

## PUTTING RURAL COMMUNITY WATER SYSTEMS FIRST

**P**hase 2 of the RES'EAU-WaterNET program was given a head start during a joint event at Aboriginal Affairs and Northern Development Canada's 6th Annual BC First Nations Water and Wastewater Operational Excellence Conference in Vancouver October 2-3, 2013. Impact 2013 attracted more than 150 community water operators and 80 network investigators and students, as well as several representatives from many of RES'EAU's partner organizations.

On Day 1, the conference brought together First Nations water operators with engineers, academic researchers, policy makers and others to explore how each sector might play a role in improving drinking water delivery in small systems. Discussions focused on the unique and sometimes conflicting points of view among each group, as well as on how to build trust and define success.

Day 2 featured experts from Canada, the US and Europe who discussed their experiences in adapting science and technology to the needs of rural communities for an audience of RES'EAU investigators and network partners.

"RES'EAU-WaterNET's mission is to build a bridge between communities, water operators and community members on the one hand, and engineers and government on the other," said Dr. Madjid Mohseni, the network's scientific director. "Ultimately, our research and outreach efforts are about creating authentic, sustainable solutions for small communities, and in that sense Impact 2013 was the perfect kickoff to our second phase."

"Everyone involved in the water community needs a voice and needs to find common ground if we truly want to improve drinking water in small systems, and I think we have started that dialogue in a meaningful way."



# DAY 1: VOICES FROM THE FRONT LINES

Community water operators and academic experts share their unique points of view on small water systems

**Impact 2013** thrust the unique and varied situations of small water systems into the spotlight. First-hand accounts from First Nations water operators were presented alongside commentary from engineering and biological sciences experts on factors that influence development and adoption of technologies and water policy. The result was a lively discussion about the immediate needs of First Nations communities from a water perspective as well as current best practices and potential future directions for innovation.

**Richard Inkster** of the Kitsumkalum Band (Tsimshian Nation) and **June Williams** of the Lake Babine Nation discussed the operation of their local systems, and noted that many First Nations operators and communities share similar challenges:

- Steep learning curves for operating new technology and understanding and meeting policy requirements. "It's the enormity that you are looking after a water plant that supplies water to your family – for me, that's a pretty big weight on your shoulders when you look at it that way," said Inkster;
- Difficulty attracting, training and retaining staff, including backup operators so primary operators can attend to other duties, take time off etc. Workload pressures on operators can therefore be immense;
- Low wages for operations staff compared with other local job opportunities;
- Long hours and low wages make it



*Richard Inkster*

"It can get difficult at times, but you're there as a public servant and to serve your community. When a person gets up in the middle of the night for a drink of water and turns on the tap and the water is there, and it's safe... That's what it's all about."

– Richard Inkster,  
Operator, Kitsumkalum Band

difficult for First Nations communities to get younger generations interested in becoming operators;

- Lack of funding for adequate operations and maintenance of water systems. "Preventive maintenance goes out the window when there is no funding," Williams stressed;
- Difficulty accessing needed treatment chemicals and other supplies as well



*June Williams*

"Establishing trust in a small community is a big challenge, especially when it comes to not being able to provide good, safe drinking water because you ran out of supplies. You have to keep communication up."

– June Williams,  
Operator, Lake Babine Nation

as requisite items, such as testing equipment; and,

- Communicating about the value of a sound water treatment system – as well as any information about immediate water quality – is important, but it can be an uphill battle. Williams goes door to door to connect with people in her community, while also holding workshops and distributing information handouts. ♦





# THE ENGINEERING AND HEALTH SCIENCES POV:

## What Drives Their Recommendations?

**T**hree renowned speakers shared their view on how and why science drives policy and technical design for water purification and delivery systems, and the implications for small communities.

