



Two Trillion Litres of Toxicity

Can oil sands tailings be cleaned up?

By JEFF GAILUS

MUCH HAS BEEN WRITTEN about the egregious environmental impacts of Alberta's oil sands, from fugitive clouds of petcoke dust (which damage human lungs and hearts) to the invisible curse of greenhouse gas emissions. But nothing compares to the size and toxicity of the tailings ponds. In a bid to provide America with oil, and shareholders with cash, oil sands companies in Alberta have accumulated two trillion litres of toxic tailings and waste water in 19 manmade lagoons along the banks of the Athabasca River. Think about that: two trillion litres that inundate an area of 257 km². That's larger than Lac la Biche. And unbeknownst to most Albertans, we have no effective regulations or technological means to deal with this mess.

When the Canada-US-Mexico Commission for Environmental Cooperation (CEC) investigated the matter in 2020, it gathered credible scientific evidence of what Alberta government officials have long denied and some scientists and engineers have long known: that oil sands tailings ponds are leaking their toxic contents into groundwater. Alarm bells went off in Ottawa. The federal government sent scientists to northern Alberta to discern the origin of the leaking chemicals, and Environment and Climate Change Minister Jonathan Wilkinson finally acknowledged the gravity of the situation. "The conclusions of the [CEC] report are very troubling, and certainly they cannot be ignored," he said. "The oil sands tailings issue is a problem we are going to have to address."

After decades of neglect, the provincial and federal governments are now in a regulatory footrace to see who will be first to create regulations to guide if, how and when treated "oil sands process water"—a euphemism for the dangerous liquids left over from the mining of bitumen—can be discharged into the Athabasca River.

Not surprisingly, Indigenous leaders and elected representatives downstream of the oil sands, from Fort Chipewyan to the Arctic's Beaufort Delta, are just as opposed to the idea of dumping toxin-laden waste in the Athabasca River as southern Albertans are to the prospect of digging new coal mines on the Eastern Slopes. "We're not supportive of this," NWT Environment Minister Shane Thompson told his colleagues in the NWT legislature about proposals to alleviate the tailings problem by flushing it downstream. "This has been a very long issue for our Indigenous governments across the territories, all the way up from the Beaufort Delta all the way down to Fort Smith."

Jesse Cardinal, executive director of the Athabasca

ALAMY

Keepers of the Water, was even more blunt. “Releasing tailings to the watershed is not a safe or just option for solving Alberta’s growing tailings crisis,” she wrote in a letter to Steve Guilbeault, a former Greenpeace activist and, as of 2021, Canada’s new minister of environment and climate change. “It is a handout to oil companies that allows them to avoid reclamation costs. It is a decision that [means] northern Indigenous communities and lands will remain a sacrifice zone for the profit of settler governments, southern populations and some of the world’s richest corporations.”

FIRST NATIONS, environmentalists and downstream residents have long understood that oil sands companies promised never to release tailings water, treated or otherwise, into the Athabasca River. They say industry representatives led people to believe that the tailings—vast quantities of sand, clay, leftover bitumen, toxic chemicals and water—would be stored safely in pits and eventually reclaimed on land, when the mines closed.

There is ample evidence for their position. For 50 years, treatment and release of oil sands process water has never been overtly mentioned in the applications and approvals for oil sands mines. Instead, tailings and waste-water management plans describe “end pit lakes” and “tailings landforms” as the destiny of the toxic byproducts created by washing gigatonnes of bitumen-infused soil in hot water and chemicals. Likewise, neither the provincial nor the federal government created regulations to allow the release of oil sands process water, even as the volumes of tailings ponds have swelled beyond all expectations. But a range of historical documents makes it clear that releasing tailings water was always the likely end game—and that it’s been happening all along.

In the beginning, industry engineers and scientists assumed oil sands tailings would behave like others they were familiar with, for mineral and coal mines. These operations’ noxious slurries are treated in a two-step process: Let the suspended solids (i.e., the tailings, or “fines”) settle to the bottom and then treat and release the remaining waste water. In coal- and mineral-mine pits, the solids are relatively large and heavy, so it takes only a matter of weeks for the particles to drop out of the water column and congregate on the bottom, allowing the waste water to be promptly treated and released. Engineers have been doing this for more than a century, and the physics and chemistry of the process are well known.

Oil sands tailings, it turned out, are less co-operative. They’re contaminated with some of the same chemicals found in coal and metal mine tailings, such as selenium, cadmium, mercury and arsenic,

but they harbour much finer particles of silt and clay. They also have troubling contaminants unique to bitumen: polycyclic hydrocarbons, naphthenic acids and high concentrations of salt. As the rainbow trout that have been used to test the lethality of tailings pond water can tell you, it is an acutely toxic mix.

