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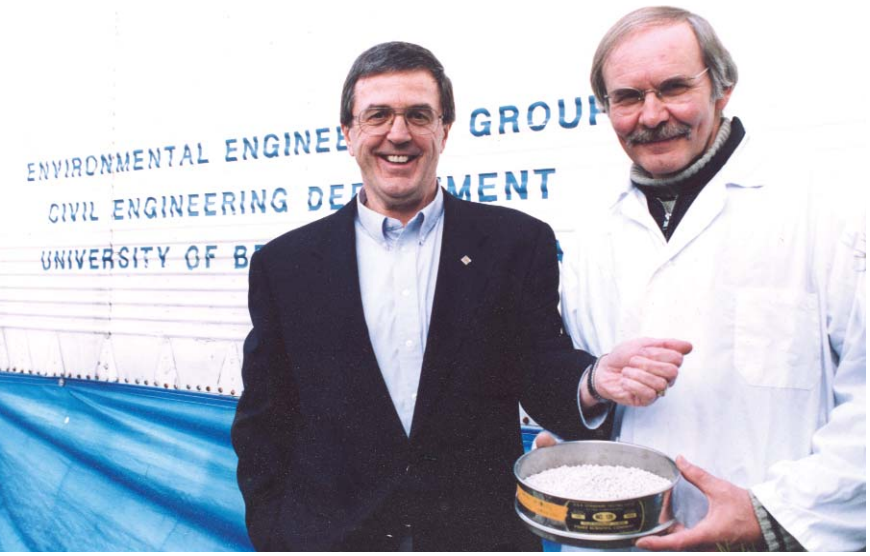
# civil@ubc

Civil Engineering News @ The University of British Columbia

# Green Team: UBC researchers pioneer environmentally friendly wastewater recovery

By Donald S. Mavinic, Ph.D., P.Eng.




Professor Don Mavinic and Research Associate, Fred Koch, admiring struvite recovered from municipal wastewater

**Professor Don Mavinic and his research group in Pollution Control and Waste Management learned, in 1999, that they were awarded a BC Hydro research grant to investigate methods for recovering phosphorus from municipal wastewaters. The funding, $400,000 over three years, came from a far-sighted and timely program known as the Strategic Environmental Initiative Program (SEIP). It turned the fortunes of the research group around.**

After a low funding period, following the early retirement, in 1995, of Environmental Engineering Group Leader, Professor and Head, W. K. "Bill" Oldham, the group's unique South Campus wastewater research facility, the UBC 'Pilot Plant', was destined to become a hub for innovative waste treatment R & D work, and the development of a new generation of environmental engineering technology. This time, the research centered around new, clean "green" technology, featuring the recovery of phosphorus fertilizers from municipal (and other biological) wastes.

The build-up in pipes, pumps and other processing equipment, from deposits of phosphate-rich materials called *struvite*, is considered a major problem in municipal wastewater treatment plants. What the research group did was apply a "P-to-P" approach—turning a problem into a product—and that product is now known internationally as *Crystal Green*®: a phosphorus rich, slow release, environmentally friendly fertilizer material, consisting primarily of *struvite*, the mineral name for $MgNH_4PO_4.6H_2O$, with an NPK content of 6-28-0 (plus 10% magnesium). The high rate, fluidized bed crystallization reactor used to produce the *struvite* is protected by patents and the technology has been commercialized by a UBC spin-off company, Ostara Nutrient Recovery Technologies Inc., based in Vancouver (http://ostara.com).

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## In this Issue

# Message from the Head

In this issue of the civil@ubc newsletter, Donald Mavinic, Associate Head of Faculty & Research and Professor of Environmental Engineering, reports on a new technology discovered at UBC that enables the recovery of a phosphate rich material called struvite from wastewater and sewage treatment facilities. This is a sustainable technology that will help replenish globally dwindling reserves of phosphorus, a key component of fertilizer deemed to be crucial for the world's food supply.

Following a recent strategic planning exercise, the department has committed to redeveloping its curriculum. Faculty and industry leaders endeavour to update our Undergraduate and Graduate programs to provide more relevant and engaging education and research opportunities to our students. I would like to express my gratitude to Barbara Lence, Professor and Associate Head of the Undergraduate Programs for her leadership of the curriculum development process, and to the members of the department's Industry Advisory Council, including the most recent additions, Marian Podlovsky, P.Eng. of Fluor Canada, and Doug Hinton, P.Eng. of Hatch Mott MacDonald, for their interest in, and contributions to, the development of our program.

I would like to extend a warm welcome to our newest faculty members, Assistant Professors, Mahdi Taiebat, Geotechnical Engineering, Mohamed (Medhat) Wahba, Transportation Engineering, Tony Yang, Structural Engineering, and to Noboru Yonemitsu, who rejoins the department as an Instructor in Hydrotechnical Engineering and Civil Engineering Design.

Currently, we are collaborating with the School of Community and Regional Planning (SCARP) at UBC, to hire a new faculty member in the area of Transportation and Infrastructure Planning. We envision that this interdisciplinary position will help foster innovative solutions to the most pressing problems facing urban societies. As well, this position will further the sustainability focus of the Trek 2010 vision for the university to "promote the values of a civil and sustainable society".

I am always interested to hear your comments and suggestions, so please feel free to send me a message at: reza.vaziri@ubc.ca.

