SETAC – PNC

Society of Environmental Toxicology and Chemistry

Prairie Northern Chapter

(Annual Meeting)

UNIVERSITY OF SASKATCHEWAN

Toxicology Centre

New Horizons, New Challenges

Program Book






1st Prairie Northern Chapter Meeting of SETAC

Saskatoon, Saskatchewan

June 11, 2010

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GENERAL INFORMATION

Emergency information:
If emergency services are needed phone 911.

The SETAC - PNC registration desk is located in front of the Education Lounge, Room 1005.
Registration hours are from 07:00 – 12:00, Friday, June 11th, 2010

Registration fees: Your registration fee covers the costs associated with your entry to all scientific sessions, as well as the following meals, refreshment breaks and receptions:

- morning coffee break
- Lunch
- afternoon coffee break
- poster session receptions (cash bar)

Name badges: Please wear your name badge during all meeting activities.

Cell phone etiquette: Please turn off or mute your cell phones during the scientific sessions and plenaries.

Smoking: Smoking is prohibited within the Education Building.

Platform presenters: Powerpoint presentations should be submitted to Dr. Michael Pietrock before 08:00 on Friday, June 11th . Dr. Pietrock can be found in the Presentation Room 1004 from 07:30 onward. In addition, please identify yourself to the Session Chair before the session begins.

Poster presenters: Each poster has a unique number in the program book that corresponds to a poster board located in the Education Lounge.

Please put up your posters between Thursday, June 10th at 16:00 and Friday, June 11th at 11:30.

Please take down your poster between Friday, June 11th at 18:30 and Monday, June 14th at 08:00.

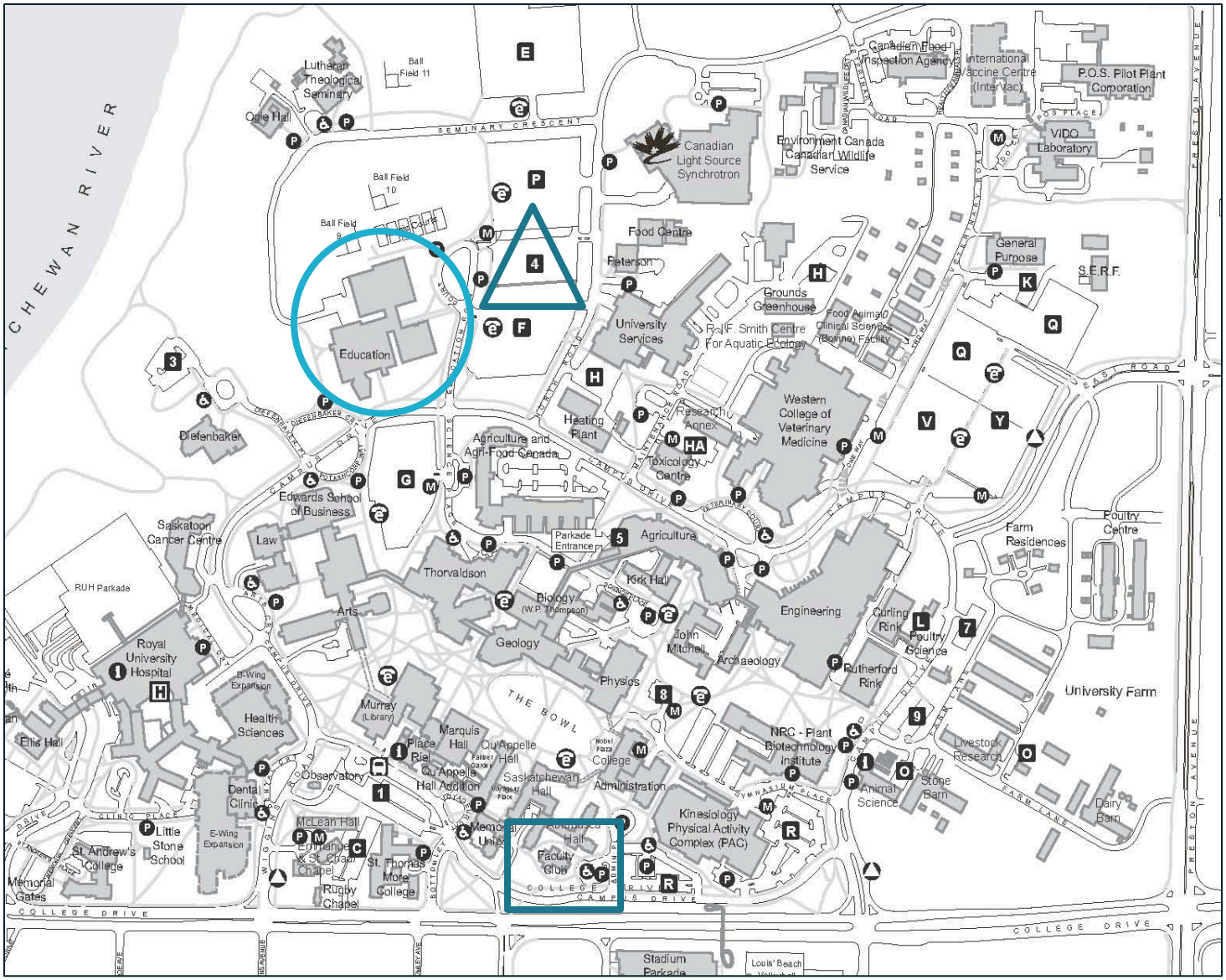
If you require assistance putting up your poster please see the registration table (located in front of the Education Lounge). It is important that students are present next to their poster during the Poster Session & Social held between 16:30 and 18:00.

Silent Auction: All books will be available to view next to the registration table throughout the entire day. The silent auction will close after the Poster Session, and winners will be announced at the Banquet.