It can take decades, even centuries, for silt and clay fines to settle out in oil sands tailings ponds, and even then, these “fine fluid tailings” remain in a mobile, semi-aqueous state akin to quicksand. This has left industry in a quandary: They can’t reclaim the solids if they can’t harden them, and they can’t treat water that’s awash in solids. Worse, every time the water is recycled for reuse in the extraction process, the chemicals and salts become ever more concentrated.

In 1973 a report entitled “An Environmental Study of the Athabasca Tar Sands,” prepared for Alberta Environment, identified the wicked problem government and industry had created for themselves: “Present technology... does not provide adequate clarification of the [tailings] water to permit total recycling” and “clay and bitumen contaminants preclude the discharge of tailings water to the Athabasca River.” The report also included a warning: The inability of industry to remove the array of toxic chemicals and solids from oil sands tailings was “the most imminent environmental constraint to the future expansion” of oil sands mining.

The warning, like so many others in Alberta, was ignored. Despite the publication of dozens of papers and reports over the following decades warning of the risks and uncertainties, the Alberta government happily approved oil sands mines as fast as industry’s engineers could draw up the plans, and the tailings ponds grew. By 2009 they contained nearly 800 billion litres of waste water, and waterfowl were dying in the ponds by the hundreds each year. Meanwhile, even as First Nations people downstream complained of deformed fish and debilitating health effects, including high rates of rare cancers, Alberta politicians and government scientists declared that this rash of development couldn’t possibly be polluting the Athabasca River.

The Great Canadian Oil Sands Duck Fiasco in 2008 brought unwanted international condemnation to the oil sands and forced the province’s hand. In 2009 the Energy Resources Conservation Board (predecessor to the Alberta Energy Regulator, or AER) finalized Directive 074, codifying tailings standards that required companies to capture and dry as much as 50 per cent of new tailings waste by 2013. Emboldened by the new policy, then-premier Ed Stelmach assured the world that oil sands companies would have to eliminate tailings ponds within “a few years.”

Directive 074 was a dismal failure. Industry outright ignored its obligations, and by 2013 tailings

volumes had increased to almost one trillion litres. Not a single oil sands operator had complied with its commitments to reclaim new tailings. But rather than enforce the regulation and demand that tailings be cleaned up, the ERCB looked the other way—then quietly scrapped the regulation. High on optimism and oblivious to irony, then-premier Alison Redford boasted to a crowd at the Brookings Institution, a Washington, DC, think tank, that “tailings ponds will disappear from Alberta’s landscape in the very near future.”

She must have had in mind a geologic timeline, because today some 1.4 trillion litres of fine fluid tailings and almost 500 billion litres of contaminated waste water fill the ponds. An analysis by the Pembina Institute, which has been warning Albertans for decades about the growing tailings pond debacle, concluded that the province’s new tailings management policy, Directive 085, will allow cumulative tailings volumes to increase for at least another 15 years.

Oil sands mines got approved despite no feasible way to treat their waste water.

GIVEN THE UNWILLINGNESS of successive Alberta governments to adequately regulate the oil sands industry, it boggles the mind how blind the federal government has been to a problem you can literally see from space. The Fisheries Act, passed in 1868, just a year after Confederation, is Canada’s strongest water protection law, because it prohibits “the deposit of a deleterious substance of any type” in “water frequented by fish.” Nonetheless, the federal government left the management of industrial water pollution to the provinces for more than a century.

Around the turn of the last century, the Canadian government belatedly realized the provinces weren’t adequately protecting water from pollution. Pulp and paper mills (1992) and metal and diamond mines (2002) were the first to be subject to stronger effluent regulations, followed by municipal waste-water regulations in 2012. Somewhat incredibly, given how long we’ve known—or should have known—that coal and oil sands mines were depositing “deleterious substances” in creeks, rivers and groundwater, we’re still waiting for federal effluent regulations to be enacted.

“It’s absolutely amazing,” says Martin Olszynski, an associate professor of law at the University of Calgary and an expert on environmental and natural resource law. “The insane thing that people don’t understand about environmental law in Canada [is] we’ve never had regulations authorizing any deposits of deleterious substances in relation to oil sands mining. But that doesn’t mean [companies] weren’t

depositing waste water—of course they were.”

