Alberta Energy Regulator

State of Fluid Tailings Management for Mineable Oil Sands, 2024

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Our mandate is to provide for the efficient, safe, orderly, and environmentally responsible development of energy and mineral resources in Alberta through our regulatory activities.

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Abbreviations

ACPN	Aurora centre pit north
AEP	Aurora east pit
AEPN-E	Aurora east pit north-east
AEPN-W	Aurora east pit north-west
AEPS	Aurora east pit south
AER	Alberta Energy Regulator
AFD	atmospheric fines drying
ARD	acid rock drainage
ASB	Aurora settling basin
BOFL	base-of-feed levelling
BML	base mine lake (formerly west in-pit)
CC	centrifuge cake
CFFT	centrifuge fluid fine tailings
CNRL	Canadian Natural Resources Limited
CNUL	Canadian Natural Upgrading Limited
COSIA	Canada's Oil Sand Innovation Alliance
CST	coarse sand tailings
CT	composite tailings
DDA	dedicated disposal area
EETA	east external tailings area
EIP	east in-pit
EPEA	*Environmental Protection and Enhancement Act*
EPO	environmental protection order

eNST	enhanced nonsegregating tailings
esNST	enhanced spiked nonsegregating tailings
ETA	external tailings area
ETF	external tailings facility
FC	fluid cell
FFT	fluid fine tailings
FTT	froth treatment tailings
ILF	in-line flocculation
ILF FT	in-line flocculation fluid tailings
IPA	integrated project amendment
IPC	in-pit cell
ITA	in-pit tailings area
KFTT	Kearl fine tailings treatment
LOMP	life-of-mine plan
LMCP	life-of-mine closure plan
MD9	mine dump 9
MD9S	mine dump 9 south
MLSB	Mildred Lake settling basin
Mm^3	million cubic metres
MSP	measurement system plan
NMCP-E	north mine centre pit-east
NMSP	north mine south pond
NMSPE	north mine south pond east
NPD	north pool deposit
NRU	naphtha recovery unit

NRUTT	naphtha recovery unit treated tailings
NST	nonsegregating tailings
OES1	out-of-pit tailings area east stage 1
OPTA	out-of-pit tailings area
OSCA	*Oil Sands Conservation Act*
PASS	permanent aquatic storage structure
PFD	process flow diagram
RTR	ready to reclaim
SC	sand cell
SD	sand dump
SFR	sand-to-fines ratio
SIR	supplemental information request
SPTA	south pit tailings area
STP	south tailings pond
SWIP	south west in-pit
SWSS	south west sand storage
TMF	*Tailings Management Framework*
TMP	tailings management plan
TMR	tailings management report
TSRU	tailings solvent recovery unit
TT	thickened tailings
TZ	transition zone
WETA	west external tailings area
WT	whole tailings

Executive Summary

Alberta has eight operating oil sands mines, and each site has an approved tailings management plan (TMP). Under *Directive 085: Fluid Tailings Management for Oil Sands Mining Projects*, mine operators must annually submit tailings management reports (TMR) that show how they are implementing their TMPs.

This report summarizes the information for the 2024 reporting year and assesses the operators' progress in managing fluid tailings. Operators report ongoing improvements in their tailings treatment technologies as well as the piloting and development of new technologies.

Directive 085 requires TMPs to be updated to build on existing approval conditions and provide assurance that the *Lower Athabasca Region: Tailings Management Framework for Mineable Oil Sands* outcomes can be achieved. Seven of the eight operating oil sands mines submitted TMP amendments between January 2022 and December 2023; one was submitted in 2025. The Alberta Energy Regulator (AER) reviews TMPs to ensure tailings profiles align with projections and reflect current technology, new knowledge, and continuous improvement.

For management purposes, fluid tailings are categorized as legacy fluid tailings (fluid tailings stored before January 1, 2015) and new fluid tailings. The total volume of fluid tailings (new and legacy tailings combined) on oil sands mine sites in the Athabasca oil sands region increased between 2014 and 2024. The increase in the total regional volume of fluid tailings is expected based on approved tailings profiles. Despite this trend, the total regional volume of fluid tailings for all operators remains below their combined profiles of new and legacy fluid tailings.

The total volume of water in fluid tailings ponds in the Athabasca oil sands region varied over the past eleven years. The total volume of water in tailings ponds decreased from 2014 to 2017, increased between 2018 and 2020, and has since decreased, with the lowest reported volumes in 2023 and 2024.

Bitumen production and the number of operating mines increased from 2014 to 2024. However, in 2020, production decreased due to a decline in global oil demand during the COVID-19 pandemic. Bitumen production peaked in 2024.

TMPs include volume profiles for both legacy and new fluid tailings. In 2024, all operators were at or below their approved profiles for new fluid tailings and for their total volume triggers and total volume limits. Also, in 2024, all operators were at or below their legacy fluid tailings profile and below their 20% deviation triggers for new and legacy fluid tailings.

Syncrude Mildred Lake exceeded its legacy fluid tailings profile from 2017 to 2022 and its new fluid tailings profile in 2023. No change in management level, as described in *Directive 085*, was required for Syncrude Mildred Lake because its volumes are within the total allowable volume trigger and limit. The

AER is closely monitoring Syncrude Mildred Lake to ensure the reduction in its fluid tailings inventory accelerates to meet the profile target.

In 2023, the AER issued an environmental protection order (EPO) to Imperial Oil Resources Limited (Imperial) under the *Environmental Protection and Enhancement Act* following incidents at the Kearl mine. Subsequently, the AER initiated a formal investigation related to the incidents. In 2024, the AER imposed an administrative penalty and issued terms and conditions on Imperial in response to the seepage incident. Imperial continues to monitor and manage seepage as required by the EPO. As of December 2024, the remaining components of the investigation were ongoing. The AER continues to review information gathered from the investigation to determine whether treated tailings deposits are achieving subobjective 2 ready-to-reclaim (RTR) criteria. Should the review indicate Imperial has not met and maintained its approved subobjective 2 RTR criteria, the AER will determine the appropriate management level and management responses.

The tailings volumes presented in this report are as reported by the operators. The AER requested clarification or additional data from all operators relating to their 2024 TMRs. The AER has not received or completed reviews of all responses before finalizing this report. Requests for clarification or additional data are part of an ongoing iterative process between the AER and operators. Operators require time to collect data, complete analyses, or review calculations before submitting responses to the AER. This report only includes information that was available at the time of writing. Further review of those responses and the fluid tailings volumes, including an assessment of whether they meet RTR criteria, may lead to changes in the reported data or analyses from previous years and will be reflected in the 2025 report.

