PEMBINA institute

Review of Directive 085 Tailings Management Plans

Backgrounder

by Jodi McNeill and Nina Lothian | March 13, 2017

Summary

The total volume of fluid tailings, a toxic byproduct of Alberta oilsands mining, reached 1.18 trillion litres in 2015. This is the result of 50 years of regulatory and engineering shortcomings. The Government of Alberta introduced the Tailings Management Framework (TMF) in March 2015 as a game-changing policy shift for tailings management in the province. Directive 085 was released in July 2016 to enforce the TMF, and it constitutes a critical opportunity to address this environmental challenge.

On November 1, 2016, Tailings Management Plans for all operating mines were submitted to comply with Directive 085. The Pembina Institute has compiled data from these plans and conducted a preliminary analysis to assess industry-wide trends and the extent to which the applications, in sum, meet the stated objectives and expectations of the Tailings Management Framework. Seven areas of concern are identified and discussed.

What are oilsands tailings?

Bitumen typically constitutes only 10% of each shovel-load of oilsands, and sizeable quantities of freshwater from the Athabasca River is required to isolate the tar-like substance from superfluous materials. While industry recycles much of this water, over time the recycled water becomes increasingly less effective for bitumen processing and causes scaling and corrosion in infrastructure, raising concerns of potentially chronic toxicity in reclaimed landscapes.[1]

For each barrel of bitumen, an average of 4–6 barrels of hot water mixed with chemical additives is used to separate out constituent inorganics, silts and clays. Leftover tailings waste is then deposited into man-made structures called tailings "ponds." While some of the waste settles out of the water, 10–40% of the mixture will form a mid-layer of mature fine tailings (MFT), also called fluid fine tailings (FFT), that cannot be dewatered and disposed of without substantial

[1] E. W. Allen, "Process Water Treatment in Canada's Oil Sands Industry I. Target Pollutants and Treatment Objectives," *Journal of Environmental Engineering Sciences*, 7(2008.).

technological intervention.[2] MFT are technically defined as tailings containing suspended clay-like fine solids measuring 44 microns or smaller.

If left alone, it would take hundreds of years for the solids in MFT to naturally settle to the bottom of the ponds. This is the primary reason why tailings ponds cannot be easily reclaimed, resulting in their perpetual growth ever since industrial-scale oilsands mining began in the late 1960s. In 2015 there were 1.18 trillion litres of tailings on Alberta's landscape,[3] and the volume of the ponds continues to grow.[4]

Why are tailings dangerous?

Toxic contents and seepage

Salt concentrations continuously increase in both tailings ponds and surrounding boreal forest habitats from mining operations, rendering reclamation progressively more unmanageable. The enormous tailings ponds also contain a host of toxic materials including bitumen, naphthenic acids, cyanide, phenols, arsenic, cadmium, chromium, copper, lead and zinc. These materials are released during oilsands processing and become increasingly concentrated in tailings ponds over time.[5] Moreover, there is evidence the ponds may leak. In 2008, Environmental Defence used industry information to arrive at a conservative estimate of overall leakage from oilsands tailings ponds in Alberta. This study estimated the ponds to be leaking at least 11 million litres a day of contaminated water into the environment, equivalent to over 4 billion litres a year.[6]

Technological uncertainties

In the last decade, industry has invested extensively in figuring out how to effectively and reliably clean up tailings. Companies are currently employing technologies such as centrifugation, tailings reduction technology, and carbon dioxide amended tailings. Unfortunately, each leading technology option still faces uncertainties in terms of its ability to not only effectively and efficiently treat tailings, but also to produce self-sustaining final ecosites. For instance, most companies currently propose 'water capping,' which would allow them to dump untreated fluid tailings into old mine pits and permanently cap them with

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[2] Natural Resources Canada, "Dewatering Wet Tailings Generated From Oil Sands Extraction." http://www.nrcan.gc.ca/energy/funding/current-funding-programs/eii/16122

[3] Calculation based on data compiled from submitted TMPs, as well as the Mildred Lake Extension (MLX) project that is currently under regulatory review. TMPs are accessible at https://www.aer.ca/about-aer/spotlight-on/fluid-tailings-management-applications

[4] Alberta Department of Energy, Facts and Statistics. http://www.energy.alberta.ca/Oilsands/791.asp

[5] "Process Water Treatment in Canada's Oil Sands Industry."