Any book purchased for under $20 will be a cash only sale , and books that sell for more than $20 can be paid for by cash or cheque. Please make your cheque payable to: ***The Prairie Northern Chapter of SETAC***

We would like to express our gratitude to SETAC for donating a variety of books for our meeting.

University of Saskatchewan – Campus Map



SETAC - PNC Meeting will take place at the:

Education Building
28 Campus Drive
Saskatoon, SK S7N 0X1

General Office: (306) 966-5973

Parking on Campus:

If travelling by vehicle, public parking is located in Lot 4, highlighted with a triangle.

LOT 4
Located off North Road
Pay on exit
May 1 - August 31 (annually)
$3.00 (per exit) daily maximum

Banquet Location:
Faculty Club, highlighted with a square.

The Prairie Northern Chapter Meeting of SETAC

New horizons, new challenges

All presentations will take place in Education, Room 1004

Registration 07:00 – 12:00 (Education Lobby)	
07:00-08:00	**Annual General Board Meeting (Education, Room 1039)**
08:00	Opening Remarks: David Janz, University of Saskatchewan
08:30	Plenary Speaker: Dr. Alice Hontela, University of Lethbridge: **"Environmental Issues in Alberta – Cows and Corn and Oil Sands"**
09:00	Plenary Speaker: Dr. Terry Hanley, Saskatchewan Watershed Authority: "**State of the Watershed Reporting – Turning Data into Knowledge"**
09:30	Plenary Speaker: Dr. Lyle Lockhart, Lake Winnipeg Foundation: **"Lake Winnipeg: Life at the Bottom of a Big Watershed"**
10:00 – 10:30	**Coffee Break (Education Lounge, Room 1005)**
10:30	**N. Pilgrim**: Effects of Se-methionine on the reproductive endpoints in rainbow trout
10:45	**J. Thomas:** Behavioural and physiological consequences of dietary selenomethionine exposure to adult zebrafish *(Danio rerio)*
11:00	**L. Miller:** The response of rainbow trout and brook trout head kidney cells to selenite and selenomethionine exposure
11:15	**S. Misra:** Sensing the smell of toxicity: understanding the mechanism of selenomethionine toxicity in isolated hepatocytes of rainbow trout
11:30	**R. Kwong:** The evidence of shared dietborne iron and cadmium uptake in the freshwater rainbow trout (*Oncorhynchus mykiss*)
11:45	**J. Ouellet:** A single metal vs whole-effluent approach to investigate causes of metal mine effluent effects
12:00 – 13:15	**Lunch (Education Lounge, Room 1005)**
13:15	**R. Annett:** Reproductive endpoints of fathead minnows (*Pimephales promelas*) exposed to agricultural drain waters in southern Alberta
13:30	**J. Low:** The effects of pruning and nodal adventitious roots on polychlorinated biphenyl uptake by *Cucurbita pepo* grown in field conditions
13:45	**M. Goertzen:** Swim performance and bioenergetic effects of uranium milling effluent exposure in spottail shiner (*Notropis hudsonius*)
14:00	**J. Anderson:** Growth of *Chironomus dilutus* larvae exposed to ozone-treated and untreated oil sands process water
14:15	**N. Puttaswamy:** Identification of causes of oil sands coke leachate toxicity
14:30 – 15:00	**Coffee Break (Education Lounge, Room 1005)**
15:00	**J. Carlson:** Photodegradation of pharmaceuticals, personal care products and endocrine disrupting compounds in drinking water
15:15	**A. Tompsett:** Characterization of the biological and phenotypic effects of 17α-ethynylestradiol exposure in *Xenopus laevis*
15:30	**S. Henderson:** Population level consequences of urban derived endocrine disrupting compounds on the reproductive function of a sentinel species
15:45	**N. Nikoobakht:** Determination of *in vitro* half lives of eight selected aldehydes in human blood by using 2,4-dinitrophenylhyrazine as trapping reagent
16:00	**O. Mysiv:** Parasites and chemical contaminants in whitefish (*Coregonus clupeaformis*) from northern Saskatchewan lakes
16:30 – 18:00	**Poster Social (Education Lounge, Room 1005) – Cash Bar**
18:30	**Dinner (UofS Faculty Club) – Ticket Required**

Plenary Speakers

"Environmental Issues in Alberta - Cows and Corn and Oil Sands"

Dr. Alice Hontela, University of Lethbridge

Plenary Address, 08:30, Education Building, Room 1004

The province of Alberta has a strong economy, rapidly growing human population and a conservative government. The integrity of the environment is increasingly challenged by economic development and industrial growth, with the oil sands industry in the north, oil and gas exploration and coal mining in the eastern slopes of the Rockies, urban centers growing at an exponential rate, and intensive agriculture with irrigation-dependent crop production and feedlots in the south. Southern Alberta's aquatic ecosystems are especially vulnerable because the area is semi-arid, the issue of water allocations to irrigation farming is unresolved, and temperatures of surface waters and demands for water are increasing with climate change. Research in ecotoxicology, both fundamental and applied, has an important role in Alberta, in solving major environmental issues and training the next generation of professionals who will have the knowledge and motivation to change the Alberta status quo. Research in our laboratory at U. of Lethbridge focuses on the physiological, biochemical and morphological responses of fish considered as indicator species of the ecosystem health. Laboratory studies and field studies are used to diagnose environmental stressors and provide mechanistic data for establishing cause-effect links at the cellular and whole organism level, and for mechanism-based risk assessment. Our studies with fathead minnow provided evidence for presence of estrogenic chemicals in the Oldman river watershed while studies with rainbow trout and brook trout in coal mining-impacted streams linked selenium to physiological dysfunctions. Current projects focus on the interactive effects of pesticides and personal care products such as Triclosan on cortisol secretion using the head kidney cell system in vitro, species-specific mechanisms of vulnerability to toxicants such as selenium, and effects of glyphosate on reproductive function. Our data indicate that Alberta's aquatic ecosystems are impacted and there is an urgent need to revise the water quality guidelines, especially relating to mixtures. (Funded by Canada Research Chair program, NSERC, Alberta Conservation Association, Alberta Ingenuity)