Operators are required to submit measurement system plans (MSPs) that demonstrate how they measure and report fluid tailings volumes as well as the performance of their tailings deposits. The AER assessed the operator MSPs to determine whether the physical properties of the tailings deposits are on a trajectory to support future stages of activity (subobjective 1 in *Directive 085*, fluid tailings volumetric calculations, laboratory testing). Additionally, the AER continues to assess MSPs to determine if they address subobjective 2 (i.e., minimizing the effects that tailings deposits have on the surrounding environment, ensuring deposits will not compromise the ability to reclaim the area to a locally common, diverse, and self-sustaining ecosystem.

Operators are required to report water quality parameters to characterize tailings surface water, the water overlying treated tailings deposits, and fluid tailings ponds. The sampling and characterization are included in the 2024 TMRs.

In 2024, the AER continued its audit of the 2023 reporting year data to verify regional fluid tailings and water volumes. The audit found the reported fluid tailings and water volumes were consistent with the

AER's calculated volumes. Additional data was requested for the 2024 reporting year. The AER is continually refining the fluid tailings auditing program.

The AER may issue additional supplemental information requests in the future. The tailings MSPs are live documents that must be regularly updated with changes to reflect current best practices and operations. Operators must notify the AER of all MSP changes.

1 Introduction

The Alberta Energy Regulator (AER) regulates oil sands mines and the associated management of fluid tailings as part of its mandate to provide for the efficient, safe, orderly, and environmentally responsible development of energy and mineral resources in Alberta over the entire development life cycle.

This report summarizes information submitted by oil sands mine operators in their annual tailings management reports (TMRs).

An approved tailings management plan (TMP) and a measurement system plan (MSP) are required for the AER to assess the data in an operator's annual TMR. Both are required for the AER to assess fluid tailings inventory data as they allow for the determination of what volumes are considered ready to reclaim (RTR) and can be removed from the operator's fluid tailings inventory. Operator reports for 2024 must adhere to all reporting requirements in *Directive 085: Fluid Tailings Management for Oil Sands Mining Projects* and to the conditions in each operator's tailings approvals.

The AER assessed the operator MSPs to determine whether the physical properties of the tailings deposits are on a trajectory to support future stages of activity (subobjective 1 in *Directive 085*, fluid tailings volumetric calculations, laboratory testing). The AER also assessed the groundwater monitoring portion of subobjective 2 in *Directive 085*—the need to minimize the effect the tailings deposit has on the surrounding environment to ensure it will not compromise the ability to reclaim the area to a locally common, diverse, and self-sustaining ecosystem. The AER continues to assess MSPs to address water quality characterization and measurement of chemicals of potential concern, which are part of subobjective 2.

Tailings MSPs must be regularly updated to reflect current best practices and operations. Operators must notify the AER of all plan changes. Operator MSPs are posted on the AER's website.

The fluid tailings volumes described in this report are presented as reported by operators and are subject to change upon further review of fluid tailings volumes, including assessment of whether they meet RTR criteria.

Annual TMRs submitted by operators are reviewed by the AER. This review may lead the AER to request further clarification or additional information from an operator. In addition, potential compliance issues are referred to the AER's Regulatory Compliance team. The AER may issue additional supplemental information requests (SIRs) in the future.

Data provided by the operators for 2024 may be revised upon further review by the AER following the publication of this report. Any changes will be incorporated into the 2025 edition of this report, which will be issued by October 30, 2026.

2 Purpose

The purpose of this report is to summarize information submitted by individual operators as required by *Directive 085*, including

- fluid tailings volumes for each operator and the region;
- water volumes stored in tailings facilities for each operator and the region;
- tailings volumes claimed as having reached RTR status;
- whether operators are within their approved fluid tailings profiles;
- site-wide fluid tailings management activities for each mine site;
- tailings treatment and developing treatment technologies;
- project-specific performance;
- progress made in managing fluid tailings; and
- alignment with the approved TMPs.

This report also includes a summary of the AER's regulatory and management actions taken in 2024 relating to fluid tailings.

This report does not address mine financial security, waterfowl protection, dam safety, or air emissions from tailings ponds. Information on these issues can be found on the AER website (www.aer.ca) or the Alberta Environment and Protected Areas oil sands information page (https://www.alberta.ca/oil-sands). This report does not include information on audits or inspections conducted by the Regulatory Compliance and Liability Management team or information reported on the AER Compliance Dashboard. However, it does include a summary of the 2024 tailings-related regulatory site inspections.

3 Regulatory and Operational Context

3.1 Regulatory Context

On March 13, 2015, the Government of Alberta released the *Lower Athabasca Region: Tailings Management Framework for Mineable Oil Sands* (*TMF*) to manage and decrease liability and environmental risk from the accumulation of fluid tailings on the landscape. The *TMF*'s goal is to "increase the rate of reclamation and enhance the reduction of tailings ponds" and establishes the following policy outcomes:

- land use must be returned to Albertans
- sustainable ecosystem (after reclamation)
- liability is minimized to Albertans
- environmental effects are managed

In support of the *Lower Athabasca Regional Plan*'s strategic direction of "encouraging timely and progressive reclamation," the *TMF* provides guidance and an objective for managing fluid tailings so that both new and legacy tailings can be reclaimed in a timely manner. The *TMF* objective states that fluid tailings accumulation be minimized by ensuring fluid tailings are progressively treated and reclaimed during the life of an oil sands mining project and by ensuring that all a project's fluid tailings are RTR within ten years of the project's end-of-mine life.

On July 14, 2016, the AER released *Directive 085* under the *Oil Sands Conservation Act* (*OSCA*), replacing *Directive 074: Tailings Performance Criteria and Requirements for Oil Sands Mining Schemes*. *Directive 085* enables the implementation of the *TMF* and aligns with the *Lower Athabasca Regional Plan*. It also sets out application and performance reporting requirements for fluid tailings management. On October 12, 2017, the AER updated *Directive 085* to clarify compliance and enforcement, public education and awareness, and the review cycle. The AER updated *Directive 085* on May 19, 2022, to address the publication date for the annual performance report on the state of fluid tailings management.

3.2 Operational Context

Table 1 lists the eight oil sands mining projects operating in 2024. The locations of operating and approved oil sands mining projects and their tailings ponds are shown in figure 1.