**Brent Alspach**, a senior engineer from Carlsbad, California-based engineering consultancy Arcadis and member of RES'EAU's Scientific Advisory Committee, emphasized that engineers are only successful when they fully understand all parameters of a particular problem. In terms of small water systems, this means they have to consider technical feasibility, costs, ease of operation and maintenance and other technical factors, as well as the influence of public perception, local politics and available budgets before recommending specific designs. This, he suggested, cannot be done without thorough engagement of the community and its water operators.

Regulators, too, need to understand the profound impact their decisions can have on small water systems, Alspach added. He cited the example of California's attempts to set limits on hexavalent chromium levels, which could have affected as many as 4,000-plus small systems or as few as 285, depending on where the targets were set – and could have incurred as little as \$50 million or as much as \$10 billion in compliance costs.

Microbiologist **Dr. Natalie Prystajeky** provided an overview of the common microbes found in groundwater that can cause human illness, and how that knowledge influences the multibarrier approach to water treatment recommended in the *Protocol for Safe Drinking Water in First Nations Communities*. Viruses such as Norovirus and bacteria like *E. coli* are susceptible to chlorine and other disinfectants, while protozoa are much more difficult to remove and must be filtered – hence there exist recommendations for filtration and primary disinfection of all surface water and groundwater under direct influence and primary disinfection for all groundwater.



*Brent Alspach*



*Dr. Natalie Prystajeky*

As microbes can enter the distribution system via cross connections and cracks, secondary disinfection is also key to health outcomes, she noted, as is consistent monitoring of water quality throughout the system. All of these approaches must be incorporated into a system's design, Dr. Prystajeky explained.

"Not all source waters are created equal – so the lesson is, know your source water," she stressed.

**Dr. Robin Collins**, Davison Professor of Environmental Engineering at the University of New Hampshire, then discussed factors that drive the development and adoption of technologies, using slow sand filtration (SSF) processes as an example. SSF is one of the oldest and most affordable engineered drinking water



*Dr. Robin Collins*

treatment processes in North America, and remains a viable option for many communities. Whether or not small communities successfully adopt proven or new technologies that will meet their unique requirements depends on several factors, Dr. Collins said, among them:

- Properly designing pilot studies (and ensuring that pilot studies are done);
- Involving operators in pilot studies;
- Properly monitoring and assessing operational and treatment performance; and,
- Optimizing operations to accommodate seasonal fluctuations and other variables.

**"Someone has to make the decision to go with a new technology, and in order to do that someone has to be first. Operators talk better with other operators about their system, more than any person from academia, more than engineers and manufacturers. Operators can convince their communities more than [anyone]."**

– Dr. Robin Collins, University of New Hampshire

# THE ENGINEERING AND HEALTH SCIENCES POV:

## What Drives Their Recommendations?



*Dr. Aaron Dotson*

**Dr. Aaron Dotson** of the University of Alaska Anchorage echoed the need to involve operators and communities' perspectives in designing and implementing drinking water treatment approaches. He cited the ongoing challenges in small Alaskan settlements, where cold winters, remote locations and widely varying source water quality make treatment difficult. Local preferences for drinking water – for example, whether or not chlorination is a desired process – and operation and maintenance costs must be factored into any decision to implement a particular system. He stressed that engineers must therefore consider whose criteria they are ultimately serving when they make technological recommendations – end users or policy makers. ♦

*"Who is the system designed for? How do we deal with innovation? We need to broaden our view and get not only engineering, but also the economic, the social and the political into the mix to make sure these systems are sustainable in the future."*

*– Prof. Aaron Dotson,  
University of Alaska Anchorage*

### Bridging The Gap: Design For Real Life On A First Nation Reserve

In partnership with Aboriginal Affairs and Northern Development Canada (AANDC), UBC (also supported by the Peter Wall Solutions Initiative) and BI Pure Water, RESEAU-WaterNET invited a team of seven fourth-year students to design a community water treatment system for the Lytton First Nations, Nickeyeah Reserve No. 25. in BC. The group met with engineers from AANDC to understand the community's needs, travelled to Nickeyeah to meet with local system operators and discussed the validity of their proposed solutions with technical experts with RES'EAU-WaterNET partner BI Pure Water.