How much they’ve deposited over the decades is difficult to say. Public record-keeping has been poor, but in 2009 Alberta environmental scientists Kevin Timoney and Peter Lee concluded that “contaminant discharges to the Athabasca River are common.” They cite a few examples, including a 1982 fire in a Suncor waste-water pond that sent flames 90 metres into the air and an unknown quantity of contaminated water down the river, closing the commercial fishing season on Lake Athabasca and reportedly causing illnesses in Fort McKay.

In 2007 human error led to the escape of 10 million litres of contaminated waste water from Suncor’s waste-water ponds. But total licensed discharges from the Suncor ponds the same year were more than 1,000 times that amount. “The total discharge from all companies,” Timoney and Lee warned, “is unknown.”

How did so many oil sands mines get approved without having a technologically feasible and cost-effective way to treat their waste water? In most other first-world democracies, you don’t get your permits until you have demonstrated to the regulator that you know how to clean up after yourself. In Canada, and Alberta in particular, a simple “we’ll figure it out later” is all that was needed to scrape 1,000 km² of boreal forest off the face of the earth.

“We’re stuck between a rock and a hard place,” said Olszynski. “We have 1.4 trillion litres of fluid tailings, and that’s an environmental hazard. But we should never have allowed it to get to this point. That’s a regulatory failure.”

WHATEVER THE OIL SANDS INDUSTRY did or didn’t promise in the 1960s and 1970s, there’s no doubt it now wants to treat and release the waste water from its massive accumulation of tailings. Corporations and industry trade groups are quick to point out that oil sands companies have spent hundreds of millions of dollars on research to solve this problem, and that we needn’t worry, because they have everything under control. John Brogly, water and tailings director for the Canadian Oil Sands Innovation Alliance (COSIA), maintains that “we have dozens of different ways to treat the water to ensure it can be released safely with no harm to the environment and downstream users.”

Oil sands companies have begun to develop some potential technologies to treat both fluid tailings and the remaining waste water. Suncor, for instance, has created a “permanent aquatic storage structure” (PASS) that modestly reduced fluid tailings inventory



ARCHIVE:
The oil sands
tailings problem,
Nov 2007
[albertaviews.ca/
archive](http://albertaviews.ca/archive)

at its Base mine in 2018 and 2019. Several companies are building pilot pit lakes to see if they can forever store fine fluid tailings under several metres of fresh water. Brogly pointed to two examples of new technology that can treat oil sands process water. One involves a combination of filtration and absorption, whereby coke, a by-product of oil sands upgrading similar to charcoal, filters out the fines and absorbs unwanted organics such as naphthenic acids. Another example is a sunlight-activated treatment process called SolarPass. It uses a proprietary photocatalyst that, when added to water and exposed to sunlight, will purportedly treat and eliminate potentially harmful organic components in water.

But these proposed technologies are still in their infancy. When COSIA assures us that “we have dozens of technologies” to treat and release waste water safely into the environment, what they really mean is they’re testing dozens of ideas that might *someday* work at the massive scale required. It’s troubling that 50 years after Great Canadian Oil Sands started accumulating fluid tailings, the same industry that spared no effort or expense to innovate the necessary technology to expand oil sands production at breakneck speed still doesn’t have a single waste-water treatment system capable of cleaning even a fraction of its polluted water at any meaningful scale.

MANY CHEMICAL ENGINEERS and environmental toxicologists believe that with a concerted effort and more money, industry could cobble together the technologies required to detoxify oil sands tailings water. That they haven’t done so is simply because they haven’t been made to do so. That needs to change.

Mandy Olsgard, an environmental toxicologist who worked for the AER during the brief reign of the Alberta NDP, worries that the province can’t be trusted to adequately manage pollutants. “We need to get federal effluent regulations under the Fisheries Act, our most robust piece of legislation, rather than [wait for] a captured provincial government to develop a system for approved releases.” Olszynski adds that federal regulations could provide, for the first time, a legal mandate for a more robust oil sands monitoring program, to ensure that regulations protect the aquatic environment.

One reason for hope is that the federal government has invited First Nations people to the table to help develop new regulations. The process is called the Crown-Indigenous Working Group, and it’s the first time the feds have engaged Indigenous communities in the development of effluent regulation under the Fisheries Act.

Strong rules are not guaranteed. The development of industrial effluent regulations is always a battle fought behind closed doors. Corporations, industry trade groups and even provincial governments routinely lobby the federal government to keep regulations weak, flexible and cheap. First Nations and the NWT government, on the other hand, want the most protective and restrictive regulations they can get. “We strongly support the cleaning of tailings ponds, but we don’t want the cleanup to mean [the creation of] environmental impacts in the Athabasca River and downstream,” said Bori Arrobo, director of sustainability at the Fort McKay First Nation. “We don’t want to swap one environmental liability for another.”