Plenary Speakers

"State of the Watershed Reporting – Turning Data in to Knowledge"

Dr. Terry Hanley, Saskatchewan Watershed Authority

Plenary Address, 09:00, Education Building, Room 1004

A challenge to successful environmental management is providing an effective mechanism to translate date from monitoring and scientific studies into readily understood information for policy and decision makers on the state of environmental health. Part of the challenge is reconciling the many different human activities occurring on the landscape and the multiple data sources and forms of data associated with these activities. To do this, indicators can be used to provide a summary with which to assess the footprint of each activity. This approach was taken in our recent study of Saskatchewan's watershed health, which is summarized in the State of the Watershed Report. Indicators were classed as being stressor, condition or response indicators. Collective assessment of these indicators provided a scientific basis for assessing watershed risk and reporting on the health of individual watersheds. Date used to develop the indicators was obtained from government and non government organizations.

"Lake Winnipeg: Life at the Bottom of a Big Watershed"

Dr. Lyle Lockhart, Lake Winnipeg Foundation

Plenary Address, 09:30, Education Building, Room 1004

Lake Winnipeg has a large surface area (about 24500 km^2 and a drainage basin some forty times larger (about 1 million km^2) but its shallow depth restricts its water volume to less than 400 km^3. Its water residence time is less than a year for the South Basin and 3-4 years for the whole lake. The lake has provided inspiration, recreation and economic livelihood for generations of Manitobans. In recent years, however, several often-interrelated problems have begun to emerge. We see more frequent and more extensive blooms of blue-green algae and inputs of algal nutrients to the lake have increased. Trace quantities of algal toxins and a number of other trace chemical contaminants have been identified in the lake. Drainage to the lake has been altered with more wetlands being drained for agricultural use. New drainage works are constructed and existing ones are expanded every year. Coliform bacteria are reported regularly at recreational beaches with the result that beaches are posted to warn against water activities. The main sources of the bacteria are reported to be wildlife and these bacteria can persist in shallow sediments or shoreline sand. Some species of animals have become rare or endangered and other non-native species have invaded the lake successfully, sometimes as a result of planned human intervention, sometimes not. A dramatic recent invader has been the rainbow smelt. The lake has become warmer (by about 1 C in the North and almost 2 C in the South) over the last century, presumably a reflection of regional climate. Increasing precipitation in the Red River watershed has brought increased river flows and increased transport of nutrients. It is not clear whether the increased flows are part of a historical cyclical pattern or whether they represent a new climate-related trend. Lake levels are regulated by Manitoba Hydro within limits and this regulation has been accompanied by much speculation about its impacts on the lake. Reaching solutions to environmental problems is difficult because of the numerous governments with overlapping and sometimes conflicting interests. The Lake Winnipeg Foundation is a non-profit, charitable corporation independent of governments, business and academia with the goal of helping to solve problems affecting the lake. Recently we have sponsored Lake Winnipeg to become part of the Living Lakes Network, part of a global network of lakes under the auspices of the Global Nature Fund. We hope this will bring increased international attention to the lake with a corresponding increase in ideas about ways we can help.

Poster Session - Schedule

Poster numbers correspond with poster board numbers. Presenting author(s) names are underlined.
The poster session will be held in the **Education Lounge, Room 1005 from 16:30 – 18:00.**

1. **A better bottom line, contribution to information gathering**
   Cheng W W, and Blenkinsopp S
2. **Pilot study of polycyclic aromatic hydrocarbon bioavailability in contaminated soil using a juvenile swine model**
   Peters R, Siciliano S, and Wickstrom M
3. **Using chitobiase activity as an indicator of impacts on secondary productivity in prairie lotic systems**
   MacKenzie S, and Hanson M
4. **Dissipation of herbicides in water and sediment of two Canadian prairie wetlands**
   Degenhardt D, Cessna A J, Humphries D, Raina R, Farenhorst A, and Pennock D J
5. **Selenium bioaccumulation and speciation in *Chironomus dilutus* exposed to organic and inorganic forms of selenium**
   Franz E D, Wiramanaden C I E, Pickering I J, Janz D M, and Liber K
6. **Bioaccumulation of selenium by *Chironomus dilutus*: comparing sediment versus surface water exposure routes using an in-situ method**
   Franz E D, Wiramanaden C I E, Pickering I J, Janz D M, and Liber K
7. **Dissipation of chlortetracycline, sulfamethazine and tylosin in composting beef cattle manure**
   Cessna A, Larney F, Kuchta S, Hao Z, Entz T, Topp E, and McAllister T
8. **Effects of upper Danube River sediments on steriodogenesis using a combination of chemical fractionation and the H295R assay**
   Higley E, Grund S, Seiler B T, Varel U L , Brack W, Schulz T, Giesy J P, Hollert H, and Hecker M
9. **Synchrotron studies of selenium in a lake system receiving treated metal mine effluent**
   Tse J J, and Pickering I J
10. **Chemical form matters: differential accumulation of organic and inorganic mercury in zebrafish larvae demonstrated using synchrotron x-ray fluorescence imaging**
    MacDonald T C, Korbas M, Pickering I J, Krone P H, and George G N
11. **Predicting metal bioaccessibility according to chemical properties**
    Laird B, Siciliano D, and Peak D
12. **Synchrotron X-ray fluorescence imaging in molecular toxicology: methylmercury fate in developing zebrafish larvae**
    Korba M, Krone P H, Pickering I J, and George G N
13. **Endocrine disrupting chemicals disrupt metabolism in male goldfish**
    Jordan J, Zare A, Pang F, Jackson L, Weljie A, and Habibi H
14. **Influence of liquid water on gas diffusion coefficient and nutrient supply rate in soil under frozen conditions**
    Harvey-Schafer A, Snape I, and Siciliano S
15. **Diatom analysis of Ross Lake sediments**
    Schiffer S T, Doig L E, and Liber K
16. **Toxicity of uranium, molybdenum, nickel, and arsenic to *Hyalella azteca* and *Chironomus dilutus* in water-only and spiked sediment toxicity tests**
    Doig L E, Liber K, and White-Sobey S L
17. **Evaluation of a novel biomarker for assessing of the endocrine disrupting potential of environmental chemicals**
    Soron M, and Raine J C
18. **Investigating the endocrine disrupting potential of oil sands sediments to developing walleye**
    Lu L, Yuan H, Tumber V, Turcotte D, and Raine J C
19. **Development of a bioassay to assess the toxicity of oil sands sediments to walleye (*Sander vitreus*)**
    Yuan H, Lu L, Tumber V, Raine J C, and Turcotte D

