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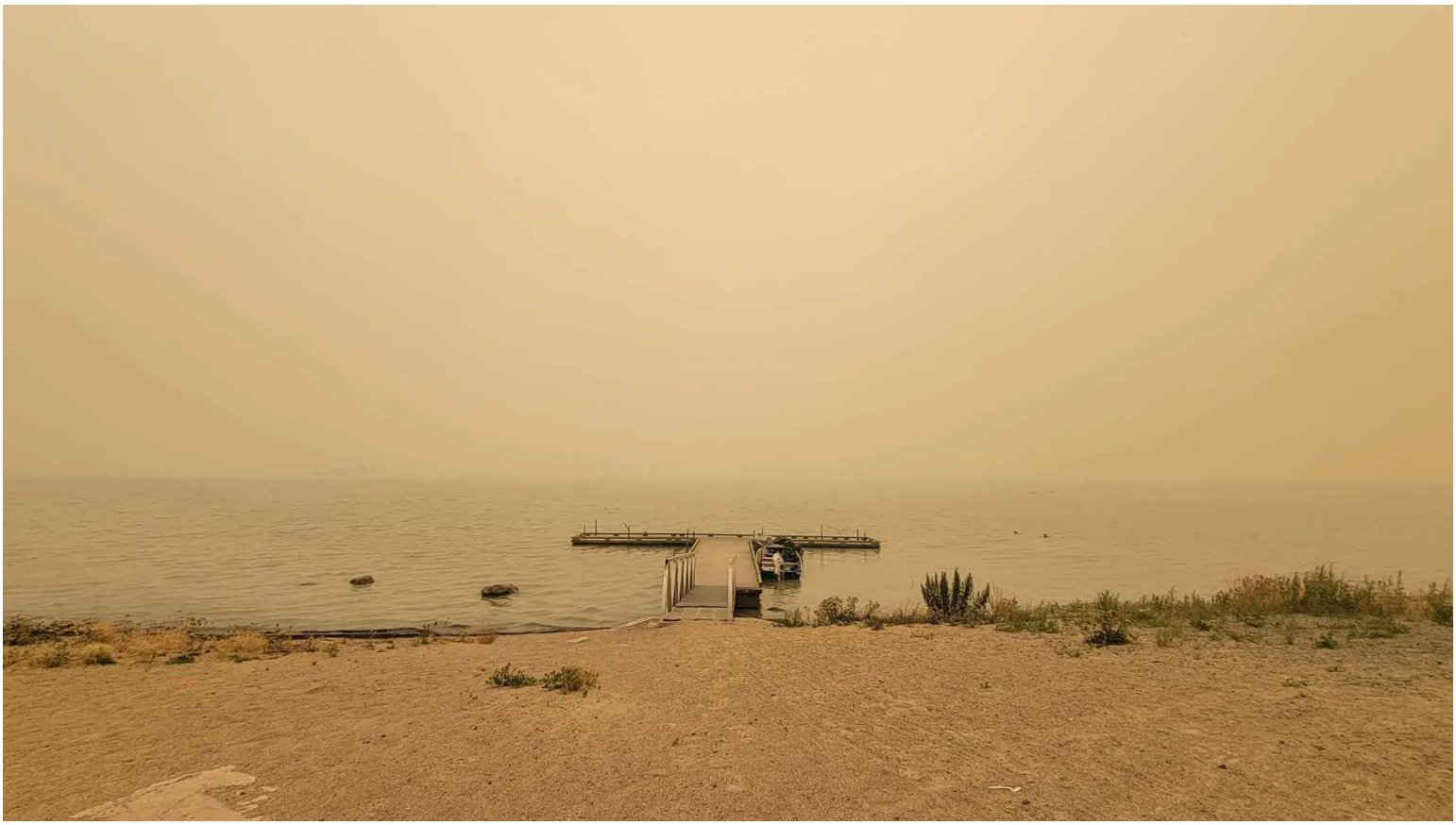
What wildfires might mean for your NWT water supply

Chloe Williams · September 19, 2023



A submitted photo of a the wildfire smoke in Behchokǫ̀ overlooking the water on July 26, 2023.

Experts say the NWT's wildfire season could affect water sources by altering water quantity and quality, potentially straining treatment systems.

The territory's extreme 2023 wildfire season has already taken a heavy toll on residents and fouled air quality for months. But fires can affect water too – sometimes in substantial ways.