**Reza Vaziri, Ph.D., P.Eng.**
**Professor and Head, Department of Civil Engineering**

## OUR MISSION

**The Department of Civil Engineering at the University of British Columbia provides an outstanding learning and research environment inspiring technical innovation, and leadership, in social and environmental responsibility, to address current and future challenges.**

# Outstanding Students
## Prestigious Awards

### Undergraduates

**Governor General's Silver Medal**

Chris Bazett, B.A.Sc.
Photo courtesy of ErinRose Handy, Faculty of Applied Science

Chris Bazett, top Civil Engineering undergraduate student for 2008, received one of three Governor General's Silver Academic Medals presented in May 2009 at UBC. Previously, he won the Governor General's Bronze Medal for his outstanding academic record at Kelowna Secondary School in 2003.

Governor General's Academic Medals are among the most prestigious awards a student in a Canadian educational institution can receive, recognizing academic excellence across Canada at four levels: Bronze at the secondary school level; Collegiate Bronze at the post-secondary, diploma level; Silver at the undergraduate level; and Gold at the graduate level.

**EIC Annual Scholarship**

Daniel Fortin

Daniel Fortin, second-year Civil Engineering student, was recognized in November 2009, for his outstanding academic and extra-curricular achievements with the Engineering Institute of Canada (EIC) Vancouver Island Branch's Annual Scholarship. The EIC Scholarship is awarded to a Vancouver Island high school graduate entering a second- or third-year engineering program with high academic standing, financial need and leadership roles in extra-curricular activities.

### Graduates

**Engineers Canada/**
**Manulife Financial Scholarship**

William Johnstone, M.A.Sc., P.Eng.

William Johnstone, Civil Engineering Ph.D. candidate specializing in Reliability and Risk Management at UBC, was awarded in October 2009, one of seven scholarships from Engineers Canada, with Manulife Financial and TD Insurance Meloche Monnex. Working under the supervision of Professor Barbara Lence, he is developing a model of Evacuation and Sheltering Systems (ESS) for catastrophic hazards and methods to assess ESS effectiveness.

Scholarship recipients demonstrate how the engineering profession can contribute to a healthier, cleaner, safer, more competitive and sustainable Canada. Engineers Canada is the national organization that regulates the practice of engineering in Canada and licenses more than 160,000 professional engineers across the country.

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# Saving Lives on the Sea-to-Sky highway

By Tarek Sayed, Ph.D., P.Eng.


Top Story

Eight injured in Deeks Creek crash

Tragic stories, like the one shown above, inspired Professor Sayed's research to evaluate road designs and making the Sea-to-Sky Highway a much safer place to travel. Image courtesy of the Squamish Chief newspaper.

Professor Tarek Sayed is leading research to quantify highway safety impacts, resulting in changes to highway design and, to aid in understanding the relationship between road design, safety performance and traffic operation. A safety evaluation on the Sea-to-Sky highway suggested that changes to the highway's design could improve safety and reduce the number of accidents. Quantifying the safety impacts supports the design process by allowing decision makers the opportunity to analyze the benefits in relation to the cost of highway improvement. This 'trade-off' approach allows for the justification and rationalization of highway infrastructure investment.

Prof. Sayed's research led to a framework that was adopted by the British Columbia Ministry of Transportation to evaluate the design of the Sea-to-Sky Highway. The framework provides a quantifiable safety and design analysis which compares the existing highway to new designs, helps determine the impact of the design parameters on safety performance, measured in collision frequency, associated with the highway design, and to evaluate design consistency, to identify and rank the locations that offer the greatest potential for safety improvement.

The analysis showed the new design developed for the Sea-to-Sky offers considerable improvement over the existing highway. As a result of improved design parameters and design consistency, the total number of accidents expected on the highway can be significantly reduced. These results were used 1) to determine the incremental safety benefits that can be achieved by a new design in relation to the existing highway conditions, 2) to identify specific locations where the estimated safety performance may be less than desirable, or could be improved and, 3) to help facilitate the investigation of opportunities for design improvements, by providing insight into the nature of the safety performance problems.


The "Sea-to-Sky Highway" section of Highway 99 North, follows the coast between Vancouver and Whistler, British Columbia

# Retirements

Susan Harper

Ayesha Ali

**September 2009**

The Department of Civil Engineering would like to announce the retirement of two long-serving members of our department. Susan Harper, Environmental Lab Manager has retired after 35 years of service with the University. Ayesha Ali, Civil Engineering Office Manager retired after 11 years.

Department Head, Prof. Reza Vaziri and other guests recognized Susan and Ayesha's hard work and dedication to the department at a reception held at the Shaughnessy Golf and Country Club on September 3, 2009.

We wish Susan and Ayesha all the best in their future endeavours and hope that they will come visit us often.

# Shake Table Donated

**April 2009**

Professor Carlos Ventura and the Engineering Earthquake Engineering Research Facility (EERF) would like to thank Nokia Products of Burnaby for their donation of a vibration shake table, valued at approximately $135,000 US. Civil Engineering technician Scott Jackson was instrumental in securing the donation. Nokia Products is downsizing its operations and has donated some of their equipment to various UBC departments.

Needless to say, the department is ecstatic about this new acquisition for the EERF since this will give us additional testing capabilities.

# Community Service Learning

## teaches global citizenship

By Susan Nesbit, Ph.D., P.Eng.

Community Service Learning (CSL) experiences are a key element to the Civil Engineering program's second-year Integrated Project courses. Working within a design environment that links professional practice to the social, geopolitical and ecological contexts of design decisions, student teams work with non-profit organizations on projects that contribute to the community. Each project challenges students to develop their design and project management skills while applying relevant analysis tools. Within a community-based context, students integrate knowledge and understanding, develop professional attitudes and practice leadership and teamwork. This integrated project experience enables students to develop their global citizenship skills.