Table 1. Oil sands mining projects operating in 2024

Approval holder	Mine	Operator
Suncor Energy Incorporated (Suncor)	Base Plant (Millennium and North Steepbank)	Suncor
Syncrude Canada Limited (Syncrude)	Mildred Lake	Syncrude
	Aurora North	Syncrude
Canadian Natural Upgrading Limited (CNUL)	Muskeg River	CNUL
	Jackpine	CNUL
Canadian Natural Resources Limited (CNRL)	Horizon	CNRL
Imperial Oil Resources Limited (Imperial)	Kearl	Imperial
Fort Hills Energy Corporation (Suncor)	Fort Hills	Suncor

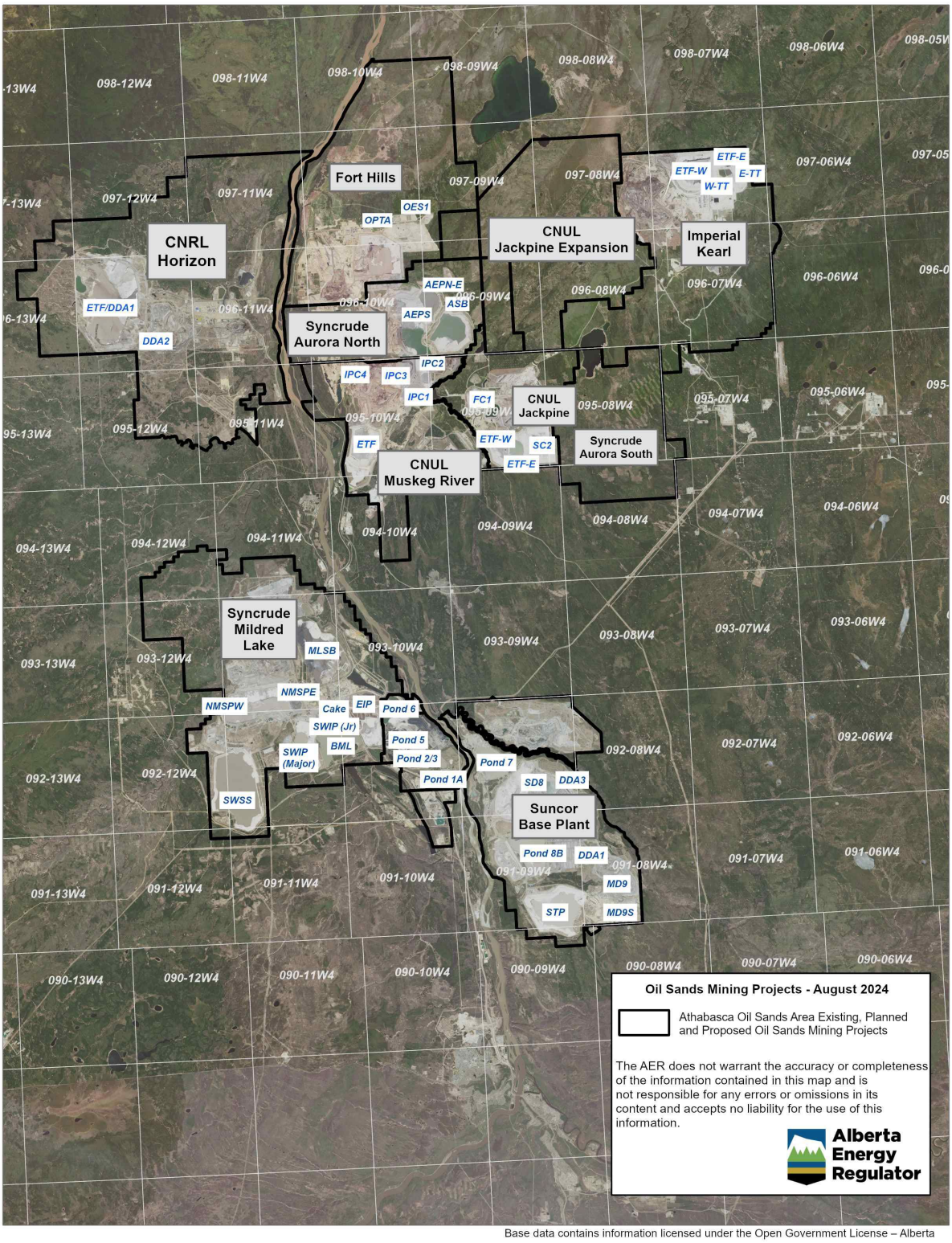


Figure 1. Operating oil sands mining projects and tailings ponds/deposits in 2024

4 2024 Reporting

The AER requires operators to report on the status of fluid tailings management at their sites by April 30 of each year in accordance with *Directive 085*. Most operators submitted their eighth annual TMR in 2025, the sixth year that all operators were required to meet full reporting requirements under *Directive 085* and their approval conditions. Operator submissions for 2024 were made available on the AER website on May 30, 2025.

Tailings and fluid volumes in this report are as-measured volumes beginning in 2019 unless otherwise stated.

4.1 2024 Report Review

As part of its review of annual tailings reports submitted by operators, the AER assessed the reported progress in 2024 for fluid tailings management, including achieving RTR status, trends over time, consistency with previous annual TMRs, and compliance with approval conditions. The intent of the review is to ensure

- operators are implementing their approved TMP, including confirming that conditions related to fluid tailings management are being met and that stated milestones are being achieved;
- fluid tailings performance is in accordance with their profiles;
- fluid tailings performance is in accordance with volume triggers and limits;
- fluid tailings management level for each operation is identified;
- fluid tailings deposits are meeting RTR criteria and are on the applicable trajectory; and
- initiated mitigation actions and contingency plans that are effective in managing fluid tailings and treated tailings deposit performance.

All oil sands mining operators had an approved TMP by the end of 2019. Seven oil sands mines submitted TMP amendments in 2022 and 2023, and one was submitted in 2025 (table 2).

Table 2. Oil sands mining projects TMP status in 2024

Approval holder	Mine	TMP status
Suncor	Base Plant	Approved 2023
Syncrude	Mildred Lake	Interim TMP Approved 2025
	Aurora North	Interim TMP Approved 2025
CNUL	Muskeg River	Approved 2023
	Jackpine	Approved 2023
CNRL	Horizon	Approved 2021. TMP amendment submitted in 2025
Imperial	Kearl	Approved 2025
Fort Hills	Fort Hills	Approved 2024

Amendment applications for oil sands mining are classified based on how the project modifications affect resource conservation, stakeholders, or the environment. Depending on the scope and scale of a proposed amendment, new or updated environmental information may be required under *Directive 023: Oil Sands Project Applications*, the *Environmental Protection and Enhancement Act* (*EPEA*), the *Public Lands Act,* the *Water Act*, or specified enactment directions. The AER may request additional information to complete its technical review. Processing times vary between 20 and 565 business days.

