Mechanical Case Study

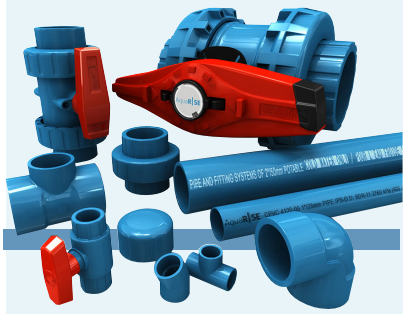
Top of the class: Schools upgrade domestic potable water distribution piping system with industry-leading AquaRise® by IPEX

A cost-saving, long-lasting CPVC solution gets an A+ in performance.

AquaRISE®

ENGINEERED SYSTEM PERFORMANCE

- Potable Water System for Commercial, Industrial and High Buildings
- Available in 1/2" to 4" Iron Pipe Size (IPS) diametres
- Continuous working pressure up to 400 psi at 73°F
- SDR 11 is for Hot & Cold and SDR 21 is exclusively for Cold water distribution



AquaRise® Hot & Cold Potable Water Systems

Backed by decades of experience designing and manufacturing Chlorinated Polyvinyl Chloride (CPVC) solutions, AquaRise is an industry-leading potable water piping system for the Canadian market. This innovative system includes hot and cold water AquaRise (SDR 11)

A robust potable water distribution solution, AquaRise is designed specifically to support commercial, industrial, and tall buildings. The highly engineered system uses TempRite® Technology compound, offering key benefits over conventional copper and metal systems including thicker, stronger walls and excellent corrosion resistance, resulting in improved long-term performance.

IPEX by aliaxis

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Overview

ONTARIO, CANADA — Creating a safe and effective learning environment is fundamental across all levels of education. This mission extends to providing clean, safe drinking water for students, teachers, and staff. For a school district in southeastern Ontario, this meant addressing a critical issue: high lead levels in many of their schools' potable water distribution systems.

This challenge is not unique. Many schools across Canada struggle with similar problems due to aging plumbing infrastructure. Over time, metallic pipes, fittings, solder, and fixtures corrode, leaching impurities into the water supply. This corrosion is especially problematic in older systems that have been in service for decades, making them prone to leaching harmful substances, including lead.

Until the mid-1980s, the National Plumbing Code permitted the use of lead in potable water materials, making it common in homes, public buildings, and schools constructed before this regulation was updated. Consequently, many older educational facilities in Ontario and across Canada still rely on metallic potable water systems that risk exposing all that consume it to unsafe lead levels in their drinking water.

Exposure to lead in drinking water poses health risks, particularly for children, who are more susceptible to the harmful effects. Lead exposure can adversely affect students' neurodevelopment, behavioural development, and overall intelligence. A study by The World Bank estimated that in 2019, children under the age of five lost a staggering 765 million IQ points due to lead exposure globally. (Source: The Lancet Public Health, 2023).

Recent research by Health Canada has confirmed that lead can be harmful even at very low levels (Health Canada, 2023). Consequently, the Maximum Acceptable Concentration (MAC) of lead in drinking water was reduced in 2019 to 5 parts per billion (ppb) from the 1992 national guideline of 10 ppb.

However, the implementation of these national MAC values and guidelines is at the discretion of each province and territory, leading to potential regional variations. It is crucial to consult the appropriate Authority Having Jurisdiction (AHJ) for specific regulations in an area. For example, Ontario has not adopted the updated national MAC, and the limit remains at 10 ppb.

Under Ontario Regulation 243/07, established under the Safe Drinking Water Act, 2002, schools, private schools, and child care centers are required to regularly flush their plumbing fixtures. The frequency of flushing depends on factors such as the potable water system's age, previous lead test results, fixture location within the system, and NSF certification status, i.e., whether the fixture is certified as safe for drinking water.

A key provision in this regulation is the testing frequency required for each facility over the life of its plumbing system. New facilities must sample all drinking water fixtures within five years of operation. Once all fixtures have been initially tested, each facility must submit one set of samples annually or once every three years if the facility is eligible for reduced sampling.