[6] M. Price, *11 Million Litres a Day: The Tar Sands' Leaking Legacy* (Environmental Defence, 2008). http://environmentaldefence.ca/report/report-11-million-litres-a-day-the-tar-sands-leaking-legacy/

freshwater from the Athabasca River. There is no guarantee that this proposed approach will permanently separate the toxic tailings from the rest of the environment.[7]

Risks for wildlife

Fluid tailings are warm when disposed of, so tailings ponds do not entirely freeze over in the winter. Consequently, wildlife are attracted to the toxic ponds in cold weather. Mine operators typically use deterrents like air cannons and decoys to scare off birds and other wildlife, but these measures are not always successful. If animals are exposed to the ponds, they can become covered in residual bitumen, a potentially deadly fate. Notorious examples of the risk tailings pose to wildlife occurred in 2008 when 1,600 migrating ducks died after landing in a Syncrude operated pond,[8] and again in 2010, when despite heightened attempts to dissuade wildlife from approaching the toxic water bodies another 230 ducks died in a Syncrude ponds.[9]

Risks to human health and greenhouse gas emissions

Tailings emit a range of harmful air pollutants: volatile organic compounds (VOCs), hydrogen sulphide and nitrous oxides. These pollutants have been shown to travel long distances before depositing on terrestrial or aquatic surfaces. VOCs are suspected to have serious human health impacts but are not adequately monitored in the oilsands.[10]

Tailings ponds also emit significant amounts of methane and carbon dioxide, two potent greenhouse gases (GHG). This is due to the microbial biodegradation and fermentation of lost diluent, as well as the oxidation of heavy minerals in residual bitumen. Industry estimates that tailings ponds account for as much as 10% of total GHG emissions from oilsands mining.[11]

History of tailings regulations in Alberta

The history of Alberta's oilsands tailings regulations in the five decades from 1967 to 2015 can be summarized into the following two broad phases.

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[7] Oil Sands Research and Information Network, *Review of Reclamation Options for Oil Sands Tailings Substrates* (2010). https://era.library.ualberta.ca/files/6q182m059/Reclamation%20Technology%20Review%20-%202010%2007%2016.pdf

[8] CBC News, "Syncrude to Pay $3M Penalty for Duck Deaths," October 22, 2010. http://www.cbc.ca/news/canada/edmonton/syncrude-to-pay-3m-penalty-for-duck-deaths-1.906420

[9] CBC News, "Oilsands Tailings Ponds Kill More Ducks," October 26, 2010. http://www.cbc.ca/news/canada/edmonton/oilsands-tailings-ponds-kill-more-ducks-1.934577

[10] Jennifer Grant and Erin Flanagan, *Losing Ground: Why the Problem of Oilsands Tailings Waste Keeps Growing* (Pembina Institute, 2013). http://www.pembina.org/pub/2470

[11] J. Van Loon and R. Penty, "Gassy Ponds May Hold Key to Oilsands Emissions Fight," *Calgary Herald*, August 20, 2016. https://www.pressreader.com/canada/calgary-herald/20160820/282617442159305

1967 to 2009: No regulations

At the outset of commercial oilsands mining, it was not anticipated that suspended clays within fluid tailings would take hundreds of years to naturally settle to the bottom of the ponds.[12] Nonetheless, in 1973 Alberta Environment published a series of reports about the Athabasca oilsands that recognized the nascent ponds as a serious problem with alarming implications for local ecologies and health, and identified industry's technical incapacity to treat MFT as "the most imminent environmental constraint to the future expansion" of oilsands mining.[13]