4.2 Ready-to-Reclaim Criteria and Trajectory

Operators were required to identify volumes of treated fluid tailings that met RTR criteria in 2024. The *TMF* and *Directive 085* both require that the progress of fluid tailings be tracked from the initial formation (accumulation) through to the RTR state and stay on a trajectory that remains in its approved RTR state. RTR criteria are used to track treated tailings during the operational stage of the deposit's trajectory to ensure the deposit can be reclaimed as predicted in the life-of-mine closure plan (LMCP) (see figure 2). Progress of fluid tailings to an RTR state includes processing with an accepted technology, placing tailings in their final position on the landscape, and meeting approved RTR performance criteria.

In the 2024 reports, operators reported the treated tailings volumes that achieved RTR status during the reporting period and confirmed that treated tailings in deposits continued to meet the RTR trajectory approval conditions. Any deposits that operators could not confirm as continuing to meet the RTR criteria were returned to the fluid tailings inventory. Operators are required to identify any volumes returned to the fluid tailings inventory. The tailings volumes in this report are presented as reported by the operators and subject to change upon further review of fluid tailings volumes and performance related to meeting RTR criteria.

Under *Directive 085* and the *TMF*, the AER is tasked with evaluating regional performance against the *TMF*'s outcomes and objectives. Future AER reports on tailings management will incorporate a summary evaluation of environmental effects and reclamation performance reporting, which may include references to other required reports (e.g., *EPEA* reports) and links to *EPEA* and reclamation regulations.

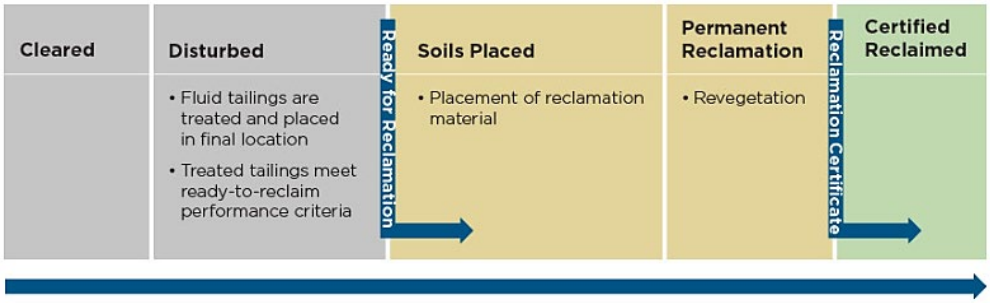


Figure 2. Reclamation stages

4.3 Environmental Performance Monitoring

Directive 085 requires operators to summarize environmental performance monitoring reports, highlighting the operator's management of environmental effects and the potential impacts of fluid tailings management activities.

The AER assesses the groundwater monitoring portion of subobjective 2 in *Directive 085,* which considers fluid tailings management activities and deposit performance concerning approved RTR criteria and alignment with the closure and reclamation trajectory.

The AER may allow operators to refer to other submitted reports (e.g., reclamation progress tracking, groundwater monitoring, industrial wastewater monitoring) to avoid duplicate reporting of performance results for managing and minimizing environmental effects and the implications of fluid tailings management activities. Reporting under *Directive 085* does not relieve an operator from complying with other tailings-related environmental reporting requirements.

Some of the 2024 TMRs refer to other *EPEA* environmental reports or provide information from these reports. Consequently, the AER must complete further reviews to verify the additional reported data and information in the referenced reports. This review of the referenced reports is not part of the evaluation of volumetric measurements for fluid tailings and treated fluid tailings management activities in 2024.

Refer to the 2024 operator TMRs for more information on surface water management, tailings seepage control, and groundwater monitoring regarding subobjective 2.

Operators are required to report the characterization and quality of water for each treated tailings deposit and fluid tailings pond. In 2022, the AER clarified the *Directive 085* water quality characterization and reporting requirements for oil sands mining operators. The AER provided the following guidance on how operators are to characterize tailings surface water quality:

- Specified the chemical and physical water quality parameters to be reported for each treated tailings deposit and fluid tailings pond. Operators must report these parameters at environmentally relevant detection limits and at a frequency to capture seasonal and temporal variations.
- Each operator was to update and resubmit its MSPs with details of the water quality sampling methods, locations, and frequency.
- TMRs must include the sampling and characterization.

The water quality parameters specified in the notice apply to water overlying treated tailings deposits and fluid tailings ponds. The sampling and characterization were included in the 2024 TMRs to help the AER evaluate tailings surface water quality. Consistency in reporting across all sites will help the AER evaluate the quality of recycle water contained in tailings ponds.

Refer to the 2024 operator TMRs for more information on sampling and analytical methods, the parameters analyzed, and the sample test results for each treated tailings deposit and fluid tailings pond.

4.4 Next Steps

Where the AER identified gaps or areas requiring clarification in the submitted 2024 TMRs, the AER followed up with the operators, requesting clarification or more information. These follow-ups may lead to data corrections, changes in the RTR status of treated tailings in a deposit, or changes in the fluid tailings inventory. Requests for clarification, SIRs, or additional data are part of an ongoing iterative process between the AER and operators. This report only includes information that was available at the time of writing.

The 2025 report will include any changes to individual company statuses resulting from responses to requests for clarification or information that was unavailable at the time of writing this report.

Changes in the RTR status of a deposit may warrant mitigation or corrective action, and changes in the fluid tailings inventory may warrant additional fluid tailings management responses.

MSPs are live documents that operators must regularly update to reflect current best practices and operations. Operators are required to notify the AER of all plan changes. All operator MSPs are posted on the AER's website.

The process and schedule for audits of the tailings reports are being developed and refined. The AER will continue to audit the measurement systems for each mine and include the results in the annual *State of Fluid Tailings Management for Oil Sands* report.

5 Tailings Description

About 20% of Alberta's oil sands reserves are recoverable by surface mining using trucks and shovels to excavate oil sands. The oil sands are transported to an extraction plant, where bitumen is separated from the sand. In 2024, mined bitumen accounted for 48% of total bitumen production in Alberta. This bitumen can be sold as a product or upgraded to synthetic crude oil or other products, which are either used on site or sold.

Tailings are a by-product of the process used to extract bitumen from mined oil sands. Tailings are a mixture of sand, clay, water, silt, residual bitumen, and other hydrocarbons, salts, and trace metals. During the early stages of mine operations, tailings are deposited into constructed aboveground (out-of-pit) structures called external tailings ponds. Once a mined-out area (pit) becomes available, tailings are stored in these mined-out areas (in-pit tailings ponds). Tailings ponds act as a settling basin to

separate water from tailings and a holding area from which water can be removed and recycled for the bitumen extraction process.