Effects of se-methionine on the reproductive endpoints in rainbow trout

Pilgrim N, Rasmussen J, and Hontela A

Presenting from 10:30 am -10:45 am

This project investigates the effect of maternally transferred selenium-methionine (Se-met) on the reproductive endpoints of rainbow trout. It has been reported by Holm *et. al* (2005) that native rainbow trout are more susceptible to the teratogenic effects of Se than brook trout and suggested this was due to oxidative stress caused by selenium compounds cycling and creating superoxide radicals. To test this hypothesis rainbow trout were fed diets of 0, 15, and 40 µg Se/g (dw) for 5 months prior to spawning. Tissue and blood samples were taken from adult fish at spawning, while eggs were fertilized and placed in a vertical incubator or under 15 cm of gravel to assess deformities and swim-up success. Plasma testosterone in adults increased in all treatments at spawning, while plasma T3 showed a decrease, compared to pre-treatment controls (T=0). Plasma cortisol results indicate impaired stress response in low and high treatments. Swim-up success was significantly lower in the high treatment, while the control and low were not different. Decreased swim-up success in the highest treatment can be attributed to the teratogenic effects of Se. The role of oxidative stress in the effects of selenium in rainbow trout is under investigation and dietary exposures of brook trout are in progress. This project will provide comparative data for the reproductive effects of selenium in two salmonid species, for use in species-specific risk assessment of selenium. (Funded by MITHE-SN).

Behavioural and physiological consequences of dietary selenomethionine exposure to adult zebrafish *(Danio rerio)*

Thomas J K, and Janz D M

Presenting from 10:45 am - 11:00 am

Selenomethionine (SEM) is the major form of organoselenium present in food. Early life stages of oviparous vertebrate species, especially fish, are highly susceptible to dietary selenium (Se) exposure, however less is known concerning effects in adults. The present study was designed to investigate behavioural and physiological consequences of dietary SEM exposure to adult zebrafish. Adult fish were fed varying concentrations of Se (1, 3, 10 and 30 µg Se/g, dry weight) in the form of SEM for 90 days. At the end of the exposure period, critical swimming speed (Ucrit), whole body cortisol levels and whole body bioenergetics (triglyceride and glycogen) status of fish were determined. Impaired swimming performance was observed in 3, 10 and 30 µg Se /g fed fish. Cortisol production in the 30 µg Se fed group was greater than control food (1 µg Se) fed fish. Higher triglyceride and glycogen levels were observed in 10 and 30 µg Se fed groups compared to control. Our results suggest that dietary SEM exposure can alter behavioural and physiological responses in adult fish, and such consequences could threaten fitness of adult fish in natural environments.

The response of rainbow trout and brook trout head kidney cells to selenite and selenomethionine exposure

Miller L L, and Hontela A

Presenting from 11:00 am - 11:15 am

Model species are often used in toxicological studies, but differences in species sensitivities to toxicants occur. There is evidence that rainbow trout show a greater rate of selenium-induced larval deformities than brook trout. The head kidney model system was used to investigate the species-specific selenium sensitivity of rainbow trout and brook trout. Suspensions of rainbow trout and brook trout head kidney cells were exposed to selenite and selenomethionine and the EC_{50}s (inhibition of ACTH stimulated cortisol secretion) determined. Rainbow trout (EC_{50} = 8.71 mg/L) were more sensitive to selenite toxicity than brook trout (EC_{50} = 90.40 mg/L). Selenite impaired cortisol secretion, but selenomethionine (EC_{50} for both species > 2000 mg/L) did not. Cell viability (trypan blue exclusion and LDH release) was not affected by selenium exposure. In a second set of experiments, cortisol secretion was stimulated with ACTH, dbcAMP, OH-cholesterol, and pregnenolone to determine the steps where biosynthesis was interrupted. Selenite appears to act at different steps in coritsol's biosynthesis pathway in rainbow trout and brook trout. The head kidney cell model could be used to further investigate the mechanism of species-specific Se toxicity.

Sensing the smell of toxicity: understanding the mechanism of selenomethionine toxicity in isolated hepatocytes of rainbow trout.