**Jim Brown**, an operator with 10 systems under his supervision (including Nickeyeah) and **Travis Pahl**, a recent UBC graduate who participated in the project and who now works as a chemical engineer with Urban Systems, shared their insights from the experience. Both stressed that involving community operators in the selection of technologies and system design is paramount to meeting the needs of small communities.



*Travis Pahl and Jim Brown*

"It took me two years (as an operator) to understand what "cost effective" meant," Brown said. "For me, it (means) that engineers today are overbuilding systems. They are not keeping it simple, and we have to simplify our designs."

*For a full summary of the design project, go to [www.reseauwaternet.ca](http://www.reseauwaternet.ca).*

### The Good News: Sharing a Small System Success Story

**Harry Nyce, Jr.** wears many hats in the Nisga'a Village of Gitwinksihlkw in British Columbia including CEO, council clerk, emergency operations manager and nursery school principal. He provided Impact 2013 delegates details of Gitwinksihlkw's \$7.5-million state-of-the-art water treatment facility, which was completed in 2011. Mr. Nyce emphasized the importance of water in Nisga'a culture, and how the village spent two years researching the appropriate sourcewater to use before selecting the Nass River. The community then worked with AANDC water, capital and funding specialists to research and test the best system to respond to local seasonal characteristics. The plant itself took a further two years to construct, during which time all operators had to become certified. The community named the facility Wilp Sim Aks, or "House of Clear Water."



*Harry Nyce Jr.*

*"We are constantly reminded by our elders...of the important of our water supply and how it sustains everything that we do. And so...we respond with a commitment to excel in water leadership and conduct our water services delivery with the same respect shown towards us as water operators for the village."*

*– Harry Nyce, Jr.,  
Village of Gitwinksihlkw*

# PANEL DISCUSSION 1:

What Else Matters Other than the Economics of a Solution?



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*Panel members (pictured, left to right): Harry Nyce Jr., Village of Gitwinksihlkw; Jim Brown, Lead Operator, Lytton; Irving Leblanc, Associate Director, Housing, Infrastructure & Emergency Issues Management, Assembly of First Nations and Vice Chair Board, RES'EAU-WaterNET; and, Danny Higashitani, Senior Engineer, Asset Management, Aboriginal Affairs and Northern Development Canada.*

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## KEY POINTS:

- Research must be user-driven, and not merely conducted for its own sake;
- Operators widely perceive that training and O&M funding is inadequate, as is operator remuneration;
- First Nations are expected to use their own user fees to partially fund infrastructure, but high unemployment and a slow economy prevent it;
- Plants are often said to be overdesigned, but that may be because planners know it may be 20 years before the community will get funding again;
- Lifecycle costing for any system is a key decision making factor – Canada needs to do a better job of getting operators involved in selecting options;
- Operators are often not consulted during the design phase of their systems – their comfort level and training are important; and,
- The Drinking Water for First Nations Act was passed without the guarantee of resources to support its implementation, resulting in widespread uncertainty among First Nations communities.

## SOUND BITES:

**"Without a strong personnel policy and a strong administration, a lot of operators are left at the mercy of what the administration will pay you."**

– Jim Brown, Lead Operator, Lytton

**"We have to recognize (operators') certification, and recognize their level of commitment, their position description and what we are asking of them, which is quite a lot."**

– Harry Nyce Jr., CEO, Village of Gitwinksihlkw

**"The Drinking Water for First Nations Act was passed without the guarantee of resources to support its implementation. Operators are taking on greater liability and responsibility on how a plant operates, and that responsibility is getting bigger. In order to retain operators ...the funding agencies are going to have to take that into consideration."**

– Irving Leblanc, Associate Director, Housing, Infrastructure & Emergency Issues Management, Assembly of First Nations and Board Member, RES'EAU-WaterNET

# PANEL DISCUSSION 2:

What Else Matters Other than the Economics of a Solution?



