

COMMUNITY CIRCLES: CO-CREATION & SOCIAL INNOVATION

Report from the *RES'EAU-WaterNET* Annual Meeting 2012



RES'EAU-WaterNET brought its annual meeting to Toronto this past November, gathering researchers, highly qualified personnel, partners and invited guests to mark the network's progress to date—and plan its future.

Day 1 featured summaries and progress updates from each of *RES'EAU's* core research themes, as well as keynote and guest lectures on topics closely related to the network's mission. These sessions are highlighted below. Day 2 focused on building consensus among researchers for the next phase of Natural Sciences and Engineering Research Council (NSERC) Strategic Network funding, for which a full application will be submitted in March, 2013.

"The breadth and depth of the expertise our speakers and attendees brought to the meeting was inspiring," says Dr. Madjid Mohseni, *RES'EAU's* Scientific Director. "Their enthusiasm fueled two days of frank and constructive discussions that will be invaluable to our planning process as we move into our next phase."



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Guest Speakers Bring International Expertise and Perspective to RES'EAU



KEYNOTE PRESENTATION



**Marvin Devries, President,
Trojan Technologies**

Trojan Technologies has been a strong supporter of *RES'EAU-WaterNET* since its inception in 2008. Attendees were fortunate to hear Marvin Devries' perspective on how academic and industry collaboration can solve some of the world's most urgent water purification needs. He highlighted seven key areas in the global water space where significant challenges—and therefore opportunities for innovation—exist:

Water Scarcity: Total global consumption of water has doubled in the last 50 years, up by almost a factor of seven over 100 years, resulting in an increasing incidence of chronic water scarcity. **High Level Research Opportunity:** Low-cost, low carbon-footprint technologies and strategies to produce potable water from wastewater and storm water at 30% of cost of desalination.

Aging Infrastructure: Inadequate investment to replace aging infrastructure has created the single most pressing water infrastructure issue for North American municipalities, while capital budgets are under severe

pressure in a tough economy. **High Level Research Opportunities:** Techniques to extend the useful life of collection and distribution systems; technologies to accurately monitor and predict failure location and time; and, minimally invasive infrastructure remediation techniques.

Pesticides, Pharmaceuticals, EDCs & Industrial Pollutants: Pesticides, industrial pollutants and other contaminants in source water are not adequately removed by conventional treatment methods. **High Level Research Opportunity:** Optimal combination of GAC filtration, advanced oxidation, and perhaps other treatment strategies for each contaminant.

Boil Water Advisories in Small Communities: Hundreds of small communities in Canada and the US experience boil water advisories each year, due to failed water quality tests (positive bacteria count, absence of residual chlorine). **High Level Research Opportunity:** Reducing Disinfection By-Products (DBP); and, simplified, cost effective treatment systems for small communities (filtration & UV or ozone).

Finite Global Phosphorus Reserves: Global depletion of economically extractable reserves is projected to occur in approximately 90 years at current extraction rates. Accordingly, the global price of phosphorus has increased fourfold during the past decade. **High Level Research Opportunity:** Cost-effective strategies to recover and re-use phosphorus, from changes in farming practices to recovery at sewage treatment plants.

Water and Sanitation in Low-Income Countries: Water delivery

“Close collaboration among academia, manufacturers and end-users increases the likelihood of appropriate and cost-effective solutions. Then, it's critically important that a proposed solution adequately address the need of the customer.”

— Marvin Devries

infrastructure is far worse here than in high income countries. Treated water is often re-contaminated in the distribution system. **High Level Research Opportunity:** Compact, cost-effective, robust, de-centralized (end of pipe) water treatment systems to circumvent re-contamination challenges in distribution systems.

Aquatic Invasive Species: Ballast water taken from one ecological zone to another can host aquatic invasive species that will detrimentally impact the biodiversity, economy or human health in the receiving community. **High Level Research Opportunities:** Optimal combinations of filtration and disinfection to achieve small footprint, low-energy consumption solution to address broad range of aquatic species (requires a robust, corrosion-resistant solution).

Treatment technologies for small systems: Innovation and sustainability



Dr. R. Scott Summers,
University of Colorado Boulder

Dr. R. Scott Summers of the University of Colorado Boulder discussed the potential research foci for a proposed National Center for Innovative Treatment Technology in Small Drinking Water Systems in the US. This initiative would focus on research complimentary to RES-EAU-WaterNET's agenda (RES-EAU will be a collaborator in the initiative). Meeting the needs of small systems in both Canada and the US means overcoming similar environmental and socio-political challenges, he stressed.

Key points:

When developing new approaches of evaluating treatment technologies, site-specific evaluation is key:

Technology for small systems cannot be evaluated in isolation, Dr. Summers noted. Rather, the needs of the utility and the fit of the technology to those needs and site-specific conditions are the primary considerations for success.

New technologies must take advantage of parameters unique to small systems. Since small systems inherently possess a bigger physical footprint versus large systems and land in SRCs is less expensive relative to infrastructure, processes that use more land hence longer residence times are attractive (e.g., open basin photolysis/oxidation or bank filtration for pre-treatment). Given the shortage of skilled operators in small systems, low complexity processes for pre-treatment, treatment and distribution will also be key to success.

“Both the decision makers and operators can create institutional barriers to success. We have to overcome those institutional barriers if any technology is going to work. You can have the right technology, but if you have administrative or operational/institutional barriers, you're not going to be able to move forward and be successful for the system.”