Last year, a team of ten second-year students worked with the Vancouver Native Health Society (VNHS) to design and build a fish smokehouse. Located in the Aboriginal Community Kitchen Garden at the UBC Farm, the student team learned about aspects of traditional values and how these values influence the smokehouse design. The smokehouse has deep significance in West Coast cultures. Working under the guidance and leadership of elders from the Haisla, Tshimshian and Kitlope First Nations, the students in the VNHS team began to understand the profound effect that infrastructure can have on people's cultural well being.

The smokehouse, designed and built with leadership from First Nations elders in UBC Farm's Aboriginal Community Kitchen Garden, provides an integrated learning experience for second-year Civil Engineering students.

A primary aim of the VNHS project was to enhance a greater self-awareness of each student's cultural background, encourage empathy and respect for the views and needs of others, and develop an appreciation for diversity—all aspects of global citizenship. Thus, global citizenship learning goals were embedded within the technical challenges of the smokehouse design-build project. Thanks to the support and leadership of the First Nations elders and the partnership between VNHS and the Civil Engineering department, these learning goals were successfully met.

# Civil Engineering Co-op

## Fast tracking a Civil Engineering career

By Laura Ramsden

Third Year Civil Engineering Student, Laura Ramsden, worked with the Department of Fisheries & Oceans this Summer.

I joined the co-op program at the beginning of my second year at UBC in 2007. My initial co-op work terms were with Klohn Crippen Berger for the Summer and Fall 2008, where I was involved in geotechnical engineering.

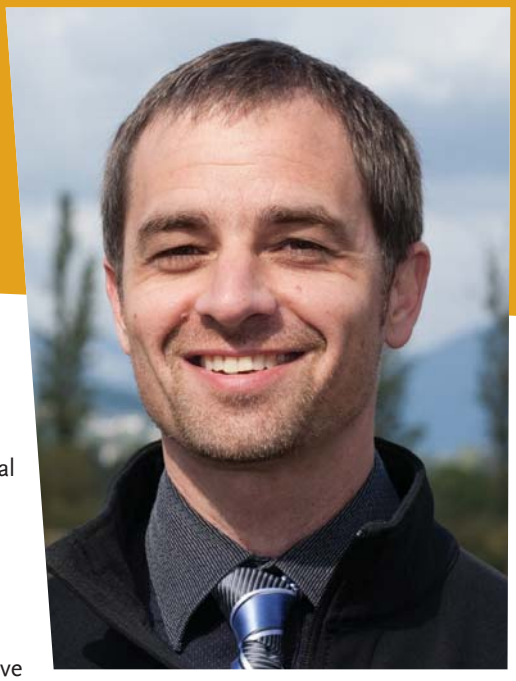
This past summer, I had the opportunity to work for the Department of Fisheries and Oceans (DFO) as part of the Resource Restoration Unit (RRU). The main focus of the group is to design, build and maintain stream works intended to enhance fish habitat; more specifically, to ensure that salmon are able to migrate upstream in order to spawn in the late summer and early fall. These works included designing culverts, modifying the physical layout of the stream by changing the substratum or adding large boulders to dissipate energy in the stream, and creating side channels for spawning purposes, and to create fish habitat. This involved diverting a small portion of water from existing streams and creating small side channels that are ideal for incubating eggs and rearing fry.

My supervisors ensured that I was exposed to many different sites and applications of fisheries projects. One of my tasks was to survey channels throughout the Lower Mainland, from Maple Ridge and Chilliwack, all the way up to Pemberton and D'Arcy. I was astonished to discover how quickly the surrounding forest reclaims the land that surrounds the channel. Many of the man-made channels looked completely natural. I had an awesome experience working for the DFO and was very fortunate to learn from experienced fisheries engineers.

I was asked to produce a preliminary design for a salmon counting fence at the small hatchery in D'Arcy to obtain an accurate estimate of how many salmon are returning to spawn there each year. As part of the design process, it was important that I observe the migration pattern of the salmon as they entered the spawning channel. I spent a few weeks waiting for the salmon to arrive – they did return – although very late in the season. This was the coolest part of the job, because the spawning salmon are pretty magnificent. I felt very excited to be working for such an important cause, especially this year, with such a large number of sockeye salmon "missing" in the Pacific Ocean.

# Risks worth taking

By Dean Shiskowski, Ph.D., P.Eng



Dean Shiskowski, Ph.D., P.Eng.

**I continue to marvel at the issues those in my chosen profession have been forced to consider over the past few years. The global drivers of energy-efficiency and self-sufficiency as well as resource limitations and climate change require those practicing in the area of wastewater management to address issues and consider ideas that were only a small or non-existent blip on the radar screen as recently as five years ago.**

Addressing challenges will require taking risks, which the current and upcoming generation of engineers will need to consider taking. The challenge is that the civil engineering world, which is entrusted with spending huge sums of public monies, is a necessarily conservative business in general. At the same time, this conservativeness, if unchecked, may prevent our society from making the changes needed to preserve and enhance our quality of life and that of our natural environment.

Consider a simple example, water conservation. You would be hard-pressed to find anyone who does not think this is a good idea. But consider a comment made by George Tchobanoglous, Ph.D., an Emeritus Professor at the University of California and a globally recognized leader in environmental engineering, at a recent Water Environment Research Foundation forum. He described the "unintended consequence" of a particular community's aggressive pursuit in the implementation of water-saving fixtures. They had succeeded in significantly reducing their potable water use. But when this reduced volume became wastewater and was discharged into the sewer system, the low-flow velocities were insufficient to flush the pipes of accumulated, settled solids. Addressing this maintenance issue required flushing the sewer system with potable water obtained from hydrants. This unintended consequence significantly compromised the sought after benefit.