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*Panellists (pictured, left to right): Haseen Khan, Newfoundland and Labrador Department of Environment and Conservation; Richard Inkster, Kitsumkalum First Nations; Prof. Ed McBean, University of Guelph; Timothy Innes, Councillor, Gitxaala Nation; and Dr. Robin Collins, University of New Hampshire.*

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## KEY POINTS:

- All small systems share common challenges of inadequate tax bases, recruitment and training of operators, and procurement of parts and chemicals;
- Provision of drinking water is a shared responsibility among owners/operators, AANDC and federal departments, provincial governments and many others – communication is a challenge;
- Fear of the unknown – owners and operators need full picture of their options to make the right choices;
- Communities must always assess cost, social and political needs when selecting new technologies;
- There is more awareness of contaminants than ever before, which puts more pressure on demand for innovations for water purification;
- Local source waters are often consumed without prior treatment and local residents report no disease or ill effects, so communities may doubt the need for water treatment; and,
- New approaches take time to build confidence in them and demonstrate efficacy.

## SOUND BITES:

**"We talk about "multibarrier" approaches, but when it comes to innovation we focus only on technology and processes. We have to adopt a holistic, overarching approach to innovation – innovation for source protection, for technology, for distribution systems, for monitoring and for operators."**

*–Haseen Khan, Newfoundland and Labrador Department of Environment and Conservation*

**"Analytically, we are measuring things we have never measured before. Sometimes, we want to design processes to remove things measured in parts per billion, and not many people know what the long-term effect of those things are... But, even though there are a lot of new regulations coming down for which new technologies will be required, let's not lose focus of the most important thing, and that's [prevention of] water-borne diseases."**

*–Dr. Robin Collins, University of New Hampshire*



# DAY 2: TOWARDS MEANINGFUL IMPACT

Experts share insights as to how RES'EAU can forge partnerships to achieve success for small systems

**T**he second day of Impact 2013 gathered participants from every part of the water community as well as RES'EAU investigators and partners to share their

experiences in adapting science and technology to the conditions found in rural communities. In particular, their goal was to highlight experiences that leave rural communities with solutions of which

they can take ownership, the approaches and resources required to achieve success and what constitutes efficiency and effectiveness for getting there.

## WATER ECONOMICS POLICY AND GOVERNANCE NETWORK: Thinking hard about the 'soft' side of water

The social sciences have an integral role to play in water systems research, **Dr. Steven Renzetti** of the Water Economics, Policy and Governance Network (WEPGN) told delegates. Rising costs and flat revenues for water systems across Canada are disturbing trends that pose significant challenges for municipal water suppliers, he said. In response, the Social Sciences and Humanities Research Council funded WEPGN, which unites the efforts of experts in economics, political science, environmental sciences and others with governments and interested NGOs to enhance water's sustainable contribution to Canadians through collaborative research.

"We recognized that the challenges that Canada faces with respect to its water had reached a certain level of dialogue, and that we had not pushed past that level of dialogue and that we had to do something new," Prof. Renzetti said. "We wanted to bring new voices in and think about these things in a new way."

WEPGN research themes focus on water and economy, information and decision-making, institutions and community, science and water policy and survey methodologies. Its next call for research proposals will likely be in fall, 2014. For more information see [www.brocku.ca/wepgn](http://www.brocku.ca/wepgn).



Dr. Steven Renzetti

## EXPERIENCES OF EAWAG WITH RESEARCH AND IMPLEMENTATION OF MEMBRANE WATER TREATMENT FOR DEVELOPING COUNTRIES

**Dr. Wouter Pronk** of the Swiss Federal Institute of Aquatic Science and Technology (EAWAG), Switzerland provided examples of how that organization's work in developing countries to design and deploy reliable household water treatment systems may hold lessons for RES'EAU WaterNET's research efforts. Through holistic approaches to designing solutions for small communities – including studying the economic, social and behavioural determinants of technology adoption and use – EAWAG investigators have found that it is indeed possible to take projects from basic science principles through implementation and, ultimately, impact, he stressed.