Despite industry and government's early knowledge about the severe and largely intractable environmental problems posed by tailings ponds, however, treating and cleaning up fluid tailings remained essentially voluntary for the 40 years prior to 2009. Under the auspices of this extremely permissive management approach, oilsands mining companies consistently failed to meet the commitments promised within their original project applications.[14]

2009 to 2013: Directive 074

Addressing mounting public concern, in 2009 the Energy Resources Conservation Board (ERCB) produced new standards for tailings management with Directive 074*: Tailings Performance Criteria and Requirements for Oil Sands Mining Schemes*.[15] This regulation held oilsands mining companies responsible for capturing and drying up to 50% of all new fluid tailings by 2013.

Despite enthusiastic early public assurances from the ERCB regarding the government's strong commitment to enforcing these standards, the Directive proved to be unsuccessful. Within months of its introduction the ERCB began accepting tailings plans that did not comply with the directive. Soon after, the regulator quietly released its annual tailings management reports, revealing that every single company had failed to meet both the standards of Directive 074 and the weaker targets they had individually negotiated with the regulator.[16]

There were no consequences for this non-compliance. The ERCB attributed the en-masse failure to technological problems the industry had encountered when attempting to implement the new standards. So, contrary to promises from the government in 2009 that tailings ponds would soon vanish entirely, the toxic legacy for Albertans has simply continued to

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[12] Andrew Nikiforuk, *Tar Sands: Dirty Oil and the Future of a Continent* (Greystone Books, 2010), p.84.

[13] Alberta Environment, *An Environmental Study of The Athabasca Tar Sands* (1973). https://era.library.ualberta.ca/files/z316q223f/1973%20-%20Intercontinental%20-%20Athabasca%20Tar%20Sands%20Report%20&%20Recommendations.pdf

[14] Jennifer Grant, "Oilsands industry losing ground on tailings management," *Pembina Institute*, August 21, 2013. http://www.pembina.org/op-ed/2471

[15] Alberta Energy Regulator, *Directive 074: Tailings Performance Criteria and Requirements for Oil Sands Mining Schemes* (2009). https://www.aer.ca/documents/directives/Directive074.pdf

[16] *Losing Ground*, p.1.

exponentially grow.[17] Taxpayers in 2006 were concerned that fluid tailings ponds and dykes could have covered an area equivalent to two Sylvan Lakes; today they could cover five.

A new direction? Introduction of the Tailings Management Framework and Directive 085

In March 2015, the Government of Alberta released the *Tailings Management Framework for the Mineable Athabasca Oil Sands* (TMF)[18] under the umbrella of the *Lower Athabasca Regional Framework* (LARP), [19] the latter constituting a 2012-2022 policy direction to establish strategic land use planning and manage the cumulative impacts of industrial development in the oilsands region. For the first time in Alberta's history the TMF set policy targets for legacy fluid tailings, defined as those produced and accrued between 1967 and 2015.

In July 2016, Directive 085: *Fluid Tailings Management for Oil Sands Mining Projects*[20] was introduced by the Alberta Energy Regulator (AER) to enforce the TMF. Unlike the strict individual targets set by Directive 074, this Directive takes a cumulative approach; it is also more flexible and permits companies to propose their own criteria for tailings treatment based on the final landscape targets delineated in their reclamation plans. Moreover, rather than focusing on prescribed standards of trafficability, Directive 085 is oriented around managing volumes of fluid tailings pre- and post-treatment.

The deadline for all current operators to submit a Tailings Management Plan in compliance with Directive 085 was November 1, 2016. With the Government of Alberta's poor track record for adequately managing oilsands tailings, it is imperative that all companies are held to the strict requirements of the Directive and that enforcement mechanisms for non-compliance be clearly prescribed, sufficiently stringent, and compulsory.

[17] "Oilsands industry losing ground on tailings management."