This is where the risk taking comes in. In this example, if we talk water conservation, the work might be installing the next kilometre of sewer pipe in the ground using a smaller diameter and greater slope than used previously. Sounds easy. But consider that this decision a) may go against decades of design practice and experience and b) could have serious consequences if in fact we don't achieve the water conservation goals set out. Would you be willing to take this decision to your municipality's political board?

Regardless of our individual role in this industry, many will have to take such risks if we are to advance the measures needed for society.

As the next generation of engineers, many of you will have the opportunity to advance new ideas from the ground floor. This will require taking risks first with your own peers. My own experience is but one example. My Ph.D. work focused on nitrous oxide ($N_2O$) generation in wastewater treatment bioreactors. $N_2O$ is a very powerful greenhouse gas (GHG) with a global warming potential equivalent to 300 times that of carbon dioxide. Very little was known about this potential greenhouse gas issue in the wastewater community at that time. My initial attempts at sharing what I had learned with those I interacted with at conferences and discussion forums were often met with resistance and apathy.

Fast forward a few years – through the efforts of a relative few raising the initial awareness – the $N_2O$ issue is now arguably the hottest GHG topic in wastewater treatment. Now, I get invited to speak at local and international conferences, provide commentary to NASA researchers, write editorials in journals and participate in related research activities conducted in Canada and elsewhere. At times it felt like pushing a rope, but in the end it has been very rewarding.

Some risks are worth taking. Will you be bold enough to take them?

*Dean Shiskowski, Ph.D., P.Eng. is the Corporate Practice Leader – Wastewater Management for Associated Engineering, a Canada-wide consulting engineering firm. He obtained his M.A.Sc. and Ph.D. degrees from UBC in 1995 and 2005, respectively, in Civil (Environmental) Engineering.*

# Curriculum Redevelopment

By Barbara Lence, Ph.D.

**Professor and Associate Head of Undergraduate Programs and Chair of Curriculum Redevelopment Committee, Barbara Lence, Ph.D.**

*The Department would like to thank the members of the Curriculum Redevelopment Committee: Barbara Lence (Chair), Thomas Froese (Co-Chair), Ken Elwood, Pierre Bérubé, Susan Nesbit, Mahdi Taiebat, Noboru Yonemitsu, Chris Bazett and Loretta Dodds.*

Undergraduate programs, offered by the Department of Civil Engineering, are currently undergoing a redevelopment that is informed by the best-practices in pedagogy and curriculum research. This curriculum initiative is in keeping with a series of related actions by the department over the past ten years, and it reflects the goals of Trek 2010 and the 2008 Faculty of Applied Science Strategic Plan.

A significant focus of the curriculum redevelopment process has been the collection of data from stakeholder groups, including students, faculty, and interest groups (consultants, government, professional organizations, crown corporations, etc.), in order to support decision-making as the reformed curriculum takes shape. In March 2009, at the meeting of the Department of Civil Engineering Advisory Council, the department engaged interest group advisors and faculty members in discussions regarding the identification of ideal graduate attributes, of necessary foundational program content, and of desirable student learning experiences. Through their insightful comments, the Advisory Council members showed their enthusiasm toward meaningful change. At the end of term, students in each year of the program were also engaged as they completed a detailed survey aimed at capturing the current experience as well as generating ideas on how best to improve the programs.

At the department's annual two-day retreat in May 2009, the faculty focused on curriculum redevelopment. Key issues such as options for program structure, approaches for addressing increasing class sizes, program-level learning outcomes and experiences, desirable assessment mechanisms, and indicators of a successful program were discussed. The collaborative engagement among the faculty members made the retreat an important springboard for future phases of the curriculum redevelopment process.

As an extension of discussions at the retreat, the department selected seven program-level learning outcomes that will be used to guide the redevelopment of the curriculum. They will help to clarify and communicate the vision for the Civil Engineering department and the purpose of the undergraduate programs. They will also help align course offerings across a given year and through the years, and will improve consistency between what is taught, learned, and assessed in the classroom. The program-level learning outcomes are fundamental to the development of a learning-centered curriculum, wherein the focus shifts from the traditional view of what is being taught to the new philosophy of what is being learned.

A significant amount of research, planning, coordination, and perseverance has been invested in the redevelopment process to date, and the early signs of success, such as stakeholder engagement and buy-in, are encouraging. We are looking forward to more strides toward a revitalized Civil Engineering program as the process continues.

# Advisory Council

The Advisory Council met in March 2009 and engaged in discussions regarding a curriculum renewal initiative in an effort to improve the Civil Engineering undergraduate program. Committed to purposeful changes, their recommendations are intended to guide program learning objectives and provide continuous curriculum monitoring to the department.

Council Members include industry representatives: Roy Grout, BC Hydro; Frank Huber, Metro Vancouver; Brian Johnson, Stantec Consulting Ltd.; Bill Kendrick, CH2M Hill; Tim Little, BC Hydro; Hew McConnell, Hew McConnell Consulting Ltd.; Sheri Plewes, TRANSLINK; Tom Timm, The City of Vancouver; Anibal Valente, PCL Constructors Westcoast Inc.; Ron DeVall, Read, Jones & Christoffersen Ltd.; and the most recent additions to the council: Doug Hinton, Hatch Mott MacDonald and Marian Podlovsky, Fluor Canada Ltd.