Directive 085 defines fluid tailings as any fluid discard from bitumen extraction facilities containing more than five mass per cent suspended solids and having less than an undrained shear strength of five kilopascals. Any liquid containing less than 5% solids is considered ponded water. Definitions of tailings management terminology are provided in *Directive 085*, appendix 1.

The particles in a tailings pond settle out of the water at different rates. Sand particles tend to settle quickly. However, smaller particles of clay and silt (i.e., fines; 44 micrometres in diameter or less) remain suspended in the water for long periods, forming fluid tailings. Without intervention, fluid tailings can take decades to settle, making the management of fluid tailings an ongoing challenge for the oil sands mining industry.

Tailings generated as part of the mining and bitumen extraction process must be managed in accordance with *Directive 085* and the conditions in the operators' approvals.

6 Fluid Tailings Treatment and Deposition

Oil sands mine operators use various technologies to treat fluid tailings, with some operations using multiple technologies. Development and implementation of new technologies and continuous improvement of existing technologies are very important for the successful management of fluid tailings in the oil sands mining industry. The ability to successfully reclaim to target ecosites is also affected by the deposit design and operation, including the size and depth of the deposit, and the capping design, both of which are reflected in the RTR trajectory. A summary of the treatment technologies and typical treated tailings deposits from the TMPs is included in appendix 1.

The initial uncertainties and risks associated with the in-deposit performance of demonstration technologies, including treated fluid tailings deposit capping, are described in the *Directive 085* decision reports on the AER website. Operators must obtain regulatory authorization before implementing a new tailings treatment technology or constructing a deposit not already included in the current approval.

7 Regional Fluid Tailings Status

Data in this report are from the site-wide fluid tailings inventory table (appendix 3 of *Directive 085*) submitted by the operators. The tailings volumes are subject to change upon further review of fluid tailings volumes, including an assessment of whether they meet RTR criteria.

The total volume of fluid tailings in the Athabasca oil sands region, including new and legacy fluid tailings, increased between 2014 and 2024. This overall increase is expected based on the new and legacy profiles in the operator TMPs approved by the AER.

Total fluid tailings volumes increased from 1075 million cubic metres (Mm^3) in 2014 to 1505 Mm^3 in 2024 (see figure 3 and appendix 3). An aggregate of new and legacy profiles for all operators in each year is included in figure 3. The aggregate of approved fluid tailings volume profiles for all operators by year is shown for comparison. From 2015 to 2024, the reported total volume of fluid tailings in the Athabasca oil sands region was below the aggregate of approved tailings profiles.

The fluid tailings inventory volumes as reported by the operators are shown in figure 3 (volumes and profiles), figure 4 (RTR status volumes), and figure 5 (changes in annual volume).

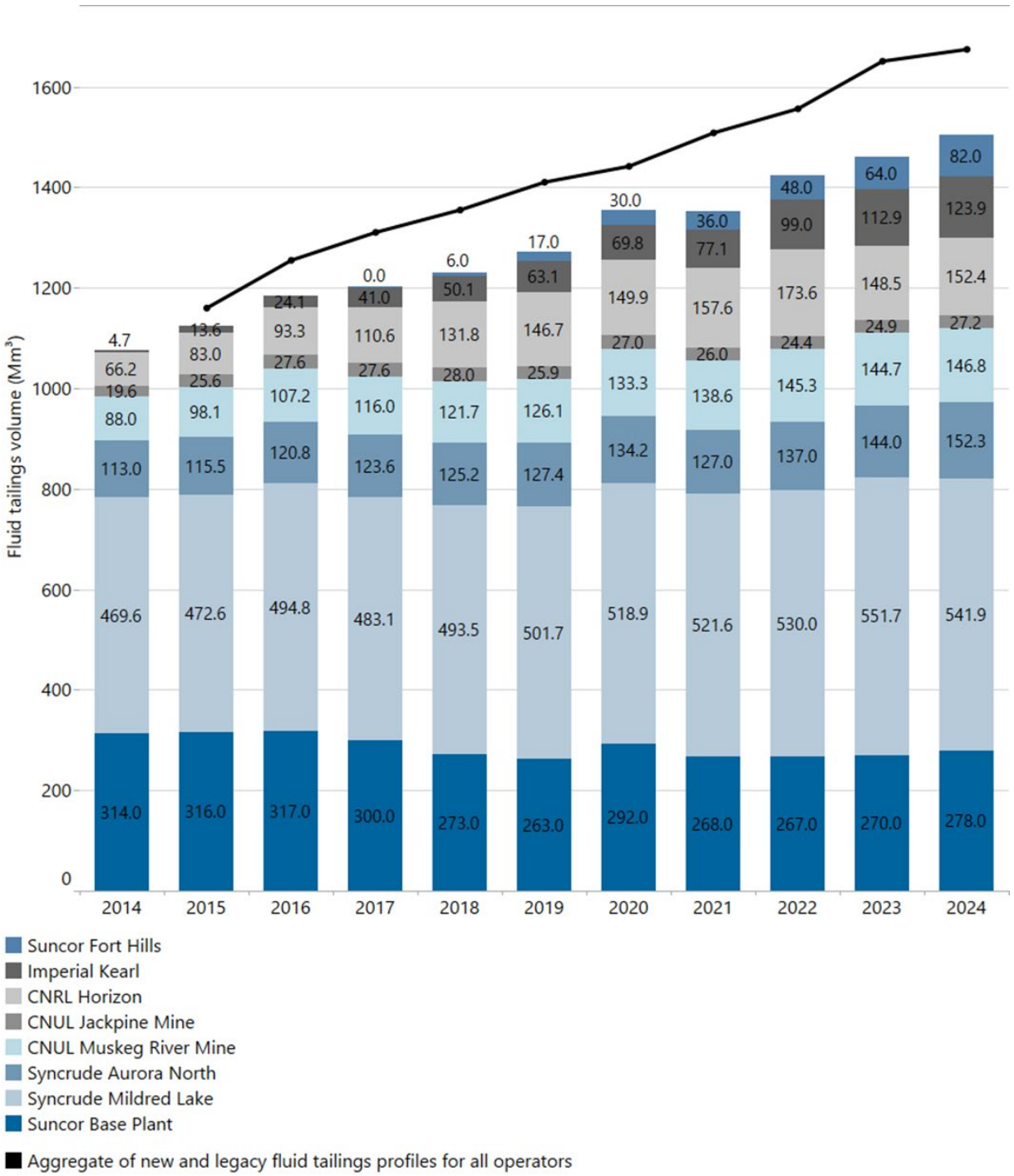
The annual change in fluid tailings volume is the volume of fluid tailings for that reporting year minus the previous year's fluid tailings volume. Each bar in figure 5 represents the volume of fluid tailings added or removed from the regional inventory in a reporting year. The volume of fluid tailings produced exceeded the volume of tailings reported as achieving RTR status from 2015 to 2024, apart from 2021.