In Alberta's Waterton Lakes National Park, for example, a waterfall ran black with soot and ash in 2018, the year after a fire burned through the park. In Fort McMurray, the after-effects of the 2016 fire forced the municipality to issue a three-month precautionary boil-water order. Fort McMurray's water treatment costs increased by 50 percent after the fire.

"Across the country, through the years, there's certainly been issues where after a wildfire, drinking water security was compromised for a little bit," said Marc-André Parisien, a research scientist at Natural Resources Canada's Northern Forestry Centre.

Based on the 2023 wildfire season the territory has been experiencing, water supplies in the NWT could run into challenges too, according to François-Nicolas Robinne, an analyst at the Pacific Salmon Foundation, who spent a decade studying the impacts of wildfire on water.

“The potential is there,” he said. “I don’t think there is any doubt about that.”

But Robinne said it’s still too soon to know what’s in store, as a multitude of factors can influence how wildfires affect water.

So far, testing at NWT water treatment plants has not revealed major changes due to wildfires, said Chirag Rohit, the territory’s chief environmental health officer.

However, Rohit added that the territory anticipates seeing variation in water quality, especially come spring, when melting snow washes burnt materials into waterways.

“The research and the information is very clear,” he said. “Wildfires of this extent – and even wildfires anywhere which affect [areas] upstream of our water sources, which for the most part is Alberta – they do affect the source water.”

Here’s what we know about how wildfires impact water, and why some experts are concerned about the territory’s water supplies.

Alterations in the water cycle

When fires burn a large part of the landscape, effects on water are to be expected, said Monica Emelko, a professor at the University of Waterloo and Canada Research Chair in Water Science, Technology and Policy.

That's because water is channeled over the landscape and collected into rivers or seepages that feed groundwater sources, she said. In North America, she added, much of the water that people use originates in forested landscapes.

When forests burn, both water quantity and water quality may be impacted, said Bill Quinton, a professor in Wilfrid Laurier University's department of geography and environmental studies, who studies hydrology in cold regions.

In terms of water quantity, he said, changes brought on by fires can affect the water cycle.

In much of the NWT, about half of the annual precipitation falls as snow, Quinton said. Tree canopies typically intercept falling snow, with most of that snow never reaching

the ground. Rather, he said, the snow is sent back into the atmosphere through sublimation – the process by which solids convert to gases.

If a severe fire removes the tree canopy, according to Quinton, trees are no longer intercepting snow and sending it back into the atmosphere. Instead, it piles up on the ground.

“That would normally mean more snow available in the spring for runoff,” Quinton said, which could lead to higher water levels.

In summer, changes in the amount of water on the landscape may also appear. Quinton said trees typically play a major role in transferring moisture back into the atmosphere via evapotranspiration – the loss of water from the land by evaporation from the surface

and transpiration through plants' leaves.

"Their roots are like straws, sucking water out of the ground," Quinton said. "The problem is, after the trees are dead, they're not doing that any more."

After a fire, Quinton said that may mean more water sitting on the landscape during the summer months.

In fact, Quinton has seen evidence of these changes at Scotty Creek, a research station located 50 km south of Fort Simpson that sustained major wildfire damage last year.

Earlier this summer, Quinton said he noticed large ponds among the blackened terrain that had never been there before. The ponds, he added, were covered in a greenish slime he had never previously witnessed.

"There's just new growth and new biological processes occurring as a result of the fire that surely have an impact on the quality of the water," he said.

Hard-to-deal-with contaminants

According to Emelko, several alterations in water quality can occur after a fire. She breaks those changes down based on whether a fire occurs in an urban landscape or a wildland area.

When urban areas burn, Emelko said, a variety of chemicals can be released from buildings and infrastructure that are not typically seen in water supplies. That includes contaminants like benzene, which was found at elevated levels in some California residents' water after wildfires, and contaminated water in Lahaina after the wildfires in Maui. Some research suggests benzene may come at least in part from heated plastic pipes.

Most water treatment plants are not equipped to deal with the kinds of contaminants that are released from urban fires, Emelko said.

Although these contaminants are not usually immediately life-threatening, she said, some are tied to increased cancer risk with prolonged exposure.

Wildland fires, on the other hand, release their own suite of compounds, such as polycyclic aromatic hydrocarbons (PAHs), dioxins and furans.