**Open discussion among Advisory Council members aids the development of curriculum**

**"The undergraduate and graduate curricula should be viewed as works in progress – they are constantly being reviewed and modified in response to identified needs and trends. The same can be said of the research activities of the Department. Thus, feedback to the Department on needs and trends and how it should be responding to them will be sought from Council members."**

*Advisory Council terms of reference, 2009*


Joe Maffei of Rutherford & Chekene Consulting presents research on seismic design. Photo courtesy of Professor Terje Haukaas.

Joe Maffei, SE, Ph.D., LEED AP

# Noel Nathan Memorial Lecture Series

**The third Noel Nathan Memorial Lecture was held on April 8, 2009 at UBC Robson Square. A reception, partially sponsored by the Structural Engineers Association of BC (SEABC), followed the presentation.**

The event, coordinated by Professor Terje Haukaas, was held to honour the memory of our colleague, Professor Noel Nathan, who left a lasting legacy in the Department of Civil Engineering at UBC. The event was very successful and was attended by approximately 100 engineers, faculty and guests.

The tribute to Professor Nathan was given by the Department of Civil Engineering Professor Emeritus, Liam Finn, who gave a personal account of Noel Nathan's warm, humorous, and thoughtful nature.

Professor Perry Adebar introduced the keynote speaker, Joe Maffei, SE, Ph.D., LEED AP, a Structural Engineer and Principal with Rutherford & Chekene Consulting Engineers in San Francisco. He is an expert on the seismic design and retrofitting of buildings.

Dr. Maffei delivered an inspiring lecture that included fascinating examples of potential earthquake damage and preventive retrofit solutions. Focusing on concrete buildings, he described common seismic deficiencies in buildings and recommendations for carrying out seismic evaluations.

The Noel Nathan Memorial Lecture series is made possible by the proceeds from generous donations from more than 50 donors ranging from companies to private citizens. The Department of Civil Engineering would like to express its sincere gratitude to all these donors for their contributions and, to Professor Terje Haukaas for coordinating this successful event.

**Email feedback from one participant (a senior influential engineer in the city):** "Thank-you for organizing the event on Wednesday, [I] enjoyed the talk and the meeting both before and after. Noel Nathan had a huge influence on not only individual engineers but also the structural engineering community as a whole and it is great that we continue his memory with these talks."

# Earthquake Symposium

By Jose Centeno, M.A.Sc.

The second annual Earthquake Engineering Symposium was held at UBC, from August 10th to 13th, 2009.

This successful event was hosted by the UBC Earthquake Engineering Research Institute (UBC EERI) Student Chapter, with the support of the Earthquake Engineering Research Facility (EERF) and the Department of Civil Engineering. Delegates from Tongji University, China; and the Universidad Nacional Autónoma de México (UNAM) (National Autonomous University of Mexico) gathered at UBC for a series of technical sessions and social events. Present at the symposium were professors, graduate and undergraduate students from Tongji University, UNAM and UBC; as well as practicing engineers from British Columbia. The technical sessions were composed of presentations on the state-of-the-art of earthquake engineering in China, Mexico and Canada, and their common research interests.

Following the symposium, faculty from Tongji University and UBC are initiating plans for a collaborative project on the evaluation of their most recent seismic retrofit guidelines. Also, student groups from Tongji University, the EERI UNAM along with the UBC EERI student chapter are working together on a project to raise earthquake awareness in their communities.

The next Earthquake Engineering Symposium is planned to be held at Tongji University in Shanghai in 2011.

**Delegates from Tongji University of China, the Universidad Nacional Autónoma de México (UNAM) and UBC, along with practicing engineers from BC, pose together following four days of workshops at the Second Annual Tongji Symposium. Photo courtesy of 2nd Year, Civil Engineering student, Yan Yang.**

# To sway or not to sway

By Pierre Bérubé, Ph.D., P.Eng.

Water filtration membranes 'sway' in the wake as air passes over them to enhance water quality

Membrane filtration systems are increasingly being used for both water and wastewater treatment applications. This is largely due to their ability to effectively remove contaminants of concern. For example, membrane systems can remove over 99.9999% of pathogens such as *Giardia lamblia* (which causes 'beaver fever'), while conventional sand filtration systems can only consistently achieve 99.9% removal[1]. However, residual material that is retained by the membrane can accumulate on the surface making it more difficult to filter additional water.

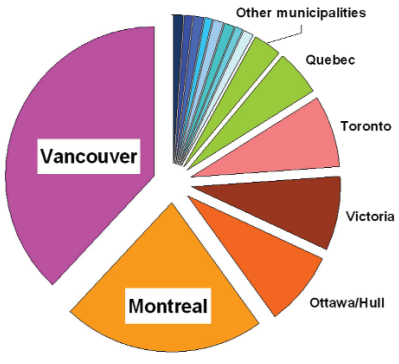
To counteract residue build-up on the membrane, air is added to mix the liquid being filtered to remove the accumulating contaminants. Until recently, it was not known how the added air actually removes the contaminants. Over the past 5 years, researchers in the Department of Civil Engineering at UBC, led by Professor Pierre Bérubé, have been studying the effect of air addition and they have discovered that air bubbles, especially the 'wake' behind rising air bubbles, induce highly variable shear forces on the membrane surfaces, which effectively removes the accumulated material. Interestingly, constant shear forces, such as those induced by bulk liquid movement (e.g. stirring), do not promote the removal of accumulated material. In addition, it appears that the air bubbles cause the membranes to sway, much like the swaying of seaweed, and it is the shear forces induced by this swaying motion that promotes the removal of accumulated contaminants. With this new knowledge, UBC researchers are assisting their industrial collaborators to optimally design membrane systems, making this technology more economically attractive. This is of particular importance to many small Canadian communities that currently cannot afford to implement advanced water treatment systems such as those based on membrane technologies.