Misra S, Peak D, and Niyogi S

Presenting from 11:15 am - 11:30 am

Selenium (Se) is known to be toxic at marginally elevated level than those required by normal physiological processes. Recent research reveals higher content of selenomethionine (SeMet) in the food chain causes adverse toxic effects on fish population residing in contaminated areas. However, little is known about the mechanism of SeMet toxicity in piscine systems. In bacteria and mammals, catalysis of SeMet by L-methionine-γ-lyase (LMGL) and corresponding redox cycling of methylselenol leading to ROS generation are implicated in SeMet toxicity. However, the presence of such enzymatic pathway in fish has not been reported conclusively. We, however, found out LMGL-like activity in trout hepatocytes. This provides an indirect evidence of methylselenol (CH_3SeH) generation upon metabolism of SeMet. Concurrent observation of reduction of glutathione (GSH) content upon reaction of SeMet with cell lysate also provides an indirect evidence of involvement of GSH in redox cycling of CH_3SeH. We then postulated if the similar redox cycling mechanism persists intracellularly under physiological O_2 tension, exposure to SeMet will result in ROS production. As hypothesized, we found out increased intracellular ROS production in response to SeMet exposure. Time course study reveals quick generation of ROS at higher dose, indicating a faster process. Thus, the present study describes the role of enzymatic catalysis of SeMet in oxidative stress.

The evidence of shared dietborne iron and cadmium uptake in the freshwater rainbow trout (*Oncorhynchus mykiss*)

Kwong R W M, Andrés J A, and Niyogi S

Presenting from 11:30 am - 11:45 am

Dietborne cadmium is an important source of cadmium accumulation and toxicity in feral fish. However, the mechanisms of dietary cadmium absorption and toxicity in fish are poorly understood. Using an *in vitro* gut sac preparation from freshwater rainbow trout (*Oncorhynchus mykiss*), we demonstrated that iron and cadmium could reciprocally inhibit the uptake of each other, thereby suggesting that both metals may be absorbed through a common transport pathway in fish intestine. In mammals, it is well documented that the absorption of dietborne cadmium is mediated by an apical iron transporter called divalent metal transporter-1 (DMT1). We identified the mRNA expression of two DMT1 isoforms (*Nramp* -β and -γ) in the gastrointestinal tract of the rainbow trout, and also demonstrated the functional role of DMT1 in iron absorption using isolated trout enterocytes. Importantly, we found that the apparent affinity for iron uptake in isolated trout enterocytes was significantly decreased (increased K_m), without any change of the maximum uptake rate (J_{max}), in the presence of cadmium. These findings indicate that the dietborne cadmium inhibits intestinal iron absorption in fish through competitive inhibition. In addition, we observed that the accumulation of cadmium in the gastrointestinal tract of fish reduced significantly following the exposure of iron-enriched diet *in vivo*. Overall, our results suggest that the absorption of dietary cadmium in fish may occur through the iron transport pathway, probably *via* DMT1.

A single metal vs whole-effluent approach to investigate causes of metal mine effluent effects

Ouellet J, Dube M, and Niyogi S

Presenting from 11:45 am - 12:00 pm

Selenomethionine (SEM) is the major form of organoselenium present in food. Early life stages of oviparous vertebrate species, especially fish, are highly susceptible to dietary selenium (Se) exposure, however less is known concerning effects in adults. The present study was designed to investigate behavioural and physiological consequences of dietary SEM exposure to adult zebrafish. Adult fish were fed varying concentrations of Se (1, 3, 10 and 30 µg Se/g, dry weight) in the form of SEM for 90 days. At the end of the exposure period, critical swimming speed (Ucrit), whole body cortisol levels and whole body bioenergetics (triglyceride and glycogen) status of fish were determined. Impaired swimming performance was observed in 3, 10 and 30 µg Se /g fed fish. Cortisol production in the 30 µg Se fed group was greater than control food (1 µg Se) fed fish. Higher triglyceride and glycogen levels were observed in 10 and 30 µg Se fed groups compared to control. Our results suggest that dietary SEM exposure can alter behavioural and physiological responses in adult fish, and such consequences could threaten fitness of adult fish in natural environments.

Reproductive endpoints of fathead minnows (*Pimephales promelas*) exposed to agricultural drain waters in southern Alberta

Annett R, and Hontela A

Presenting from 13:15 pm - 13:30 pm

The Oldman River basin in southern Alberta is among the most highly impacted watersheds in Canada. The combination of urban and rural uses places significant stress on the often limited supply of surface water. The highly variable flow regime of the Oldman River produces periods of low river flow combined with high levels of irrigation use, amplifying the overall potential for surface water contamination. Contamination sources, including pesticide residues and runoff from confined feeding operations, combine to produce an environment with the potential to alter normal vertebrate physiology. The purpose of this study is to determine the biological effects of exposure to agricultural drain waters using fathead minnow (*Pimephales promelas*) as a sentinel fish species.

Fathead minnows were collected from irrigation canals and agricultural drains within the Bow River Irrigation District during the summer and autumn of 2009 and tissue samples were collected for biochemical analysis. Acetylcholinesterase (AChE) activity was determined and used as a marker for organophosphate pesticide exposure, while steroidogenic tissue and liver were collected and analyzed for exposure to endocrine disrupting chemicals. Results of these analyses, combined with water quality data, suggest a temporal pattern of increased pesticide exposure during the sampling period, determined by AChE inhibition. Additionally, these data suggest a role for wetlands in buffering contamination within the irrigation drainage flows prior to returning to the Oldman River. (Funded by Alberta Water Research Institute).

The effects of pruning and nodal adventitious roots on polychlorinated biphenyl uptake by *cucurbita pepo* grown in field conditions

Low J, Whitfield Å, Melissa L, Rutter A, and Zeeb B A

Presenting from 13:30 pm - 13:45 pm

Two cultivation techniques (i-pruning and ii-nodal adventitious root encouragement) were investigated for their ability to increase PCB phytoextraction by *Cucurbita pepo* ssp *pepo* cv. Howden (pumpkin) plants *in situ* at a contaminated industrial site in Ontario (Aroclor 1248, mean soil [PCB] = 5.6 $\mu g \cdot g^{-1}$). Pruning was implemented to increase plant biomass close to the root where PCB concentration is known to be highest. This treatment was found to have no effect on final shoot biomass or PCB concentration, however, shoot biomass was based on the final plant without accounting for the material pruned from the plant during the growth season. The encouragement of nodal adventitious roots at stem nodes did significantly increase the PCB concentration in the primary stem, while not affecting shoot biomass. Both techniques are easily applied cultivation practices that may be implemented to decrease phytoextraction treatment time.