People may be most familiar with these compounds in the context of barbecuing, Emelko said. PAHs are one of the compounds formed in grilled meat that have been linked to increased cancer risk.

Emelko notes that these compounds tend to be diluted in most watersheds, however.

When it comes to compounds that water treatment plants struggle to deal with, she said the products of urban fires tend to pose a bigger threat than compounds released by wildland fires.

Water treatment bottlenecks

Wildfires can create other, long-term problems for water supplies, too.

"The longer-term part worries us the most," Emelko said.

In the years after a fire, two key aspects of water quality tend to change, she said. The

load of fine particles suspended in the water often increases, as does the concentration of dissolved organic carbon – tiny particles responsible for turning water the colour of tea.

Fluctuations in these properties can make it challenging to efficiently produce safe drinking water, according to Emelko.

That's because the first step in water treatment involves adding chemicals that cause fine particles to coagulate and settle out of the water, she said. The dose of chemicals needed depends on the source water's concentration of dissolved organic carbon.

"If you overdose your chemicals, you can plug up your system with solids and stop the water from flowing," Emelko said.

When that happens, she added, operators have to clean out the system, which can take hours or even days.

Conversely, Emelko said, if operators don't use enough chemicals, they risk letting fine

particles through that could be carrying other contaminants released by fires, such as heavy metals or PAHs. Sediment can also interfere with the final disinfection stage of treatment.

“If you don’t hit your chemical dosing appropriately, it decreases the efficiency of downstream treatment processes,” Emelko said. This can lead to reduced water availability, a water treatment plant shutdown, or a boil-water advisory.

These kinds of challenge are the reason Fort McMurray has seen at least $500,000 per year in additional chemical costs since the 2016 fire, according to Emelko, who helped study the fire’s impact on the municipality’s water.

Other effects from the fire may cost Fort McMurray around $20 to $50 million for water

treatment upgrades, Emelko estimates.

Along with water treatment challenges, algal blooms have occurred near Fort McMurray every year since 2016, she said – a result of increased phosphorus released after the fire.

Emelko described algae as a nuisance that can lead to unpleasant tastes or odours and clog treatment systems.

Algal blooms can also produce toxins, she said, which can be expensive to test for – and not all of which are regulated.

Emelko pointed out that because wildlife doesn't have the benefit of treated drinking water, they are often more exposed to wildfires' effects.

Wildfires may pose risks to people who drink raw water, too. For instance, Robinne said, nutrients released post-fire can spur the growth of microorganisms. He recommended that people drinking untreated water seek advice from local health services.

How will the NWT fare?

As of September 14, there were no boil-water advisories on the GNWT's website related to impacts from this season's wildfires, although the territory advised some residents to drain water holding tanks or wait for a water tank refill upon their return home after lengthy evacuations.

Rohit, the territory's chief environmental health officer, said routine daily testing of water coming in and out of treatment plants has shown water parameters are within normal ranges.

"We are routinely receiving water results from different communities and there is no risk to the water right now," he said.

Emelko said not all of the effects from fire are immediately obvious, however.

Sometimes, she said, they can take years to show up.

She is particularly concerned about the NWT because smaller communities tend to have fewer resources to deal with challenges that may lay ahead.

“If you have a small crew operating a water treatment plant, it’s not that they’re not trained. But how many intensive shifts can they do? How many resources do they have available to them to get the analyses done that they need, to gauge if their water quality is changed?” she said.

According to Robinne, based on preliminary data, the areas of highest concern may be around Hay River, Fort Providence, Sambaa K’e, Tulita and Behchokǫ̀.

“Some of those watersheds were vastly burned,” he said, “or the fire happened very close to the water intake.”

He said it’s hard to say how things will shape up in the NWT because there are still so many unknowns. The fire season isn’t over, he said, and information on fire severity – as well as the fires’ exact perimeters – is not yet available. Wildfires’ impact on water sources is also heavily influenced by precipitation.

Although there are legitimate reasons for concern, Robinne said, there are also cases where water quality remained largely unchanged after a major fire due to a lack of rain.

“There is no need to necessarily be alarmist,” he said.

At the same time, Robinne said governments, communities and drinking-water providers should take the possibility of water-related issues seriously.

According to Rohit, the territory is planning additional testing to understand how the wildfires are affecting water.

If results show some parameters spiking, he said there are “engineering folks” who can make adjustments to treatment plants and look into what needs to be done to make the water safe.

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