[1] (Health Canada guidelines recommend that "water treatment must achieve at least 99.9% and 99.99% removal or inactivation, or both, of Giardia and viruses, respectively...". Source: http://hc-sc.gc.ca/ewh-semt/pubs/water-eau/part_i-partie_i/microbiological-microbiologiques-eng.php.)

# Canadian Seismic Research Network Launched

A major study on natural hazards and disasters concluded that "a significant earthquake...is probably Canada's greatest potential natural disaster" (Etkin et al, 2004).

Researchers from across Canada recently formed the *Canadian Seismic Research Network*, focusing on urban centres: Metro Vancouver, Victoria, Montréal, Ottawa, Toronto and Québec City; which comprise approximately two-thirds of Canada's population and more than three-quarters of its seismic risk. A team of key researchers in seismology, risk assessment, geotechnical engineering, structural engineering, public policy and disaster management, are coordinating with each other to develop a uniquely Canadian solution to seismic risk reduction.




Relative contributions to seismic risk in Canada (source: Geological Survey of Canada)

Canadian guidelines are urgently needed; collaboration between public policy makers, emergency managers and emergency response teams is essential in developing effective action plans to deal with earthquake preparedness and post-earthquake response.

The research is aimed at the development of tools for engineers, planners and decision makers faced with the challenging task of reducing urban seismic risk. The research will contribute to the goals of Canada's proposed National Disaster Mitigation Strategy "to reduce risks, impact and costs associated with natural disasters, as well as to foster a disaster-resilient society."

Researchers from eight universities across Canada (University of British Columbia, University of Western Ontario, University of Toronto, University of Ottawa, Carleton University, McGill University, École Polytechnique de Montréal, and Université de Sherbrooke) are working to address the varied needs and deficiencies found in different seismological environments throughout the country, ensuring effective risk-reduction outcomes. Here at the Department of Civil Engineering, the researchers include Professors Perry Adebar, Ken Elwood, Liam Finn, Terje Haukaas and Carlos Ventura.

Funding for the five-year NSERC Strategic Network includes $5 million from NSERC as well as cash and in-kind contributions from numerous partner organizations and the universities.

# Green Team

continued from page 1

Treatment plants that experience *struvite* build-up often use the "enhanced biological phosphorus removal" (EBPR) process. This technology was also studied and developed at UBC in the 1980's, by Bill Oldham's team, and is now being used globally. Besides being associated with *struvite* problems in treatment plants, this process also happens to be the best available technology for producing phosphorus-rich sludge biosolids, where the phosphates are easily recoverable. So, these two technologies, one old and one new, fit together like a hand in a glove. They will no doubt become integral components of new, truly sustainable wastewater treatment processes.

Established in 1981, the UBC Pilot Plant has been the centerpiece of efforts to control and understand the fundamentals of the EBPR phenomenon as this technology was rolled out. Over 70 M.A.Sc. and Ph.D. students have subsequently made use of this facility. The UBC pilot plant was decommissioned in early 2009, and moved to the new Staging Environmental Research Centre (SERC) being built on the South Campus. Past achievements were internationally recognized in 2006, when one of the papers (Comeau, Oldham, Hall and Hancock, 1986 – *"A biochemical model for enhanced biological phosphorus removal"*, Water Research, Vol. 20, No. 12, pp. 1511-1521) was selected as one of the "Top Ten" key publications in the first forty years of Water Research.

The achievements of Professor Mavinic's research group, related to phosphorus recovery technologies, are now starting to be recognized, with recent articles on the new Canadian *struvite* recovery technology being featured in both Nature (October 8, 2009) and Scientific American (November 2009). Such recognition is a definite credit to UBC and the Department of Civil Engineering, as much for its foresight into the rapidly evolving world of sustainable wastewater engineering practice, as for the significant contributions made to bring cost-effective, environmental technologies into the market place. Progressive municipalities are already realizing this and are now factoring in recovery economics.

A brave new world of environmentally friendly (and sustainable) engineering process technologies is emerging. Professor Mavinic's group is playing a role in supporting the development of these, and other new treatment and recovery technologies, currently taking place in the application to resource recovery from agricultural and animal wastes. Together, with a research group led by Professor K.V. "Victor" Lo, the combined team is focusing on nutrient (and energy) recovery from animal waste. Piloting these new processes is taking place at the UBC Research Dairy Centre in Agassiz, as well as on campus, at the SERC facility. The *'peroxide microwave'* (PM) process is another new technology that can be used to enhance the release of nutrient materials from sludge biosolids and other agricultural waste products; it also increases the potential for energy recovery, via increased methane gas production. Research Associate, Ping Liao, Ph.D., manages this aspect of Professor Lo's research initiative.

In addition to the work on animal waste, research is now being conducted on the recovery of ammonia from waste streams. Although not limited in supply (unlike phosphorus, where global reserves are now dwindling), ammonia recovery will likely become the big topic in the next phase of sustainable process development, due to the large carbon footprint associated with ammonia production.