EAWAG projects looking at gravity-driven household water treatment systems (HWTS) in Kenya and Bolivia have concluded that, while water has a high value in small communities and that people are willing to pay for it, cost effectiveness, education and training of personnel and maintenance and quality monitoring are still major concerns for any system.

The key attributes for decentralized water systems are that they are aspirational in design and function, easy to use and maintain, deliver high water quality and are as low-maintenance and "fool-proof" as possible, Dr. Pronk concluded.



Dr. Wouter Pronk

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## ROLE OF NETWORKING IN THE GOVERNANCE OF SMALL WATER SYSTEMS

Small, rural and First Nations communities face a long list of impediments that make sound water governance difficult to achieve, from operating challenges that result in higher risk for contaminants, high costs of construction and O&M and inadequate resources to comply with regulatory requirements. The only solution, according to **Haseen Khan** of the Newfoundland and Labrador Department of Environment and Conservation, is to focus on developing practical and sustainable treatment technologies, risk management and regulatory tools for small systems that consider local conditions, challenges and the experience of others. This can only be achieved, he said, through meaningful networking with all relevant stakeholders across government, academia, industry, operators and more.

"Networking promotes a unity of purpose and objective, recognizing the diversity of actions required – and that is what you have in RES'EAU," Khan explained. Networking within stakeholder groups (e.g. operators) can efficiently achieve peer support and the sharing of best practices, while building linkages across stakeholder groups can lead to economically sustainable and socially acceptable treatment technologies, monitoring sensors and risk management techniques, he said.

*"In terms of research and development, we have to put our talk into our walk, and demonstrate leadership through action," Khan concluded. "R&D has been (around) for ages, but I think recently there has been a paradigm shift. Especially, I like the concept of RES'EAU's*



*Haseen Khan*

*Living Labs – trying to move away from closed-door academic labs to open public labs. I think that is a step in the right direction, and in my opinion it is a paradigm shift."*

## IF YOU BUILD IT, WILL THEY COME? PREDICTING INDIVIDUAL UPTAKE OF RURAL WATER SERVICES IN THE PERUVIAN AMAZON

**Dr. Karl Linden**, University of Colorado, Boulder provided attendees with further lessons learned from ongoing small water systems research in developing countries. He shared findings from survey work conducted in remote communities in Peru by students participating in the University of Colorado's Engineering in Developing Communities program, through which student spend a summer working with a local Peruvian NGO to understand more about how to make water resources there more sustainable.

While the NGO (CONAPAC) had installed community water plants in small communities along the Amazon River, they were interested in learning more about factors that drove use or non-use among the population – understanding why, within areas that have functioning community water treatment systems, some individuals

continued to use water from unsafe sources. Prof. Linden noted that many studies have found a high degree of non-use in communities throughout the world where water plants have been installed – a serious issue, considering even occasional consumption of untreated water has been shown to reduce health benefits.

Surveys of the Peruvian communities conducted during the students' visits identified a large number of inconsistent water system users. Preliminary data suggest that while distance to the plant, the age of the plant and lower education levels were associated with inconsistent use, regular attendance of community meetings and contact with the NGO was a significant determinant of whether or not individuals were consistent users or non- users.