In 2021, the volume of tailings reported by industry as achieving RTR status (i.e., tailings that could be removed from the fluid tailings inventory) exceeded the volume of fluid tailings produced.

The reported annual change in volume of fluid tailings in the Athabasca oil sands region increased from 36.4 Mm^3 in 2023 to 43.8 Mm^3 in 2024 (see figure 5).

Bitumen production increased from 60.2 Mm^3 in 2014 to 99.8 Mm^3 in 2024.

Regional fluid tailings volumes were expected to increase in 2024 based on the new and legacy profiles in the TMPs approved by the AER.

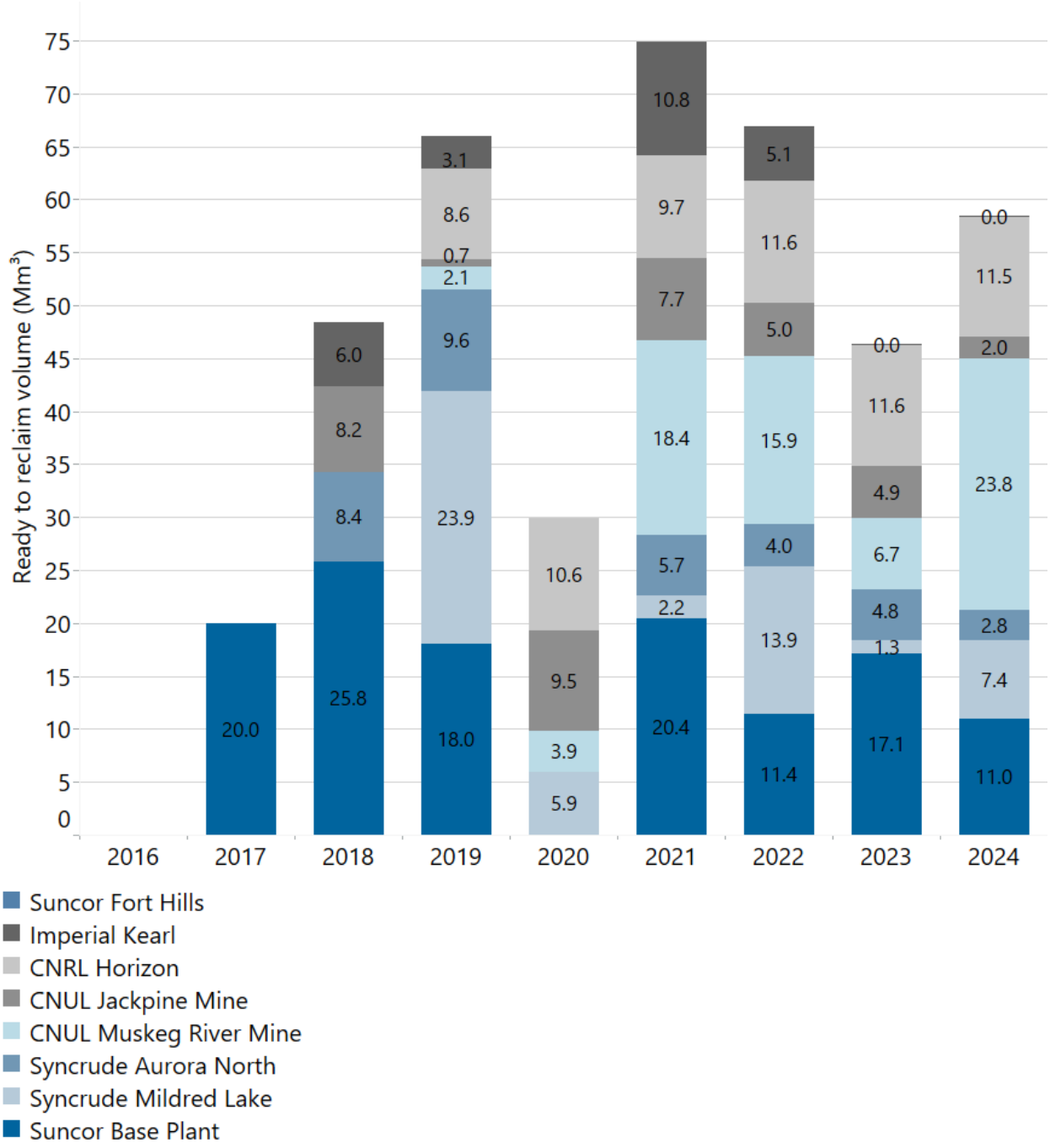


Note: Fluid tailings volumes are presented as reported by operators and are subject to change upon further review by the AER, including an assessment of whether volumes meet the RTR criteria.

Data are from the site-wide fluid tailings inventory table (appendix 3 of *Directive 085*) submitted annually by operators.