Presently, it will be the quest (and real need) for reusable, recyclable phosphate that gets the lion's share of public attention. Already, the world's first full-scale *struvite* production facility is now operational at Clean Water Services' Durham Advanced Wastewater Treatment Facility, near Portland, Oregon. Two new plants are under construction elsewhere in the US (York, Pennsylvania and Suffolk, Virginia). As the commercialization of the new *struvite* technology progresses, pilot scale testing has also been conducted in Haifa, Israel, and at the Severn Trent's sewage treatment works in the UK. The City of Edmonton is considering expanding their single reactor system (the first full-scale *struvite* recovery demonstration reactor, commissioned in 2007) to a 5 or 6 reactor system; this will enable them to treat their entire sewage flow, recovering 1200 metric tonnes of Crystal Green® annually and saving over 12,000 tonnes of $CO_2$ equivalents per year. Given the high degree of interest in this technology, as many as 20 new reactors will be running globally before the end of 2010. Thus, it looks like sewage's first cash crop may be here to stay.

**Section of Sewage pipe clogged with phosphorus-rich struvite**

# Meet the People of Civil Engineering

**Mohamed (Medhat) Wahba, Ph.D.** joined the Department of Civil Engineering as an Assistant Professor in July of 2009.

He received his B.Sc. (July 2000) in Operations Research and Computer Science (ranking first in his class) from the Faculty of Computers and Information at Cairo University and, holds a degree in Management Sciences, M.Phil. (July 2003) from Cambridge University, UK. He earned his M.A.Sc. (Sept 2004) and Ph.D. (Sept 2008), majoring in transportation engineering, from the Civil Engineering Department at the University of Toronto. He then joined the Massachusetts Institute of Technology as a Postdoctoral Fellow in the Civil and Environmental Engineering Department. In 2008, Mohamed was elected for a one-year term as the President of the Egyptian Student Association in North America, an international graduate student body.

Mohamed has demonstrated innovating thinking in his research on transit system analysis and has gained research and field experience in Intelligent Transportation System (ITS) applications. His areas of research interest include: transportation planning; public transportation operations; intelligent transportation systems modelling and operations, and micro-simulation of advanced public transportation systems.

**Tony Yang, Ph.D.** joined the Department of Civil Engineering as an Assistant Professor in January of 2010.

Tony earned his B.Sc. (2001) and M.Sc. (2002) from the University at Buffalo, New York, and received his Ph.D. from the University of California, Berkeley in 2006.

His research experience focuses on improving the structural response through advanced analytical simulation and experimental testing. He has developed the next-generation performance-based design guidelines in the United States; developed advanced experimental testing technologies to evaluate structural response under extreme loading conditions, including hybrid simulations and non-linear control of shake table tests; and developed risk simulation models for important facilities under extreme events.

He has peer-reviewed landmark buildings in the United States, including the tallest steel plate shear wall structure in the world; was involved with the Tall Buildings Initiative to develop seismic design guidelines for tall buildings; and has been involved in using novel technologies to improve structural performance, including the use of base isolation systems and dampers.

Tony co-developed '*OpenSees Navigator*' a software program widely used by design engineers and researchers to design and analyze complex structural systems. He has also developed 'PBEE', a software program to quantify facility loss under extreme events.

**Noboru Yonemitsu, Ph.D.** joined the Department of Civil Engineering as an Instructor I in September of 2009.

Noboru holds a B.A.Sc. (1984) and M.A.Sc. (1986) in Engineering Physics from Hokkaido University, Japan. He earned his Ph.D. (1992) in Water Resources Engineering from The University of Alberta.

He was an Assistant Professor in the Department of Civil Engineering from 1999 to 2003, after which he went on to pursue opportunities with other engineering consultancies and educational institutions such as, Northwest Hydraulic Consultants, NASA and BCIT.

His background is in Engineering Physics, which provides him with a very versatile technological knowledge base, particularly in instrumentation and experimental techniques. His general areas of expertise include Environmental Fluid Mechanics and Non-destructive testing spanning a number of related areas and physical scales such as mixing processes in stratified fluids; interaction between microscale turbulent structures and benthic organisms; contaminant/sediment transport; rehabilitation of mine-tailing ponds; nutrient recovery device design for wastewater treatment systems; and development of remote sensing technologies. His approach to these problems has been through the use of laboratory and field experimentation allied with relatively simple numerical and analytical models.

**Mahdi Taiebat, Ph.D.** joined the Department of Civil Engineering as an Assistant Professor in July of 2009.

He received his B.Sc. (2001) and M.Sc. (2003) in Civil Engineering from Sharif University of Technology, Tehran, Iran and his Ph.D. (2008) in Civil and Environmental Engineering from the University of California, Davis. After completing his Ph.D., he was awarded a post-doctoral fellowship to work in the Computational Geomechanics Division of the Norwegian Geotechnical Institute. He has worked on constitutive and numerical modeling research projects for the Pacific Earthquake Engineering Research Center, Shell International Exploration and Production, British Petroleum, and Woodside Energy. In 2007, he received the UC Davis Excellence in Geotechnical Engineering Award (known as the Idriss Award) in recognition of his outstanding scholarship, leadership, and fellowship.

Mahdi's primary areas of research interest are related to topics in theoretical and computational geomechanics, including rational mechanics and mathematical formulations, numerical methods and implementations, and computational modeling and simulations for practical applications. Of particular interest are the theory of plasticity and constitutive modeling of geomaterials; seismic wave propagation through saturated porous media; numerical methods in geomechanics (FEM, FDM, DEM); geotechnical earthquake engineering; and static and dynamic soil–structure interaction.

**Dana Vanier, Ph.D.**, has been an Adjunct Professor, working with the Construction Management Group, for nearly a decade.

He holds a B.Eng. (1974) in Civil Engineering from RMC Kingston, M.Eng. (1978) in Building Engineering from Concordia University and a Ph.D. (1994) in Architecture from Université de Montréal. His Ph.D. research developed a "parsimonious classification system to extract project specific building codes."