A decrease in Aroclor 1248 concentrations with increasing distance from the root was also observed for the first time.

Swim performance and bioenergetic effects of uranium milling effluent exposure in spottail shiner (*Notropis hudsonius*)

Goertzen M M, Hauck D, Phibbs J, Weber L P, and Janz D M

Presenting from 13:45 pm - 14:00 pm

The Key Lake uranium milling operation (Saskatchewan, Canada) releases complex effluent into the local watershed that we hypothesized to have ecophysiological effects on native fish. Critical swimming speed did not differ significantly in juvenile spottail shiner (*Notropis hudsonius*) collected from the exposure versus reference lake (n=8-17 fish, $p>0.05$ in one-way ANOVA). Captured fish used in swim tests were considered fatigued. In both non-fatigued (non-swam) and fatigued fish, liver glycogen was significantly greater in fish from the exposure compared to the reference site ($p<0.05$ for site and fatigue factors in two-way ANOVA). While there was no difference in plasma lactate or liver triglycerides in non-fatigued fish between sites, lactate was greater and triglycerides decreased after swimming only in reference fish. In non-fatigued fish, plasma glucose did not significantly differ between sites, but significantly decreased after swimming only in exposure site fish. In contrast, swimming significantly increased hematocrit in fish from the reference site, while non-fatigued exposure site fish had elevated hematocrit that failed to further increase with swimming. In summary, non-fatigued fish from the exposure site demonstrated signs of metabolic stress, yet exposure site fish had greater energy stores and retained similar swimming ability compared to fish from the reference site.

Growth of *chironomus dilutus* larvae exposed to ozone-treated and untreated oil sands process water

Anderson J, Wiseman S, Franz E, El-Din G M, Martin J W, Jones P, Liber K, and Giesy J P

Presenting from 14:00 pm - 14:15 pm

Bitumen extraction processes utilized at the Alberta oil sands require extensive freshwater and result in vast quantities of oil sands process water (OSPW) which must be stored on-site. Pressure to remediate this water and return it to natural systems has encouraged investigation of different treatment methods that may eliminate toxicity to downstream organisms in future release scenarios. Since the acute toxicity of OSPW has been mainly attributed to naphthenic acids, these are the most important target fractions for treatment. Ozonation has shown potential for reducing OSPW toxicity, but effects of ozonation on aquatic invertebrates are unknown.

In this study, effects of exposure to untreated and ozonated OSPW were investigated in the larvae of the benthic invertebrate *Chironomus dilutus*. OSPW was treated with either a 50 or 80 mg O_3/L dose of ozonation, and both levels of ozonation were examined for effects on *C. dilutus* growth and survival. Following a 10-day exposure there were no significant effects (relative to a freshwater control) on survival of larvae exposed to either ozone-treated or untreated OSPW. OSPW-exposed larvae were 64-77% smaller than their respective controls, but the mean wet mass of organisms exposed to 50 mg O_3/L ozonated OSPW was not significantly different from that of the controls ($p=0.486$). Larvae exposed to 80 mg O_3/L ozonated OSPW were only 40% smaller than the freshwater controls. Ozonation reduces growth inhibition caused by exposure to OSPW and these results suggest that ozonation may be a viable treatment method to reduce toxicity of OSPW to benthic invertebrates. Experiments are being conducted to elucidate the biochemical and/or molecular basis for the observed differences in growth.

Identification of causes of oil sands coke leachate toxicity

Puttaswamy N, and Liber K

Presenting from 14:15 pm - 14:30 pm

Toxicity characterization of field collected oil sands coke leachates showed that oil sands coke leachates (CL) were acutely toxic to *Ceriodaphnia dubia*. However, the cause of coke leachate toxicity was not known. Therefore, the purpose of this study was to generate CL in the laboratory in order to characterize the contaminant release potential from coke, to evaluate the toxicity response of *C. dubia* to CLs and to perform toxicity identification evaluation (TIE) tests to identify the cause(s) of CL toxicity. Coke was subjected to a 15-day batch leaching process at two pH values (5.5 and 9.5). Leachates were filtered on day 15 and used for chemical and toxicological characterization. The 7-day LC50 estimates for *C. dubia* survival were 6.3 and 28.7% for pH 5.5 and 9.5 CLs, respectively. Addition of EDTA to CLs significantly ($p \leq 0.05$) improved *C. dubia* survival and reproduction in pH 5.5 CL, but not in pH 9.5 CL. A cationic resin treatment removed toxicity of pH 5.5 CL only. Conversely, the toxicity of pH 9.5 CL was completely removed with an anion resin treatment suggesting that the pH 9.5 CL contained metals that form oxyanions. Trace element characterization of the CLs showed Ni and V levels to be well above their 7-day LC50 values for *C. dubia*. Further, toxicity reappeared when Ni and V were added back to resin-treated CLs at their original levels. The TIE results combined with the trace element chemistry of the CLs suggest that both Ni and V could be acting as toxicants in the pH 5.5 CL, whereas V appears to be the primary cause of toxicity in pH 9.5 CL.