[18] Government of Alberta, *Lower Athabasca Region: Tailings Management Framework for the Mineable Athabasca Oil Sands* (2015). http://aep.alberta.ca/lands-forests/cumulative-effects/regional-planning/documents/LARP-TailingsMgtAthabascaOilsands-Mar2015.pdf

[19] Government of Alberta, *Lower Athabasca Regional Plan: 2012-2022* (2012). https://landuse.alberta.ca/LandUse%20Documents/Lower%20Athabasca%20Regional%20Plan%202012-2022%20Approved%202012-08.pdf

[20] Alberta Energy Regulator, *Directive 085: Fluid Tailings Management for Oil Sands Mining Projects* (2016). https://www.aer.ca/documents/directives/Directive085.pdf

Analysis of industry-wide trends in the Directive 085 applications

The Pembina Institute has compiled data and conducted an analysis of industry-wide trends using Tailings Management Plan (TMP) applications for all operating mines submitted by the November 1 deadline. This analysis identified seven major areas of concern:

1. Cumulative tailings volumes

The intent of the Tailings Management Framework is to halt the growth of cumulative fluid tailings volumes *as soon as technically possible* and then to require companies to steadily reduce volumes while accelerating the rate of reclamation. The Pembina Institute is concerned that this intent is not reflected in the individual TMPs.

The graph on page 28 of the TMF is a central reference in determining how the applications are, in sum, measuring up to the stated expectations of the framework. This graph was predicated on $100/bbl oil, and included projected tailings profiles for five hypothetical oilsands projects and three projects for which data is not available (Total's Joslyn Mine, Syncrude's Aurora South Mine, and Suncor's Fort Hills Mine). For the analysis, the Pembina Institute removed these projects from the original TMF line (Figure 1). The adjusted graph demonstrates that tailings volumes could now be expected to decline after 2020.