— Dr. R. Scott Summers

Online monitoring key to water safety, security



Dr. Regan Murray,
US Environmental Protection Agency

Dr. Regan Murray of the US Environmental Protection Agency was on hand to discuss how water quality sensors can be used to detect contamination incidents as well as routine water quality issues. Through various case studies, she illustrated several challenges with developing an online monitoring system, emphasizing the need to coordinate the use of different technologies to detect multiple contaminants with sufficient time to mitigate their effects. Robust software is essential for managing large volumes of noisy water quality data and providing actionable information to operators, she stressed. To this end, the EPA and Sandia National Laboratory have developed CANARY, open-source software that “evaluates standard water quality data over time and uses mathematical and statistical techniques to identify the onset of anomalous water quality incidents.”

“Innovation is not just an invention or a great idea; it's getting that idea into the world and changing the way people do business.”

— Dr. Regan Murray

Understanding the true costs of innovation



Dr. Robin Collins,
University of New Hampshire

Dr. Robin Collins of the University of New Hampshire presented an overview of costing approaches for water purification processes and technologies. He suggested that operation and maintenance costs may impact water utilities' selection of particular approaches as much as, or more, than construction costs alone, as the former are a “lifelong” commitment.

Noteworthy quote: “The issue is, how do you get innovation into small systems? No one wants to be first with new technologies, because even though we may have a handle on the modelling, the individuals who select a particular design for a community are responsible to the people who drink the water. It's a very conservative field. But believe me, if they are built and they work as advertised, word of mouth from utility to utility is what really drives [wide-scale adoption].”

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An open mic for the future

Several experts from Canada and the US were gathered for an open discussion of RES'EAU's progress to date, and the tactics the network needs to adopt in its proposed second phase. The discussion was moderated by **Dr. Karl Linden**, Helen and Huber Croft Professor of Environmental Engineering at the University of Colorado Boulder and member of the RES'EAU-WaterNET Scientific Advisory Committee.

Participants included (left to right in photo): **Jim Malley**, Professor, University of New Hampshire; **Cooper Langford**, RES'EAU Lead Researcher and faculty professor in the Science, Technology and Society Program at the University of Calgary; **Michele Prevost**, NSERC Industrial Research Chair and Professor in the Department of Civil, Geological and Mining Engineering, École Polytechnique de Montréal; **Bill Cairns**, RES'EAU-WaterNET Board Chair, Chief Scientist, Trojan Technologies; and **Ted Molyneux** of the Community Infrastructure Directorate, Aboriginal Affairs and Northern Development Canada.

In a lively discussion, the panelists and audience suggested several pearls the network must consider as it develops a proposal for Phase II NSERC funding:

- RES'EAU-WaterNET needs to continue its communication efforts and further build and integrate its network of partners towards the application of the technologies it develops on users' terms. End-users and operators need to be an integral part of the network.
- ROI from RES'EAU's research must be measured not only in economic terms, but also in terms of the public health benefits of preventing outbreaks of disease.
- It's not enough to make operators aware of the need for better technologies and processes. Community members, municipal leadership, provincial/territorial and federal governments must understand the need as well, as their buy-in will ultimately influence whether or not a new technology is adopted.
- Assessing risk in small communities and helping them understand the value of safe water is a significant barrier to the adoption of new approaches to water purification.
- RES'EAU should focus on the application of technology as much as technology development—identifying simple and robust barriers that communities can easily take care of is paramount to meeting their needs. Incorporating more input from the social sciences in network activities could be of value in this area.
- A hierarchy of priorities for each of the technologies in development by RES'EAU should be established by consulting end-users to ensure that success is on their terms.
- RES'EAU must engage regulators by understanding their unique perspective (e.g., the current regulatory environment, budget constraints, their relationship with municipalities, their ability to enforce regulations, etc.) and what drives their decisions.
- All current and future projects should be scrutinized for their potential for actual adoption and application, in terms of meeting the needs of end-users and decision makers. Long-term cost models are critical for helping municipalities and utilities make decisions.
- Consultants should be integrated into the network, as they can serve as a direct bridge between utilities and government.



“You have something amazingly special here (in RES'EAU) . . . This is amazing to me. The unification I've seen here is amazing, and I hope you can capture that in your application (for Phase II funding).”

— Jim Malley, Professor, University of New Hampshire

RES'EAU-WaterNET 2012 Poster Competition Winners

Almost 30 highly qualified personnel (24 of them graduate students) from across RES'EAU's research teams attended the annual meeting, which included a **special full-day entrepreneurship course sponsored by Mitacs and the Walkerton Clean Water Centre (WCWC)**. Pictured: Bill Cairns, Chief Scientist for Trojan Technologies and RES'EAU Board Chair (far right), presents prizes to the winners of the poster competition:

First Prize: Aaron Janzen, University of Calgary (second from left): *Operation & Maintenance and Capital Unit Costs for Small Water Treatment Plants*

Second Prize: Laleh Dashtban, École Polytechnique de Montréal (third from left): *Integrated Fluidized Bed-Ultrafiltration Process for Improved Iron and Manganese Control in Groundwater*

Third Prize: Laith Furatani, UBC (left): *Advanced Oxidation using 185 nm Radiation and the Influence of Dissolved Organic Matter*



Special WQTC panel looks at small systems risk

RES'EAU-WaterNET sponsored a special session at the 2012 American Water Works Water Quality Technology Conference (WQTC) on November 7th in Toronto. Entitled Assessing and Reducing the Vulnerability of Small Systems to Water Quality Failure, our goal was to present recent data, knowledge and strategies to evaluate and reduce the vulnerability of small systems to water contamination. Issues discussed included the reduction of microbiological and chemical risks, the impact of climate change on water quality and strategies to ensure water quality security in small systems. Pictured (l to r): Gordon Huang (University of Regina), Enos Inniss (University of Missouri), Frederick Pontius (California Baptist University School of Engineering), Manuel Rodriguez (Université Laval; session moderator), Regan Murray (EPA), and Mark Borchardt (USDA-ARS).