Dana started as a military engineer with the Canadian Forces. He was a researcher at the NRC Institute for Research in Construction (NRC-IRC) for the past 28 years and retired recently from the federal government after 38 years. He continues to work part-time with NRC-IRC as a post-retirement researcher in Vancouver.

Dana has published over 100 peer-reviewed articles, client reports and book chapters relating to computer-aided design, IT in construction, automated building codes, building envelopes, municipal infrastructure and sustainability. His research interests include the modeling of infrastructure deterioration (specifically wastewater networks) and developing decision systems to support sustainable infrastructure management.

Dana has co-supervised two successful Ph.D. students and is currently sharing lecturing responsibilities with other Faculty members. He has a keen interest in promoting the research and teaching of sustainable infrastructure management in the Department of Civil Engineering.

**Alireza Forghani, M.Sc.**
Alireza Forghani, M.Sc. was appointed as a Sessional Lecturer in the Departments of Civil Engineering and Materials Engineering in 2009.

Alireza received his B.Sc. in 2003 and M.Sc. in 2005 from the Sharif University of Technology in Tehran, Iran. He began his studies as a Ph.D. student at UBC in 2005 and, in addition to being a Sessional Lecturer, he is a Research Assistant and Ph.D. candidate working under the supervision of Professor Reza Vaziri.

Alireza is a member of the UBC Composites Group. His research interests include computational mechanics and dynamics and, more specifically, fracture and damage modelling . In his M.Sc. research project, he worked on the simulation of cohesive cracks using the Extended Finite Element Method (X-FEM).

The goal in his current research is to develop a structural-level model to simulate damage and fracture in fibre reinforced composites. Fibre reinforced composites are being used in primary structural members of aircrafts (e.g., Boeing 787 and Airbus A350), and are also being used in retrofitting buildings.

# Congratulations on a year of success

In late November 2009, Professor Jonathan Fannin was the invited team-leader for a group of international geotechnical specialists from Canada and Europe, on an evaluation of recovery strategies and techniques following earthquake-induced landslides in Gansu Province, in China. With expertise on debris flow initiation and travel distance, he contributed to the work of the team on natural hazards risk assessment in landslide-prone terrain.

Professor Emeritus, Frank Navin, Ph.D., D.Sc.(Hon), P.Eng., was awarded a "Professor Honorario, el Consejo Superior de la Universidad de Piura" (UdeP) in the Faculty of Engineering in October 2009. UdeP is in Piura, Peru. This award is in recognition of academic and other contributions to Civil Engineering at UdeP for more than 20 years.

Professor Tarek Sayed has been selected to receive the 2010 Sandford Fleming Award from the Canadian Society for Civil Engineering. The Sandford Fleming Award, established in 1999 in honour of Sir Sandford Fleming (1827-1915), is presented to a member of CSCE who has made particularly outstanding contributions to the development and practice of transportation engineering in Canada.

Professor Carlos Ventura was awarded a Fellowship with Engineers Canada for his outstanding service to the engineering profession.

Civil Engineering graduate students, Wael Ekilla and Mohamed El Esawey along with Professor Tarek Sayed have received an award for best paper at the 2009 Annual Meeting of the Transportation Association of Canada in Vancouver, BC. The paper is entitled "Dynamic Transit Signal Priority Strategy".

The Civil Engineering Club has selected its top professors for 2008-09. "Outstanding Professing" awards were given to Professors Perry Adebar for 2nd Year; Rob Millar for 3rd Year and Don Mavinic for 4th Year. Professors Barbara Lence and Terje Haukaas were honoured for their Exceptional Commitment to Students.

Correction:
In the Spring 2009 issue, we reported that the Civil Engineering Club announced its choices for the top undergraduate professors for 2008-09 as; Professor Reza Vaziri, 2nd Year; Profs. Rob Millar and Violeta Martin, 3rd Year; and, Professor Don Mavinic, 4th Year; along with Profs Barbara Lence and Sheryl Staub-French for their exceptional commitment to students. These professors were actually recognized for the 2007-08 academic year.

## Outstanding Students
### Prestigious Awards (continued from page 2)

**Kaley Crawford-Flett**

**CDA Gary Salmon Memorial Scholarship**

Ph.D. student, Kaley Crawford-Flett, studying geotechnical engineering under the supervision of Professor Jonathan Fannin, was awarded the CDA Gary Salmon Memorial Scholarship in October 2009.

The newly established CDA Gary Salmon Memorial Scholarship, celebrates the legacy and professional achievements of the late Gary Salmon (1932-2007), and is awarded to a full-time Canadian postgraduate student whose program of study focuses on dam safety and/or the management of dams.

**NSERC CGS and Four-year Fellowships**

The Department of Civil Engineering would also like to congratulate the following graduate students for their success in winning major scholarships.

In April 2009, the Natural Sciences and Engineering Research Council of Canada (NSERC) awarded the Alexander Graham Bell Canada Graduate Scholarship (CGS), which provides financial support to students for their masters (M) and doctoral (D) studies. Ph.D. candidate, Andrew Hamilton was awarded a CGSD; and M.A.Sc. students Belinda Li, Stephen Mercer, Chad Novotny, Osmar Penner and, Jeff Yathon were each awarded a CGSM.

Beginning in the 2009-2010 academic year, Four Year Doctoral Fellowships (4YF) provide financial support to UBC's best Ph.D. students for the first four years of their Ph.D. studies and research. Announced in the autumn of 2009, Civil Engineering Ph.D. students Antone Dabeet, Kaley Crawford-Flett and Sardar Malekmohammadi were each awarded one of these prestigious awards in the program's inaugural year.

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