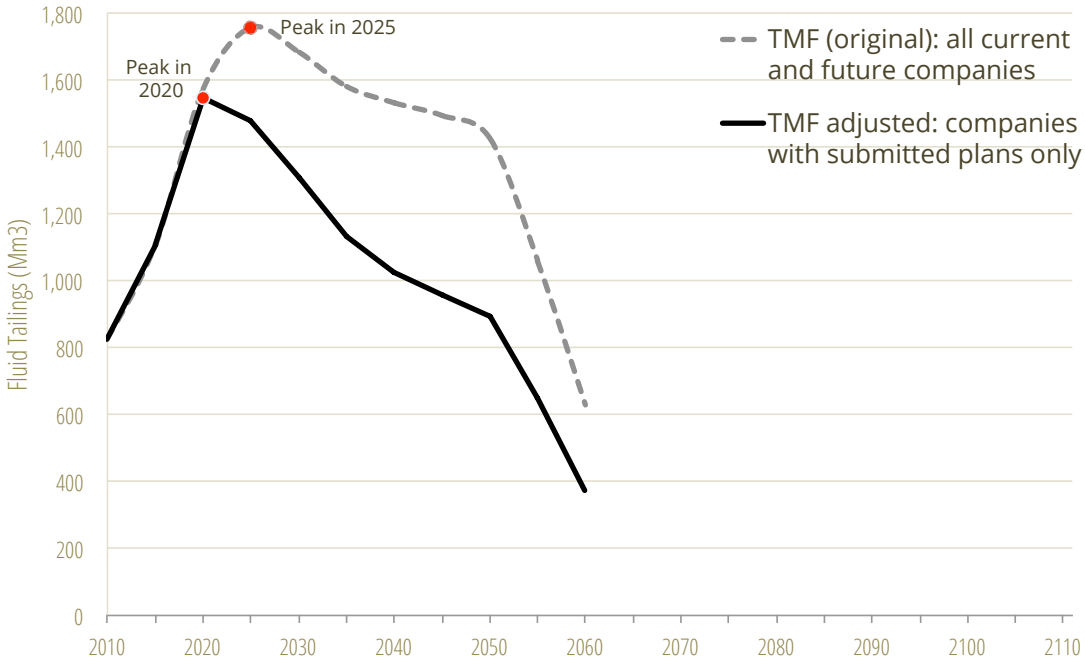

Figure 1. Expected cumulative fluid tailings volumes in the TMF

The Pembina Institute combined the projected fluid tailings volumes from all tailings data available to date, and compared it with the adjusted TMF graph. This analysis has demonstrated that, based on the profiles submitted, cumulative fluid tailings will not be reduced from the landscape until 2037 (Figure 2). After 50 years of unconstrained growth, waiting 20 more years before tailings ponds begin to shrink is not consistent with the goals of the TMF.

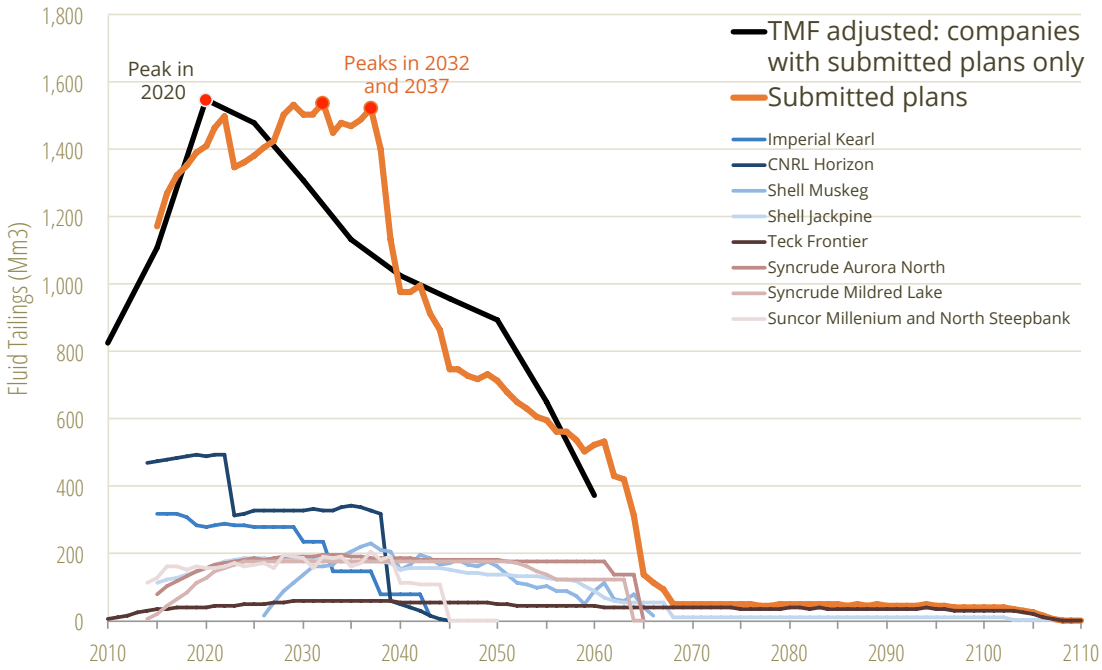

Figure 2. Analysis of cumulative fluid tailings volumes

2. Compliance and enforcement

The enforcement mechanisms for non-compliance under Directive 085 will be determined based on pre-existing AER protocols and tools in *ICAF* and Manual 013.[21] For each of the four non-compliance levels delineated within the TMF and Directive 085, management actions will be selected from a range of options based on the discretion of the AER and its assessment of what is appropriate in each individual case.

However, since Directive 085 itself was designed to be highly flexible, this significant degree of flexibility in the compliance and enforcement regime is concerning. The Pembina Institute recommends that clear and pre-determined enforcement actions be prescribed for each of the four non-compliance levels delineated within the TMF and D085. The AER should additionally justify how the enforcement mechanisms selected for each non-compliance level will be effective in compelling companies to address problem(s) urgently and effectively. These

[21] AER, *DRAFT Directive 085: Fluid Tailings Management* (2017). https://www.aer.ca/rules-and-regulations/directives/directive-085-draft

measures will be necessary to regain the trust of the public following the lack of enforcement of Directive 074.