*"In terms of sustainability, we obviously want consistent use of water systems... but (achieving that) is not just about giving clean water or creating good*



*Dr. Karl Linden*

*situations for people to use the water," Dr. Linden said. "The more you can foster the sense of community and create social pressure to join in to talk about all the issues in the community including the water plant ...the more people felt like they would be participating and using the water."*



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## REDUCING VULNERABILITY OF SMALL DRINKING WATER SYSTEMS THROUGH IMPROVED UNDERSTANDING OF MULTIPLE BARRIERS

Small systems that struggle with inadequate funding, a dearth of operator training and complex challenges with robust system operation and maintenance are vulnerable for significant and potentially lengthy failures from a wide variety of causes, according to **Dr. Ed McBean** of the University of Guelph. While multiple-barrier approaches for safe water (using an integrated system of procedures, processes and tools to reduce the contamination of drinking water from source to tap) are considered best practices for any water system, small systems have limited resources to ensure they are effective across the core barriers of source water, treatment, distribution, monitoring and alarm, he said.

To add to small system's disadvantages, current drinking water tools designed to help with key assessments and decisions do not capture the probability of failure, as users rely only on potential hazards associated with drinking water systems

(using qualitative scoring approaches to reflect the inherent uncertainty associated with assessing the condition of infrastructure). There is no universal agreement as to what should be included in a drinking water tool, Dr. McBean stressed, and the technical understanding of the individuals who fill out the cumbersome tools is often lacking.

"What we are trying to do (with drinking water tools) is get people in the field to be able visit sites and say 'these are where problems exist'," Dr. McBean said. "But, the technical background to understand the issues is certainly not trivial."

He cited examples of system failures in communities such as Walkerton, ON where multi-barrier approaches broke down due to a combination of operator, technical, social and inter-departmental errors and omissions and led to widespread illness and several deaths. In Dr. McBean's analysis, the sheer number of individuals and agencies within a community who need specific information to act appropriately when problems arise can create delays and cause confusion, further adding to the vulnerability of the system. The solution, he suggested, is more than a technical issue.



Dr. Ed McBean

"To look at vulnerability, it's partly technical in terms of the treatment plant system itself, but when you think broadly about source waters etc. it's not just a technical issue, it's all of the barriers that are important. I don't think we can approach this problem without a broader look beyond the technical issues."

### SUCCESSFUL WATER SYSTEMS PROJECTS SHARE COMMON FACTORS, HE CONCLUDED, AMONG THEM:

- Keeping a clear focus on the needed deliverables;
- Considering both short-term and long-term deliverables;
- Communicating widely via workshops/webinars involving the appropriate people; and,
- Flexibility in development - adjust as needed to meet the project objectives.

"What we are trying to do (with drinking water tools) is get people in the field to be able visit sites and say 'these are where problems exist.' But, the technical background to understand the issues is certainly not trivial."

# PANEL DISCUSSION

What Are the Roles of the Public and Private Sectors, the Scientific Community and Rural Communities in Bringing Safe Water to People?



*Panelists (pictured left to right): Dr. Robin Collins, University of New Hampshire; Liam Edwards, Director, Infrastructure and Engineering, BC Ministry of Community, Sport and Cultural Development; Irfan Gehlen, Water Quality and Treatment Lead and First Nations Business Development, Kerr Wood Leidal; Steven Renzetti, Water Economics, Policy and Governance Network; Wouter Pronk, Swiss Federal Institute of Aquatic Science and Technology (EAWAG); Bill Cairns, Chief Scientist, Trojan Technologies and RES'EAU-WaterNET Board Chair (moderator).*

## KEY POINTS:

### WHAT THE PRIVATE SECTOR SHOULD BE DOING:

- Systems designers must communicate with operators about even the simplest technology design;
- Operations manuals should be written to match the skill level of operators – explaining things simply will have a major impact on the success of the design;
- Look for innovation, but with an emphasis on keeping things simple; education and communication about proposed solutions are a key part of getting communities to buy into new technologies;
- Work collaboratively to close the gap between basic research and actual commercialization;
- Focus on flexible solutions – one solution will not work everywhere.