Photodegradation of pharmaceuticals, personal care products and endocrine disrupting compounds in drinking water

Carlson J, Metcalfe C, and Stefan M

Presenting from 15:00 pm - 15:15 pm

There is potential for contamination of drinking water by pharmaceuticals and personal care products (PPCPs) and endocrine disrupting compounds (EDCs). Thus, we describe parameters affecting the efficacy of UV treatment processes for removal of 15 PPCPs and EDCs. UV irradiations were performed using both low- and medium-pressure mercury light sources. Analytes were processed by solid phase extraction (SPE) and quantified by liquid chromatography tandem mass spectrometry (LC/MS/MS). The characteristic UV absorption spectra and quantum yields determined as a function of pH, and the measured $OH^{\bullet}$ radical rate constants were used to interpret the experimental removal efficiency of these emerging contaminants through direct photolysis and advanced oxidation processes. Compound pK_a values were determined using photometric titrations. Irradiation in the presence of 4 mg/L H_2O_2 was an efficient removal method for all target compounds. With the exception of sulphamethoxazole (SMX) and triclosan (TRI), which undergo rapid degradation by direct photolysis due to their large quantum yields, reaction with $OH^{\bullet}$ radicals was the dominant removal pathway when the irradiations were performed in the presence of H_2O_2. Using medium-pressure mercury lamps, the influence of nitrate, H_2O_2, and dissolved organic matter on the removal rates of the PPCPs and EDCs was studied in two natural waters. The addition of 15 mg/L nitrate had a variable effect on the removal of different compounds. A discussion of potential interactions is provided.

Characterization of the biological and phenotypic effects of 17α-ethynylestradiol exposure in *Xenopus laevis*

Tompsett A R, Wiseman S, Giesy J P, and Hecker M

Presenting from 15:15 pm - 15:30 pm

Estrogenic chemicals in the environment have been implicated in causing a variety of adverse effects in exposed organisms. Exposure to estrogens, especially at critical times during sexual development, can cause feminization and/or demasculination of males of many species. 17α-ethynylestradiol (EE2), a hormone analog commonly used in oral contraceptives, is an estrogenic chemical of environmental concern. EE2 has well-documented and drastic effects on *Xenopus laevis* sexual differentiation and development. At low doses, EE2 can sex reverse genetically male tadpoles to phenotypic females. Using EE2 as a model compound and DM-W, a recently discovered *X. laevis* sex-linked gene, as an indicator of genetic sex, an exposure was performed to attempt to discover the mechanisms underlying the biologically relevant phenomenon of sex-reversal. *X. laevis* were exposed to 0.1, 1, and 10 µg/L EE2 from 12 h post-oviposition through 13 wks post-hatch. These concentrations span the full spectrum of concentrations previously reported to cause male-to-female sex reversal, and the lowest 2 doses are similar to maximal values that have been measured in some watersheds. All concentrations of EE2 tested in the current experiment significantly delayed completion of metamorphosis. Exposure to 1 µg/L EE2 caused a significant decrease in weight at termination of the experiment. In addition, phenotypically determined sex-ratios were significantly female-biased in all EE2 treatments but not in controls. Genotyping of a subset of EE2 exposed phenotypic female froglets indicated that genetic sex-ratios of these animals was about 60% female and 40% male, which did not differ from sex-ratios in control treatments. DM-W genotyping also allowed definitive classification of EE2 exposed phenotypic female froglets as genetic males for the first time in an experiment of this type.

Population level concequences of urban derived endocrine disrupting compounds on the reproductive function of a sentinel species

Henderson S, Jackson L, Habibi H

Presenting from 15:30 pm - 15:45 pm

We sampled longnose dace at eight sites along the Bow River within the urban footprint of Calgary. We measured sex ratios, gene expression relevant to reproductive function as well as gonad malformation (intersex). Female-biased sex ratios were found at the majority of sites. Elevated vitellogenin mRNA levels were found in male fish and changes in estrogen receptor alpha and insulin like growth factor-1 were noted in males and females. Our results indicate that there is widespread endocrine disruption, including neuro-endocrine disruption, throughout the range of sites we sampled. We also found that males and females respond differently to endocrine disrupting compounds.

Determination of in vitro half lives of eight selected aldehydes in human blood by using 2,4-dinitrophenylhyrazine as trapping reagent

Nikoobakht N, Rydperg P, and von Stedingk H

Presenting from 15:45 pm - 16:00 pm

Measurement of aldehydes in human blood is of importance for several reasons; one is that aldehydes can be used as potential biomarkers for lipid peroxidation which is associated to various diseases. The electrophilic reactivity of aldehydes makes the analysis very difficult in complex matrices, such as blood. There have however been many efforts of development and application of various methods for aldehyde analysis in vivo.

A highly sensitive reagent for measuring aldehydes is 2, 4-dinitrophenylhydrazine (2, 4-DNPH), which after reaction with aldehydes forms the corresponding hydrazone analytes. In the present study this reagent was used for studies of stability of aldehydes in human blood after incubation in vitro and for analysis of background occurrence of aldehydes in blood. Eight aldehydes, formaldehyde, acetaldehyde, butanal, hexanal, heptanal, nonanal, benzaldehyde and hydrxymethylfurfural(HMF) were studied by liquid chromatography mass spectrometry.This study showed that butanal, hexanal, heptanal and nonanal have significantly shorter half lives (less than 2 hours) compared to the aromatic aldehydes i.e., HMF and benzaldehyde (57 hours and even longer, respectively) in human blood in vitro.

In a small pilot study background levels of aldehydes in both human and sheep blood was roughly estimated by LC-ESI-MS/MS in the negative ion mode using calibration curves obtained from synthetic standards. By applying the 2, 4-DNPH method for analysis of background levels of aldehydes; formaldehyde, acetaldehyde, butanal, hexanal, heptanal and nonanl in both human blood and sheep blood were estimated. This study showed that the levels of aldehydes in human blood were higher as compared to sheep blood.