3. Water-capped tailings

All but two mines currently plan to rely heavily on water capping, wherein tailings are placed in mined-out pits and covered in water to "treat" them in perpetuity. There are persistent technical and research gaps with water capping, as well as policy gaps involving the use of open water management systems; therefore, it should not be accepted as a primary treatment technology. Rather, tailings management plans must be based on proven technologies only. Both Directive 085 and the TMF explicitly require comprehensive contingency plans for any proposition of water capped tailings, which have for the most part not been provided by the submitted TMPs. It is imperative that anywhere water-capped tailings are proposed, comprehensive and realistic contingency plans must be included.

4. Determination of RTR criteria

Ready-to-reclaim (RTR) criteria are currently being assessed on a case-by-case basis by the AER as it reviews each application. Thus far, this process is a regulatory 'black box' that is not open to stakeholders or the public.

The Directive's effectiveness will ultimately rest on what the AER accepts as the criteria for sufficient 'treatment.' It is thus imperative that all stakeholders understand how RTR criteria are selected for each project, and how to independently judge the stringency and industry-wide consistency of the AER's conditions.

5. Progressive reclamation

The objective of the TMF, as explicitly stated within Section 3.4, is "[to ensure] fluid tailings are treated and reclaimed progressively during the life of the project."[22] However, in the Directive 085 applications submitted to date, there is substantial variation among the plans in their commitment to progressive reclamation both during and after operations. For instance, reclamation timelines vary drastically, with some plans expecting landscapes to be reclaimed within 15 years of the end of mining operations, while other plans predict 70 years (Figure 3).

[22] *Lower Athabasca Region: Tailings Management Framework for the Mineable Athabasca Oil Sands,* 8.