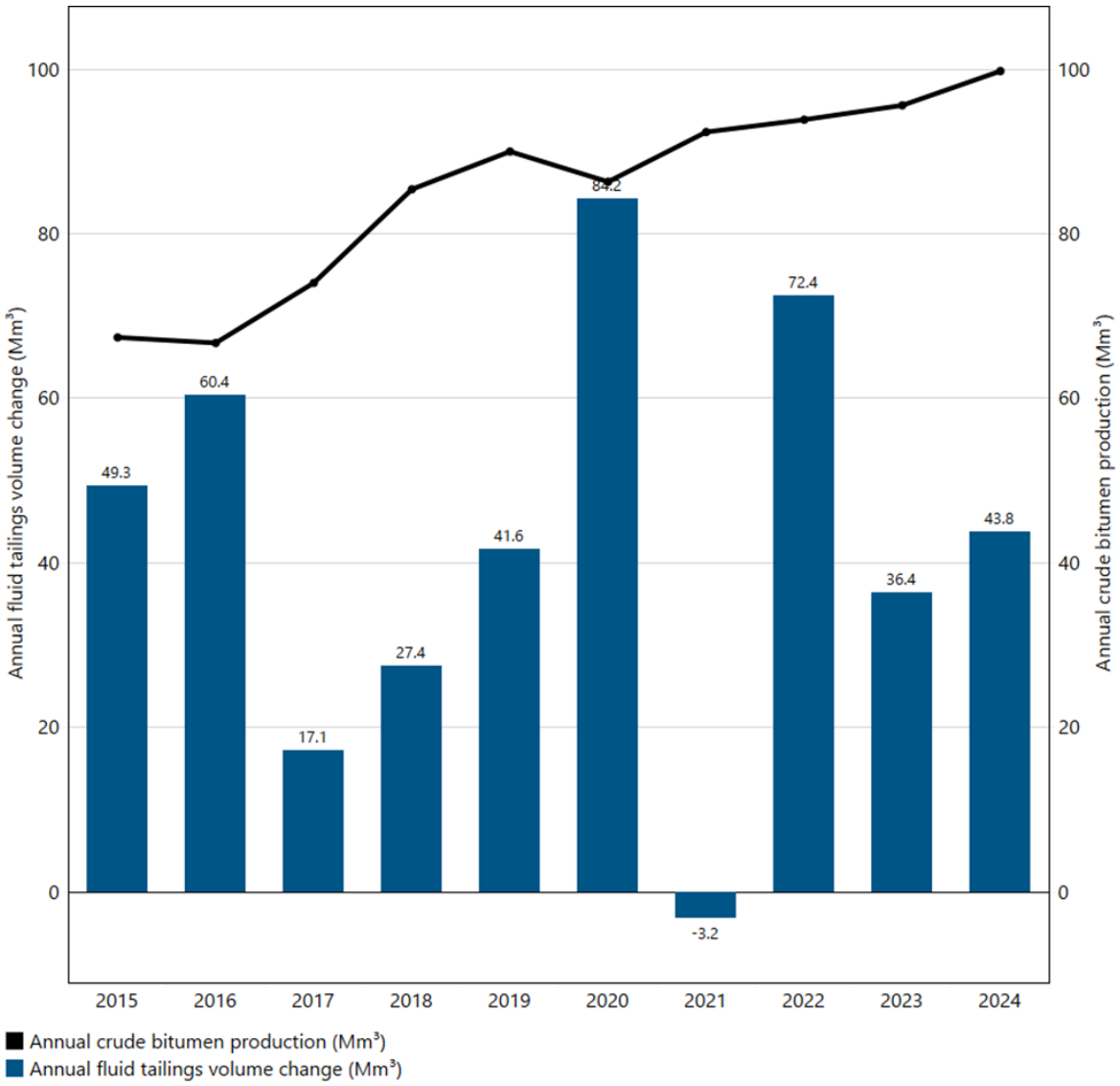
In 2018, Syncrude Aurora North and Mildred Lake data are as-measured values, not projected to year-end. Data are as-measured values starting in 2019, except for Imperial Kearl, which provided year-end predicted values for 2019.

Figure 3. Regional fluid tailings volumes and approved aggregate profiles, 2014 to 2024



Note: Fluid tailings volumes are presented as reported by operators and are subject to change upon further review by the AER, including an assessment of whether volumes meet the RTR criteria.

Figure 4. Regional claimed RTR volumes, 2014 to 2024



Note: Fluid tailings volumes are presented as reported by operators and are subject to change upon further review by the AER, including an assessment of whether volumes meet the RTR criteria.

Data are from the site-wide fluid tailings inventory table (appendix 3 of *Directive 085*) submitted annually by operators.

In 2018, Syncrude Aurora North and Mildred Lake data are as-measured values, not projected to year-end. Data are as-measured values starting in 2019, except for Imperial Kearl, which provided year-end predicted values for 2019.

Figure 5. Change in annual fluid tailings volume in the Athabasca oil sands region, 2015 to 2024

7.1 Fluid Tailings Treatment and Deposition

Table 3 shows the treated fluid tailings volumes by operator from 2014 to 2024.

Table 3. Treated fluid tailings volumes reported by operator, 2014 to 2024, in million cubic metres (Mm^3)

Project	Technology	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Base Plant	Thin-lift drying	11.7	14.8	9.9	18.5	14.0	0.0	0.0	0.0	0.0	0.0	0.0
	PASS	0.0	0.0	0.0	0.0	14.0	26.7	25.0	21.2	22.0	23.0	23.1
	Coke capping	0.0	0.0	0.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Co-disposal										3.3	1.6
Mildred Lake	CT	5.7	4.9	0.3	2.4	2.1	5.0	0.6	0.0	0.0	0.0	0.0
	Centrifuge	2.7	4.1	6.0	6.7	6.4	3.8	3.4	5.0	2.6	3.1	1.4
	Floc-T plant									1.1	7.2	14.4
Aurora North	CT	5.0	10.9	11.8	13.7[a]	16.3[a]	23.9	4.7	0.0	2.2	6.2	4.6
Muskeg River mine[b]	AFD	3.9	0.9	0.1	0.0	0.0	1.3	3.6	6.2	5.9	2.2	4.6
	FFT drying at mine advance area	0.2	0.3	n/a	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	CT	0.3	1.3	n/a	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TT	15.1[c,d]	13.6[c,d]	19.4[d]	22.5[e]	22.9	13.0	27.0	24.4	21.7	23.8	25.4
	CST/WT					5.8	4.9	8.3	13.2	16.9	32.5	27.5
	TSRU					4.8	4.2	3.6	2.9	3.5	3.7	2.6
Jackpine mine	Centrifuge	1.1	3.9	3.9	2.3	2.2	2.1	1.4	2.6	2.2	1.8	1.3
	TT	16.4[c,f]	12.6[c,f]	17.5[f]	19.7[g]	16.4	16.3	15.8	12.5	12.9	1.8	13.7
	CST/WT										31.3	21.9
Horizon	NST/eNST/esNST	0.0	7.7h	48.7h	62.7h	131.8	156.3[h]	139.3	125.8	149.9	151.6	138.5
	NRU	0.0	0.0	0.0	0.0	17.2	20.8	18.6	16.5	17.8	20.5	17.8
	esNST legacy	0.0	0.0	0.0	0.0	0.0	1.1	1.5	2.6	4.5	7.0	7.0
Kearl	TT	0.0	0.0	2.4[i]	8.5	8.7[i]	13.6	19.0	26.0	28.0	30.5	37.6
Fort Hills	To be determined						0.0	0.0	0.0	0.0	0.0	0.0

Note: Volumes cannot be added together between technologies or sites because of the differences in technologies and differences in performance of similar technologies at different sites.

[a] Volume of CT slurry volume and CT beach deposit. Revised from CT beach deposit only reported in 2017.

[b] TT combined with CST, WT, and tailings solvent recovery unit (TSRU) material in a single deposit forms north-pool-deposit (NPD) type.

[c] Updated in April 2017 submission.

[d] Volume of TT slurry at solids content of average 23.6% from 2014 to 2016.

[e] Volume of TT slurry at solids content of 21.9% in 2017.