Parasites and chemical contaminants in whitefish (coregonus clupeaformis) from Northern Saskatchewan lakes

Mysiv O, and Pietrock M

Presenting from 16:00 pm - 16:15 pm

Whitefish is an important food source for Indigenous people in Northern Saskatchewan. There has been an increase in whitefish parasitism over the last years leading to concerns that this might be related to industrial activities in the North and water pollution. Therefore, a study has been initiated to investigate parasites and chemical contaminants in whitefish from Montreal and Reindeer Lakes to determine the risk related to whitefish consumption. In both lakes *C. clupeaformis* were infected by cestodes, trematodes, nematodes, and acanthocephalans. A total of 20 species has been found so far. All fish were infected by at least one parasite. The most prevalent species is *Cotylurus erraticus*, which occurs in cysts around the heart. Contamination of fish with metals and organic compounds is low. Average mercury concentrations in the fillet were 45.34 µg/kg d.w. (Reindeer Lake) and 18.40 µg/kg d.w. (Montreal Lake), respectively. PCB congener concentrations detected in the samples from both lakes were extremely low with many below the detection limit of the instrument. Overall, the investigated whitefish harbour parasites which are typical for this host, and the impact of environmental contaminants on fish parasitism is negligible in the sampled lakes. Further investigation is necessary to uncover the reasons for the perceived increase in whitefish parasitism.

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•examining the links between land-use activities and the effects of associated non-point source pollution on water quality;
•assessing in-stream flow needs for the support of various ecological functions;
•exploring the habitat implications of changes to hydrologic patterns;
•determining the effects of water impoundment structures on biological communities;
•constructing benthic biomonitoring and ecosystem health protocols, including the development of an appropriate reporting framework;
•assessing urban runoff; and
•undertaking ecological risk assessments.

For more information on the research currently being conducted by the Saskatchewan Watershed Authority, please contact our Water Quality Services office in Saskatoon at (306) 933-7442.

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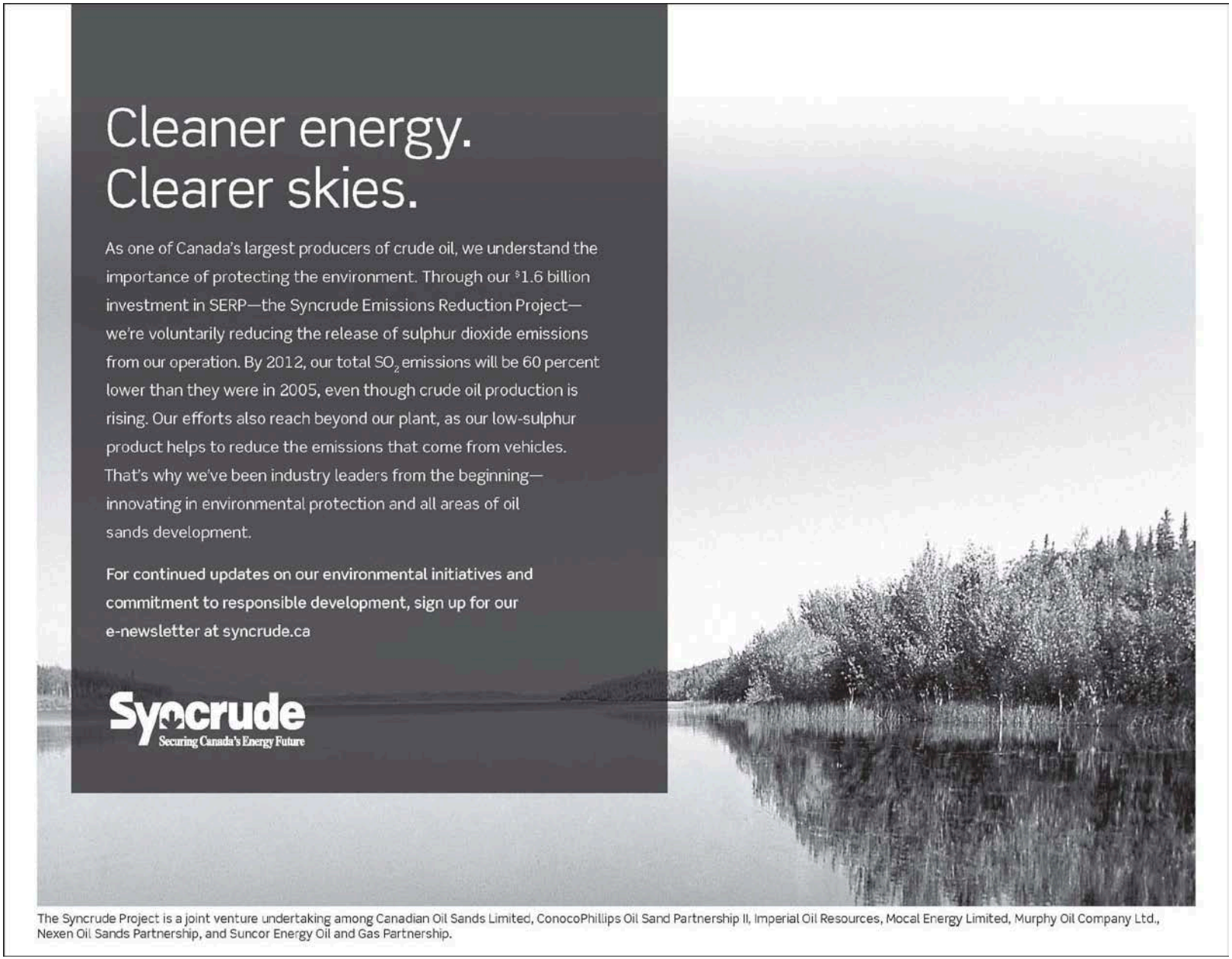

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