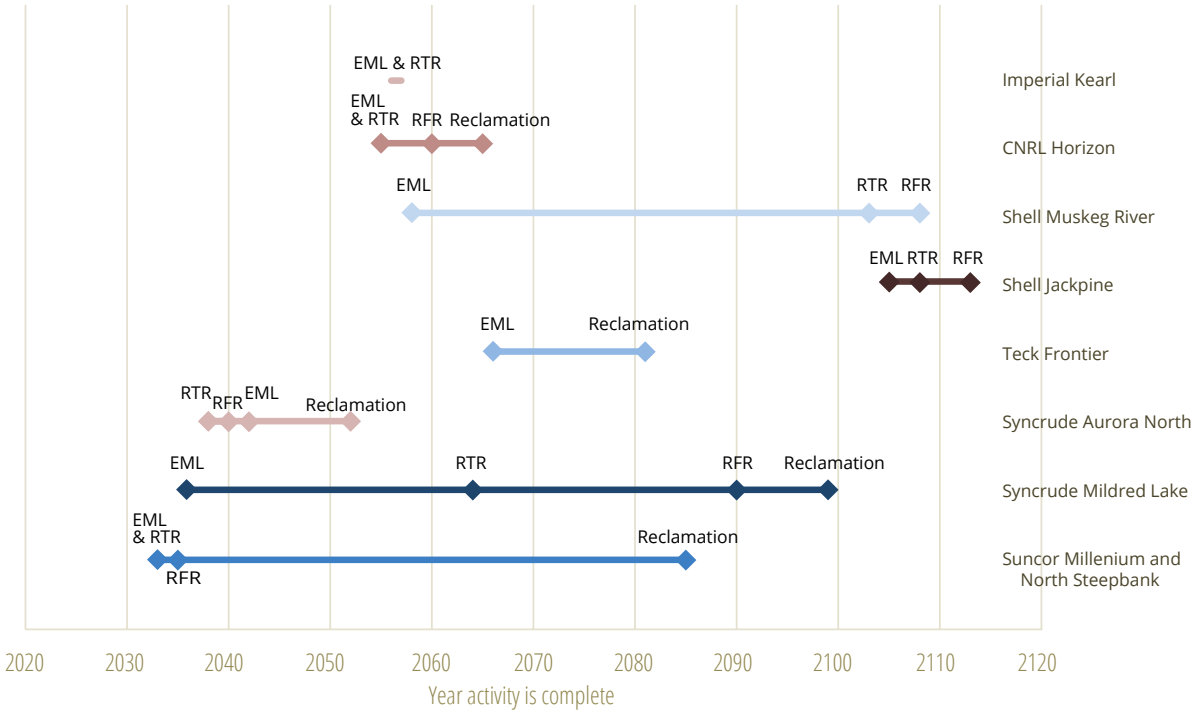

Figure 3. Comparative timelines for terrestrial tailings reclamation

This high degree of variability is problematic, and is a result of a significant policy gap regarding reclamation and closure requirements. The Government of Alberta has informally expressed an intention to address this in coming years, but it is difficult to reconcile the stated objective of the TMF when such an important piece of the puzzle is still missing.

6. Public liability and the Mine Financial Security Program

Public liability is central to any discussion of tailings treatment and progressive reclamation, as the extent to which true costs for fluid tailings management will be covered by the Mine Financial Security Program (MFSP) is not yet clear. In December 2015 the Alberta auditor general released a report that estimated total reclamation liabilities for Alberta oilsands mines at $20.8 billion. However, under the 2011 MFSP only $1.57 billion is currently being held in securities for these sites.[23] This is in part because the MFSP is designed heavily around assets, whereby oilsands developers may offer undeveloped oilsands deposits as collateral for their liability costs. The Government of Alberta will only collect securities for the full costs of reclamation near the end of mine life.

This policy gap should be addressed effectively and inclusively as soon as possible, especially as the majority of operating mines are expected to operate well into the mid- to late 21st century.

[23] Auditor General of Alberta, *Report of the Auditor General of Alberta* (2015). https://www.oag.ab.ca/webfiles/reports/OAG%20Report%20July%202015.pdf

This poses a significant risk to Alberta taxpayers, as the only protection against these reclamation costs becoming a public liability is the value of bitumen itself, due to heavily asset-based design of the MFSP. This approach to liability insurance poses particularly high risks given the significant degree of uncertainty in predicting long-term international oil prices — and, by extension, the economic viability of Alberta oilsands mining — in a post-Paris climate agreement world.

7. Directive 082 and resource optimization

Directive 082 defines resource recovery requirements for oilsands mine and processing plant operations in Alberta. This directive provides criteria for the AER to determine which oilsands resources operators are obliged to mine, as well as the volume of bitumen that must be recovered from processing operations. These requirements currently compel companies to mine poorer quality ores at the expense of higher monetary and environmental costs. Resource optimization is a term used to describe the many potential opportunities afforded by changing the Directive to permit companies to be more selective in mining only higher-quality ores.

Shell has recently submitted a Directive 082 waiver request to the AER based on the strong potential demonstrated by its pilot project on resource optimization. The data in this report shows highly promising results including reduction in tailings fines of up to 18%, a 3.5 year reduction in mine life, and an 8-12% reduction in greenhouse gases.[24]

Directive 082 should be formally reassessed to explore how resource optimization could improve cumulative industry-wide tailings volumes and peak dates, as well as reclamation timelines. It is important that this occurs prior to any further tailings plan approvals as flexibility around Directive 082 may greatly improve tailings management performance, and hence binding tailings targets assigned by the AER.

[24] Shell, *Waiver Request: Mining Criteria-Directive 082 Shell Canada Energy – Muskeg River and Jackpine Mine Approval No. 8523 & 9756* (2016). https://dds.aer.ca/iar_query/FindApplications.aspx.