CASE STUDY

RES'EAU-WaterNET research consortium's mobile pilot plants

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Determining and validating the best water treatment technologies to meet the unique needs of small, rural and First Nations communities (SRCs) has gone mobile.

The RES'EAU WaterNET mobile plant accesses muddy back roads in Middle River (NW of Prince George) with its dual rear wheels

RES'EAU WaterNET launched the Mobile Water Treatment Pilot Plant this past year, a state-of-the-art lab on wheels, which can be deployed to any small community in Canada. It contains a range of water treatment systems, including various filtration and disinfection types.

RES'EAU-WaterNET is a Natural Sciences and Engineering Research Council (NSERC) Strategic Network founded in 2008 and is based at the University of British Columbia. The mobile plant project consists of three units, a van, a trailer, and semi-size trailer-mounted pilot plants. These units take research out of the laboratory and into the real world and are part of RES'EAU WaterNET's "Community Circle" program. RES'EAU-WaterNET 's investigators are able to work closely with communities to understand the limitations and constraints they face and identify research priorities.

The latest mobile unit is a dual rear wheel Mercedes Sprinter Van fitted out as a flexible water treatment pilot plant. It contains a range of water treatment systems and has the ability to disinfect by chlorination.

The pilot assesses for the most cost-effective and best treatment process for a particular type of source water. The low flow through the apparatus is regulated to simulate the design flow conditions that would exist in the full-size plant. The typical pilot trailer system has been

scaled down to fit in a service-type van. While the larger of RES'EAU's mobile units, the trailer, has an additional ion exchange skid, hydrogen peroxide injection before the UV, and a pressure tank, the pressure is maintained in the van's system via back pressure and pressure relief valves. The van also has added insulation to protect the equipment from freezing.

The filtration systems used are smaller versions of what would be proposed for the full-scale plant, consisting of membrane filtration and two types of UV. The surface area of the filters is of a known value and the flux through the filter would be regulated to simulate conditions that the proposed larger filters would be subject to. The information obtained from the pilot plant operation is used to verify and/or aid in the final plant design, and predict operating costs for future budgeting. Small communities benefit as they are assured that their future water system would work.

The van is designed for a production capacity of 20 L/min of treated water, providing means to evaluate the effectiveness of various techniques in dealing with any or all of the following:

A bag filter, cartridge filters, activated carbon filters, ultraviolet units and chemical metering systems can be combined in the mobile water treatment pilot plant

- Suspended solids and precipitates reduction
- Organics and tannin reduction
- Protection against pathogenic cysts, bacteria and viruses
- Suppression of pesticides and industrial pollutants
- OH – radicals suppression
- Colour reduction, taste and odour improvement

In summary:

The pilot plant contains a Y-strainer, bag filter, cartridge filters followed by ultra violet disinfection of two types. The UV treatment consists of a conventional UV lamp and a newly developed vacuum ultra-violet irradiation [VUV] system), designed to treat pesticides and industrial pollutants as well as conventional UV treatment. After the UV treatment, secondary disinfection is completed by sodium hypochlorite injection. Each of the filters, bag filter skid, and UV systems can be isolated with valves for testing various processes. The various treatment processes are measured individually or in combination, at different SRCs.

"The mobile water treatment pilot plant gives us the advantage of selecting and testing specific components in real time to confirm that they are cost-effective for any specific water source," says Dr. Madjid Mohseni, scientific director for RES'EAU-WaterNET. "With precise in-situ treatment results, we can pinpoint design requirements, initial costs, and operations and maintenance requirements, all in the context of a specific community's needs. But the process really begins and ends with the people in the community".

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Local operators are exposed to the operation and maintenance of the systems. The outcome of the water operator's training results in the operators being trained at keeping the system running at peak efficiency.

UBC's research topics are also furthered. The UV system allows comparisons of UV and VUV irradiations with small flows (<15 L/min), for the removal of organics, disinfection by-products precursors, and chemicals of emerging concern that are becoming more common in many water supplies. A chemical metering tank installed before the lamps doses emerging contaminants or microbiological contaminants for the specified research questions.

Megan testing source water with the pilot plant at Middle River, BC

"As a research network that focuses on overcoming the distinct environmental, socio-economic and technological challenges Canada's small water systems face, we are excited to have the mobile plant on the road," said Dr. Madjid Mohseni, scientific director for RES'EAU-WaterNET. "The mobile facility will allow us to bring research impacts to the communities that need them most, so we can assess which technologies meet their requirements. This allows the research, and its findings, to be tailored directly to the community's requirements and needs based on the quality and type of their source water."

The mobile van began testing source water at Middle River, Northwest of Prince George, BC, this past fall. Megan Wood and David Chan took turns operating the pilot plant and gathering research results.

"Taking the research from a dark room laboratory to the field was inspiring, although some difficulties were encountered along the way," says Megan. "It is a great tool for conducting research, and to train students and community operators. They get to sense what it feels like being in the laboratory while being in the real world."

Partners who collaborated on the development of the mobile unit were: UBC, RES'EAU WaterNET, with industry leaders, Trojan Technologies and BI Pure Water Inc.

BI Pure Water (BIPW) specializes in reviewing water quality test results, analyzing customer needs and then prescribing the most cost-effective solution. BIPW engineers pilot, design, manufacture, install, start-up and commission package water treatment plants. The operators are then trained and the plants can be serviced on a regular basis. BIPW focuses on small and medium-sized water treatment plants to meet the needs of Federal, Provincial and Municipal Governments, Industrial Process, Mining Camps, Private Water Systems, Resorts and First Nations communities.

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