Notably, the regulation advises:

> **"For future sampling, we recommend that you rotate where you take your sample. We suggest you start with the fixture that has gone the longest without being sampled or take a sample from a fixture where lead issues have been identified."**

This advisory effectively permits schools to select only one fixture per year for testing, with a recommendation—not a requirement—to vary the sampling location. In practice, this allows facilities to repeatedly sample the same fixture, potentially a primary or upstream fixture near the system's source or mainline, rather than one at the end of a branch.

This approach can be problematic. Fixtures at the end of plumbing system branches often carry a higher risk of elevated lead levels. These endpoints are more prone to water stagnation, leading to prolonged contact time between water and lead-containing materials. Additionally, these fixtures experience lower water turnover, allowing sediment and lead deposits to accumulate, which increases the potential for lead contamination.

The lack of a strict requirement to vary sampling locations and test more than one fixture per year may allow significant lead level exceedances to go undetected, thus compromising the safety of drinking water within these educational facilities.

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The Challenge

The four high schools and three primary schools in question needed to implement a sustainable and effective remedy for their water quality issues. Like many older educational facilities, they faced challenges related to extended periods of no or low water demand, such as weekends, March break, Christmas, summer holidays, and the pandemic.

When buildings are unoccupied, water sits stagnant in metallic pipes, fittings, and fixtures, increasing contact time between the water and the metallic components,

which amplifies the risk of lead leaching. The rate of corrosion can be further accelerated by the varying composition of the water, including its acidity levels, mineral content, and the chlorine used for disinfection. When regular water demand resumes, the lead accumulated during stagnation can be released directly into the drinking water, posing a health risk to students and staff.

Temporary measures, such as flushing the lines and providing bottled water, were initially employed to mitigate the risk. However, these solutions proved unsustainable, inefficient, and environmentally harmful, leading to considerable water waste without fully resolving the lead contamination issue.

After a widely shared media report brought public attention to the issue, pressure mounted on the school board to implement an immediate, permanent, long-term sustainable solution to safeguard the well-being of attending students and staff.

The Solution

After exploring various temporary mitigation measures, the affected school boards determined that the most effective long-term solution was to remove the water distribution system completely to eradicate the source of the lead. Upgrading the potable water piping material to a lead-free solution was identified as a lasting and comprehensive resolution.

When researching options for replacing the piping systems, the school board contacted a local plumbing contractor who had a long-standing, trusted relationship with thermoplastic pipe manufacturer IPEX. This experienced installer of IPEX products sought expert guidance from the company and Outside Technical Sales Representative Phil Plath, C.E.T.

Together, the team thoroughly evaluated alternative potable water piping products in the market, focusing on performance, safety, and reliability. Based on these criteria, they identified the AquaRise potable water distribution system as the optimal solution to address the lead contamination issue.

Rather than relying on traditional metal options, the AquaRise system was proposed for its numerous advantages over traditional metal pipes:

- **LEAD-FREE COMPOSITION:** Made from CPVC, AquaRise eliminates the risk of lead contamination, ensuring safer water for students.
- **CORROSION RESISTANCE:** AquaRise does not corrode over time, unlike metal pipes that can leach harmful contaminants and require frequent maintenance.
- **CHEMICAL RESISTANCE:** AquaRise withstands a variety of water treatment chemicals, maintaining water purity and system integrity without degrading or producing harmful by-products.
- **SMOOTH INTERIOR SURFACE:** Its smooth surface reduces biofilm and scale buildup, contributing to a cleaner water supply.
- **NSF/ANSI 61 CERTIFICATION:** AquaRise is certified safe for potable water, meeting stringent safety standards and ensuring no harmful chemicals like lead are present.

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The Solution (con't)

During the installation phase across all converted schools, IPEX provided comprehensive training to all personnel involved, offering detailed instructions to ensure proper installation protocols were followed.

> "On-site support, training, and overseeing the preparation and installation of AquaRise piping system is the added value IPEX brings to its contractors," *explains Plath.* "This involves ensuring that all pipe-cutting, fitting preparations, and solvent cementing procedures are meticulously completed. When dealing with pressurized potable water systems, they require precise installation practices."
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> "I ensure that every installation step is followed correctly," *he states.* "The attention to detail ensures that each system is installed properly at each school, reflecting the high standards expected in our products."

The installation process, which required plumbers to identify and switch out old copper and lead pipes for CPVC, proved labour-intensive. Completing the transition in one school took the team several weeks. The work was conducted during the Christmas and March break and summer closures to minimize interruptions and allow for complete water shutoffs.