### WHAT THE PUBLIC SECTOR SHOULD BE DOING:

- Provide stable, long-term and adequate funding to support drinking water and any core public infrastructure;
- Need more innovative, proven technologies to meet needs – but funders, regulators and communities need to agree on the efficacy and actual costs of new technologies;
- Create mechanisms to approve new technologies for use in certain situations – e.g. utilities can try to fund their system via tax revenues they can invest in future requirements;
- Be prepared to invest for future requirements;
- Communicate widely so the public is aware of the value of public health facilities like water treatment systems, which can help lay the groundwork and support for funding.

### WHAT THE SCIENTIFIC COMMUNITY SHOULD BE DOING:

- Work closely with private sector to validate prototypes that are as close as possible to the final commercial product i.e. accelerate innovation into commercial practice;
- Confirm and communicate that a technology actually does what it claims to do, via validation studies in RES'EAU's Living Labs;
- Getting local utilities involved in research to provide side-by-side tests with current equipment will add credibility to the validation process; and,
- Factor knowledge from the behavioural sciences into technical research understand how people make decisions, and why they sometimes behave irrationally.

# PANEL DISCUSSION

What Are the Roles of the Public and Private Sectors, the Scientific Community and Rural Communities in Bringing Safe Water to People?

## WHAT COMMUNITIES SHOULD BE DOING:

- Challenge governments and academia about the importance of the intrinsic value of water beyond simple dollar signs;
- Examine new roles and responsibilities for accepting innovation; and,
- Communicate to community members to build trust in system, share information and ensure the value of clean water is understood – people tend to undervalue water and when investment is made they may not see the value.

## WHAT DOES THE WATER COMMUNITY STAND FOR?

- Access to clean safe affordable drinkable water basic right;
- Creating a change in climate for innovation as a whole – pioneering a new mechanism in changing in public thinking and behaviour about a certain topic;
- Raise the perception of the value of water; and,
- Raise awareness of the need to improve the situation in small communities, and also raise the profile and perceived of the people who make water happen, ie. operators.

## SOUND BITES:

**"The private sector plays an important role. One of the key things they can do is to take a stronger role in corporate social responsibility or 'acquiring social license.' In doing that, they will gain the credibility, integrity and respect from the community to be able to promote things like innovation and education. At the same time, they will be able to push the regulators and bureaucrats to do the same thing."**

*–Liam Edwards, Director, Infrastructure and Engineering, BC Ministry of Community, Sport and Cultural Development*

**"In terms of what RES'EAU needs to focus on, in my mind the best bang for the buck in having a true impact on small systems is to focus on tangible items that really give (communities) a deliverable they can use."**

*–Irfan Gehlen, Water Quality and Treatment Lead and First Nations Business Development Kerr Wood Leidal and Member of RESE'WAU's Impact Management Committee*

**"I see the role of the private sector... as commercializing basic research. That's a fundamentally important task. There has been a lot of research demonstrating that Canadian universities are producing a lot of the basic research but it's not getting into the marketplace. You want private firms to take risks to make money. So, how do we create that environment where bright young students coming out of these programs are willing to make start-up companies? That's an aspect that has not been explored fully."**

*–Steven Renzetti, Water Economics, Policy and Governance Network*

## IMPACT 2013 POSTER COMPETITION WINNERS



Pictured, left to right:

**Irving Leblanc**, Associate Director, Housing, Infrastructure & Emergency Issues Management, Assembly of First Nations and Vice Chair of the Board, RES'EAU-WaterNET;

**Mehdi Bagheri** (UBC), first place: *Computer-Aided Investigation of Micro-Pollutants Removal from Drinking Water Using Continuous Flow VUV/UV Photoreactor*;

**Clara Duca** (UBC), third place (tie): *Degradation of Micropollutants with Vacuum UV (VUV) Process*; **Anna Scheili** (Laval), third place (tie): *Sensitivity Analysis of CCME Water Quality Index for Representation of Drinking Water Quality in Small Systems*;

**Nilufar Islam** (UBC Okanagan), second place: *Optimizing Booster Chlorination in Small Municipalities: A risk-cost trade-off analysis*.