Olsgard maintains it’s way too early to talk about releasing treated tailings. We don’t know the condition of the Athabasca River below the mines before oil sands development started, because monitoring data before 2010 is inadequate. And more research is needed to better inform people living downstream, especially First Nations, about how to identify environmental and health protection goals and work back from there. “We’ve moved beyond acute risk and into the space of chronic, sub-clinical toxicity,” she says. “We don’t want fish with deformities or whose populations crash because of reproductive effects. Those are the protection goals my colleagues and I are pushing for.”

Though industry is pushing hard for “treat and release,” other strategies could keep water pollution low enough to protect environmental and human health. Monique Dubé, an environmental toxicologist who headed the Oil Sands Monitoring Program from 2017 to 2020, says the focus must be on a holistic and integrated water management strategy. “Certainly, some water will have to be treated and released, but a lot of water could be more effectively managed for treatment and reuse,” she says. “This alternative needs to be on the agenda; it’s certainly on the agenda for Indigenous communities in the region, and it absolutely needs to be for industry and governments.”

Some oil sands companies propose to create more end pit lakes and artificial wetlands to store the toxic fines, but little evidence exists that these ersatz waterbodies will remain stable and safe over the long term.

The best alternative would be to mandate that companies remove the fines and treat the leftover waste water back to its natural state. Oil sands companies could then choose to reuse the water, construct clean wetlands, or release certified clean water into the river, greatly reducing environmental impacts on a landscape on which First Nations hope to resume their traditional hunting and gathering activities for generations to come.



Inspired by how activated carbon removes contaminants in home water filters, Syncrude engineer Warren Zubot is now using petroleum coke—a by-product of the company’s upgrading process—to filter out contaminants in tailings water (results shown above). The rub, as always, is cost.

The rub, as always, is cost. To adequately treat contaminated oil sands waste water will not be cheap. The more polluted the effluent and the stricter the limits on pollution, the more expensive treatment will be. Consider: An average high-end waste-water plant at a metal mine can treat five million m³ of waste water a year and cost \$50-million to build. To process just the current volume of stored oil sands tailings and waste water by 2070 would require eight such plants running full tilt for 48 years, with eight more plants needed to treat the new tailings (~40 million m³) produced each year. That’s 16 treatment plants, for an initial capital cost of roughly \$800-million.

The per unit operating costs for an oil-sands-specific treatment plant might approximate those of desalination plants used in Israel: \$2–\$4 per m³. Total cost? Somewhere in the neighbourhood of \$5-billion to \$9-billion, probably more when you factor in delays and hiccups and inflation.

Of course, the solids—sand, clay, silt, bitumen—have to be removed before the waste water can be treated. Finding a way to store this toxic mix is perhaps the bigger challenge than treating the liquids. “The solids are arguably more contaminated,” says Olsgard. “When you bring in the solids and the liquid tailings... and you place them in forests and lakes and wetlands and release them to the river? What does that look like? It’s a complete unknown.”

IN AUGUST 2021, LESS THAN A YEAR after then-Minister of Environment and Climate Change Jonathan Wilkinson went public with his concerns about the oil sands tailings ponds, he rejected Riversdale’s application to build the

The oil sands industry wants to treat and release waste water from tailings into the Athabasca River.

Grassy Mountain coal mine in southern Alberta. “The Government of Canada must make decisions based on the best available scientific evidence while balancing economic and environmental considerations,” he wrote in a statement justifying his decision, which was celebrated by mine opponents across southern Alberta. “It is in Canada’s best interests to safeguard our waterways for healthy fish populations like the westslope cutthroat trout, respect Indigenous peoples’ culture and way of life, and protect the environment for future generations.”

If these sentiments had been taken seriously when assessing and approving oil sands mines, Alberta wouldn’t be in this mess in the first place. For generations, politicians and CEOs have thrown caution and integrity to the wind, prioritizing GDP, jobs and profits over clean water and healthy communities—and nowhere more so than in northeastern Alberta.

But perhaps things are improving. If a single coal mine is now considered too risky for Alberta’s fish and waterways, and if respect for the rights and lifeways of Indigenous peoples is so important, then surely preventing the oil sands industry from further damaging the Athabasca River with toxic waste water should be a similarly high priority for new environment minister Guilbeault. An environmental impact assessment and strong regulations are the least the federal government can do to ensure that the residents of Fort McKay and Fort Chipewyan and the NWT are treated with the same respect as people in Lethbridge and Calgary. ■

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