QCL WATER SCIENCE

MANTECH

PeCOD
Drinking Water Accessibility in High Arctic Communities

Access to safe drinking water in remote northern communities, particularly in the Arctic, is still a challenge in Canada. Harsh climates, presence of permafrost, and unique socio-economic conditions prevent traditional underground water piping systems from being constructed. Since 2020, 80% of the communities in Inuit Nunangat have been receiving truck-to-cistern and sanitation-to-truck services.

A study published by the Royal Society of Chemistry examined how drinking water quality changes from source to point of consumption in Mittimatalik (Pond Inlet), Nunavut and whether community practices greatly influence its quality.

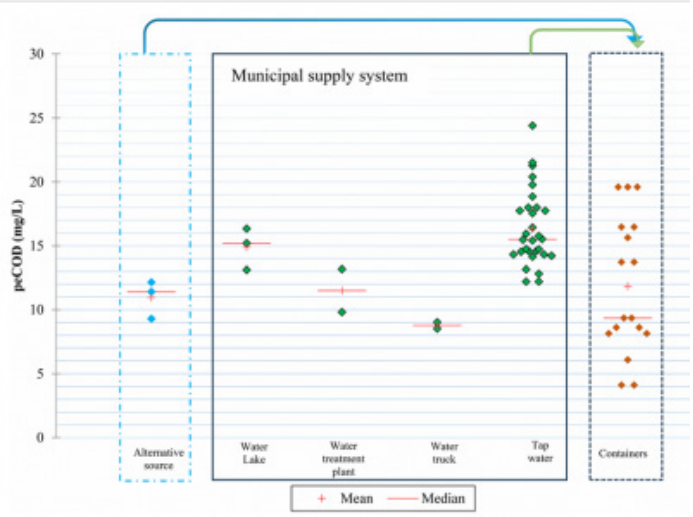
This study also evaluated the potential of Mantech's PeCOD analyser as an alternative to Total Organic Carbon (TOC) and Chemical Oxygen Demand (COD) based on the dichromate method, and as an early indicator of water quality deterioration. PeCOD responds to how easily organic compounds oxidize. Elevated values can indicate the presence of biologically or chemically reactive organics.

Case Study Results

While the source water had generally good water quality, the study discovered signs of progressive deterioration throughout the distribution system. During transport and storage, free chlorine residuals decreased significantly while turbidity levels remained high. This weakens the effectiveness of disinfection from the chlorine residuals and creates an environment where microbial growth can occur after treatment.

Microbial testing revealed that nearly 20% of tap samples contained total coliform counts exceeding the limits of safe drinking water. In addition, *Pseudomonas aeruginosa*, an opportunistic pathogen commonly found in water, soil, and plants, was detected in over 30% of tap samples, suggesting contamination occurs after treatment, likely linked to cistern storage and plumbing systems. Infection from these bacteria can cause a variety of serious illnesses and weaken the immune system.

The graph displays PeCOD values with two trends. One trend gradually decreasing between lake water, water treatment plant, and water truck with no statistical significance. The second trend displays an increase from truck to taps and containers with statistical significance, indicating water quality deterioration occurs during transportation and storage.



PeCOD as an Indicator of Water Quality Deterioration

With the help of Mantech's PeCOD, the study identified two distinct trends across sampling points. In the first trend, there was a gradual decrease in PeCOD values during treatment and distribution. Between the source, treatment plants, and water trucks, the differences in PeCOD were not statistically significant. However, the second trend shows a significant increase in PeCOD values between water trucks and household taps and containers. This trend suggests water quality deterioration occurs after treatment, rather than at the source. Thus, supporting the hypothesis that PeCOD can serve as an early indicator of water quality deterioration in systems with cistern storage.

Monitoring Drinking Water with PeCOD

Mantech's PeCOD analyser provides a safe, environmentally friendly, and reliable solution to drinking water testing. A major advantage is its ability to deliver BOD-correlated and COD results in just 10 minutes, giving operators real-time insight into changing water quality.

Unlike conventional COD testing, PeCOD relies on photoelectrochemical oxidation, using only salt and sugar reagents, eliminating hazardous chemicals, safety risks, and disposal concerns. This makes PeCOD particularly well suited for remote and northern communities where access to laboratories may be limited.

The PeCOD comes in multiple configurations:

- **Benchtop:** The base model used in municipal, government, and academic lab settings
- **Autosampler:** For larger operations handling large sample volumes
- **Online Autonomous Solution:** For hands-free monitoring directly from sample stream

FOR MORE INFORMATION CONTACT:

QCL, Riverside, Forest Row Business Park, Forest Row, East Sussex, RH18 5DW

qclscientific.com info@qclscientific.com 01342 820820

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