exposure versus non-exposed controls. Over 20 proteins were identified as differentially expressed in the F2 generation in response to BPA, suggesting that historical BPA exposure can have intergenerational effects. Identified differentially expressed proteins were primarily associated with oxidative stress, xenobiotic metabolism, and amino acid metabolism. These results demonstrate BPA can have downstream effects on offspring well after previous maternal exposure.

Assessing the toxicity of quantum dot nanoparticles in *Zea mays*

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Key Words: Metal-based quantum dots, Carbon dots, uptake, plant

The increasing use of engineered nanomaterials in industry and consumer products has generated concern regarding undesirable impacts of nanotechnology on the environment. Plants will be directly impacted by nanomaterials, as soil will be an important sink for ENMs that may eventually aggregate and fall out of suspension. This study focuses on assessing the toxicity of different metal-based and carbon quantum dots (QDs) in *Zea mays*. Carbon dots (C-dots) are chemically inert, water-dispersible, and highly resistant to photobleaching. Therefore, they could be an alternative to the use of metal-based QDs.

Preliminary exposure of *Zea mays* to CdSe QDs capped with 3-mercaptopropionate under hydroponic conditions exhibited plant uptake of these nanomaterials. Plant uptake was determined by using ICP-MS. Se uptake was favored over Cd uptake, despite the differences in Cd/Se ratio of exposure. The stability of C-dots and different CdSe QDs in the growth media was assessed to determine the optimum conditions for future exposure, as well as to assess the different mechanisms associated with their uptake in plants. Future work consists of exposing *Zea mays* to the optimized conditions, evaluating the uptake of QDs and changes in plant exudate profiling by using ICP-MS and LC/MS/MS, respectively.

An examination of pesticide levels in Canadian groundwater and the tools used to predict their presence

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Key Words: risk assessment, pesticides, groundwater monitoring, modelling

The presence and levels of pesticides in groundwater across Canada are not well understood. The Environmental Assessment Directorate (EAD) of the PMRA currently uses both prospective and retrospective groundwater monitoring, and predictive tools such as Groundwater Ubiquity Score (GUS) and computer modelling to assess potential levels of pesticides in groundwater for use in risk assessments. The objectives of this study were:

1: To summarise current knowledge of the frequency and detection concentrations of pesticides in Canadian groundwater;
2: To identify key data gaps and limitations; and
3: To assess the tools EAD currently uses to predict pesticide concentrations in groundwater.

Data collection was limited to approximately 80 pesticides of interest. Environment Canada and Federal Provincial and Territorial (FPT) Committee members from all provinces/territories were contacted to identify and compile data from Canadian groundwater monitoring programs. Other readily-available information, such as monitoring data from prominent U.S. databases (NAQWA, STORET) and Canadian usage and sales data, were also compiled. Monitoring data was compared with leaching indicators and predictive tools (e.g. GUS, modelling). Overall, Canadian pesticide detections were relatively infrequent, at relatively low concentrations which did not exceed available GCDWQ. Pesticide monitoring programs are regional and highly variable, which negatively affects the consistency and thus, quality of the data. Transformation products are often not included in monitoring programs, so knowledge of their presence in groundwater is very limited. There is a weak correlation between monitoring data and leaching indicators such as GUS. Pesticide usage/sales data tend to be better predictors of leaching than GUS.

Effect of an herbicide surfactant, polyethoxylated tallow amine, on oviposition and viability of eggs of rams-horn snail, *Planorbella pilsbryi*

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Polyethoxylated tallow amine (POEA) is a commonly used surfactant in formulations of the herbicide glyphosate. A number of studies have shown that POEA is more toxic to aquatic species than the active ingredient used in the formulation, with the exception of primary producers. The present study examined the effect of POEA exposure on the rams-horn snail, *Planobella pilsbryi*, which is a common freshwater species widely-distributed across North America.

The first portion of this study examined the effect of static exposure of POEA at three different points in the life stage of the snails (i.e., adult, juvenile, and egg). Adults or juveniles were exposed to POEA at concentrations up to 21.4 mg/L for 96 h. Mortality was not observed in concentrations ≤3.0 mg/L. A negative concentration-dependent trend in oviposition was observed in the test with adults, resulting in an EC_{50} value of 2.0 mg/L. However, there were no significant differences between the viability of eggs produced by adults in the 96 h test at concentrations ≤5.1 mg/L and the controls ($p>0.05$). Exposure of eggs to POEA at concentration up to 9.9 mg/L showed no effect on the viability of eggs. The findings of the initial portion of the study suggested that exposure of freshwater snails to environmentally relevant concentrations of POEA may inhibit oviposition but not the viability of eggs.

The second portion of the study examined whether oviposition would resume if exposure to POEA was removed, which is important to consider due to the relatively short half-life of POEA in aquatic systems (e.g., $t_{1/2}$: ~12-20 h). Snails were exposed to POEA for 96 h then removed to water that did not contain POEA and monitored for 10 days. Oviposition was significantly inhibited ($p<0.05$) at concentrations of POEA ≥1.24 mg/L. However, there was no significant difference in oviposition across treatments subsequent to snails being transferred to water that did not contain POEA.

PCB toxicity of Lyons Creek sediments in comparison to historical trends

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Key Words: Lyons Creek, Areas of Concern, sediment toxicity, PBCs

Lyons Creek East (Welland, Ontario) is a tributary of the Niagara River, and part of the Niagara River Area of Concern. Pollutants of potential concern for this site are mainly polychlorinated biphenyls (PCBs), with historical contamination being monitored since the 1990's. Beneficial Use Impairments highlighted as a result of this contamination include degradation of benthos, and fish consumption restrictions. Despite this contamination, Lyons Creek represents a diverse biological community, and is designated as a Provincially Significant Wetland.

In this study, a sediment quality tetrad approach (including toxicity tests, bulk sediment chemistry, benthic community structure, and bioaccumulation tests) will be utilized to investigate changes in sediment quality in Lyons Creek. The upper region of Lyons Creek, stretching from the Welland Canal to Highway 140 had the highest levels of total PCBs in sediment, and sediments from here were acutely toxic to benthos during laboratory experiments. The data generated from these investigations will contribute to the many lines of evidence utilized for the Monitored Natural Recovery sediment management option designated under the Remedial Action Plan.

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