The overall project to replace the water systems in all seven affected schools spanned approximately three school years.

- LONG-TERM DURABILITY: Offering minimal maintenance and long service life, AquaRise reduces operational disruptions and costs compared to metal pipes, which can corrode and require regular upkeep.
- THERMAL INSULATION PROPERTIES: AquaRise provides better thermal insulation, reducing heat loss and the need for extra insulation, which enhances energy efficiency and lowers overall costs.
- COMPATIBILITY WITH EXISTING SYSTEMS: AquaRise can be easily integrated with current plumbing, allowing schools to upgrade to lead-free piping with minimal disruption and cost.

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The Results

Post-implementation data from the affected schools revealed a notable reduction, on average, in lead exceedance rates, using the National Guideline maximum of five parts per billion (ppb) as the testing standard.

During the COVID-19 pandemic, stagnant water and reduced water demand likely increased corrosion activity in metallic pipes and fixtures. The prolonged contact with chlorinated water led to higher lead content in water tests when demand rose after schools reopened.

While schools replaced large-diameter pipes (risers, mains, etc.) with AquaRise during changeovers, many smaller-diameter metal pipes, often inaccessible (e.g., behind concrete walls), were not replaced. These smaller pipes, which connect to fixtures throughout the schools, can contribute to lead leaching into the water supply. Additionally, some fixtures may contain components that leach lead or have lead particles dislodged due to corrosion, further contributing to elevated lead levels in the water.

Despite this, based on the most recent testing data from the 2022-2023 school year, the seven schools demonstrated an average 31% reduction in exceedance failures, highlighting the effectiveness of the AquaRise system in improving water quality.

Understanding the significant differences between the National Guideline's five-ppb standard and Ontario's ten-ppb guideline for lead in water is crucial. When comparing water quality test results from the seven schools over the period of 2016-2023, the number of lead level exceedances increased dramatically when evaluating the five-ppb standard against the ten-ppb guideline.

Out of 714 tests conducted across these schools, the five-ppb threshold detected 186 exceedances, while the ten-ppb threshold detected only 90 exceedances. This represents a 107% increase in the number of exceedances when using the more stringent five-ppb standard.

Testing at the five-ppb level allows for more precise detection of lead contaminants, identifying lower concentrations that are particularly critical for the long-term health and development of children. This precision is essential for ensuring safer drinking water in schools and protecting children's health.

Despite an identified need for schools to upgrade their potable water systems to reduce lead levels in drinking water, the onset of the COVID-19 pandemic highlighted an urgent need for enhanced ventilation and air filtration infrastructure within schools. Prior to 2020, schools had received increased funding specifically to improve plumbing infrastructure, aiming to address lead contamination in water supplies. However, as the pandemic heightened awareness of indoor air quality, focus and resources shifted significantly towards a "clean air" campaign.

Consequently, funds initially allocated for potable water quality improvements were substantially reduced to prioritize ventilation upgrades. To illustrate the scale of this shift, the Ontario government invested $600 million in school ventilation improvements over the 2020-21 and 2021-22 school years alone (Ontario News, 2022). While these upgrades play a critical role in health and safety during those unprecedented times, a shift back to prioritizing water quality is now needed to address ongoing lead contamination issues in aging potable water distribution systems.

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The Results (con't)

The successful partnership between IPEX and the Ontario schools highlights the crucial role of innovative solutions such as AquaRise in tackling the public health problem of lead contamination in drinking water. This collaboration not only focuses on addressing the root cause of the issue—lead leaching from aging plumbing systems—but also emphasizes the importance of proactive measures to ensure safe drinking water for students and staff.

By implementing a robust solution like AquaRise, schools can effectively safeguard their students' health while complying with stringent safety standards set by health authorities. This initiative reflects a commitment to providing a safe learning environment, demonstrating that when educational institutions and concerned manufacturers work together on innovative solutions, they can create lasting positive change for their communities.

> "Implementing AquaRise in these schools has made a real difference," *says Plath.* "The reduction in lead levels not only complies with safety standards but also brings peace of mind to the community."

Disclaimer

The data provided in this case study is based on available information at the time of publishing. Results may vary based on individual circumstances and further updates or developments in data.

References

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