[f] Volume of TT slurry at solids content of average 15% from 2014 to 2016.

[g] Volume of TT slurry at solids content of 13.7% in 2017.

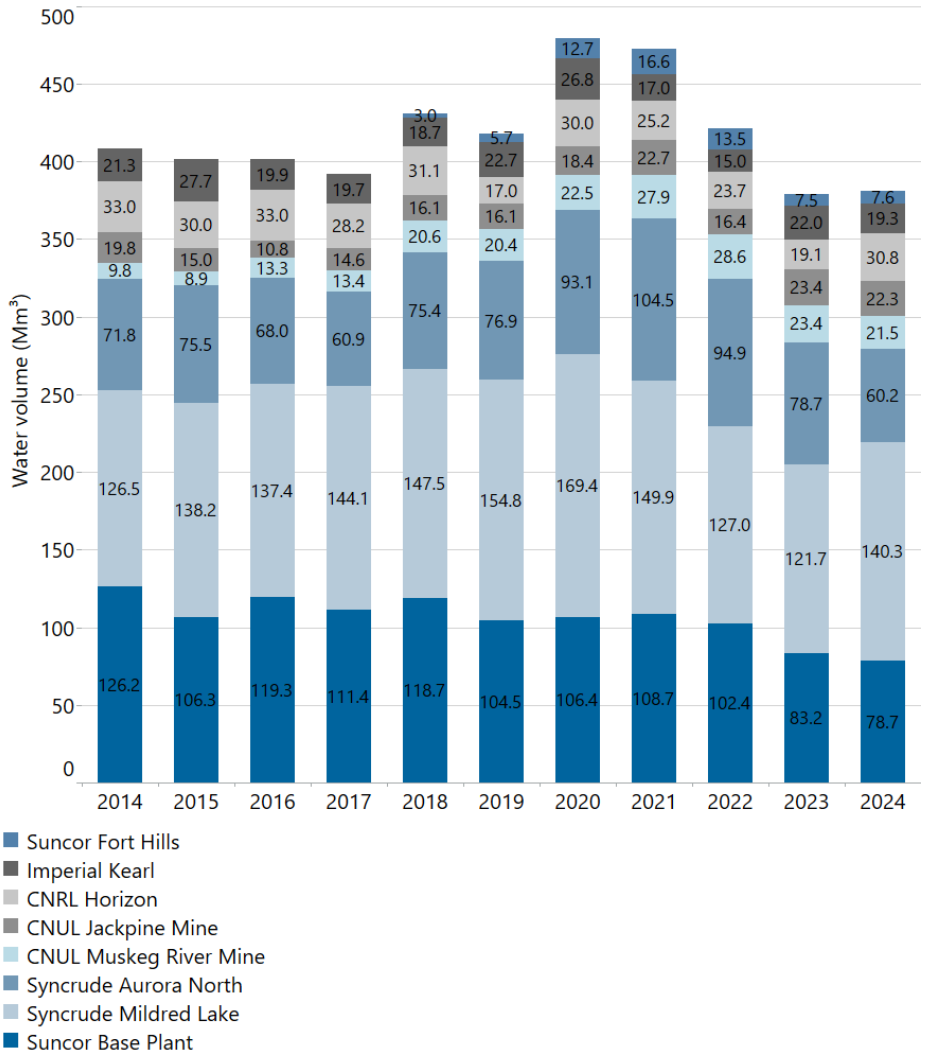
[h] Volume of NST.

AFD = atmospheric fines drying
CST = coarse sand tailings
CT = composite tailings
eNST = enhanced nonsegregating tailings
esNST = enhanced spiked nonsegregating tailings
FFT = fluid fine tailings
NST = nonsegregating tailings
NRU = naphtha recovery unit
PASS = permanent aquatic storage structure
TT = thickened tailings
WT = whole tailings

7.2 Water Volumes

Based on the data reported by operators from 2014 to 2024, the volume of water contained in tailings ponds and deposits in the Athabasca oil sands region ranged from a high of 479.3 Mm^3 (2020) to a low of 379.0 Mm^3 in 2023 (see figure 6 and appendix 4). The increased ponded water volumes in 2020 compared with other years may have resulted from increased precipitation in the Athabasca oil sands region falling on the mine sites and ending up in the recycle water ponds. In 2024, the volume of water contained in tailings ponds remained low (380.7 Mm^3). The 2024 pond water volume appears consistent with those from 2014 to 2019, likely resulting from using recycle water and a return to average rainfall in the region.

The water volumes are subject to change upon further review of pond and deposit volumes by the AER.



Note: Water volumes are presented as reported by operators and are subject to change upon further review by the AER.

Figure 6. Ponded water volume in tailings ponds, 2014 to 2024

7.3 Regional Measurement System Audit

The AER has continued development of an auditing system for fluid tailings.

In 2023, the AER requested fluid tailings and clear water zone surface data from mining operators and completed an initial audit to verify the regional fluid tailings and water volumes. In 2024, the AER continued with the audit of 2023 surface data and followed up with questions for select mines. In some cases, the AER requested additional raw data to build on the validation of fluid tailings volumes.

Lessons learned from the initial validation audit are being applied to further refine the design of the audit program and optimize submission data. The AER will continue its fluid tailings auditing program in the coming years and plans to provide information on the audits of individual companies, containment requirements, and RTR volumes in future reports.

8 Suncor – Base Plant Fluid Tailings Status

In 2024, 11 tailings facilities were operating at Suncor Base Plant (see table 4).

The tailings facilities vary in their primary function, contents, and size.

Table 4. Tailings facilities operating at Suncor Base Plant

Facility	Function	Contents
Pond 1A	Fluid and solid tailings storage Water recycle	CST Fluid tailings
Pond 2/3	Fluid and solid tailings storage Water recycle FTT deposition	FTT Fluid tailings
Pond 5	Fluid and solid tailings storage	Fluid tailings CST CT Coke
Pond 6	Fluid and solid tailings storage	Fluid tailings CST CT
Pond 7	Fluid and solid tailings storage Water recycle FTT deposition	FTT Fluid tailings CST CT
Pond 8B	Fluid and solid tailings storage	Fluid tailings CST
Dedicated disposal area 1 (DDA1)	Fluid and solid tailings storage	Fluid tailings CST
DDA3	Fluid and solid tailings storage and treatment	Fluid tailings CST

Facility	Function	Contents
South tailings pond (STP)	Ongoing tailings deposition Water recycle	Fluid tailings CST
Sand dump 8 (SD8)	Ongoing tailings deposition	Fluid tailings CST
Mine dump 9 / mine dump 9 south (MD9/MD9S)	Solid tailings deposition and treatment	Overburden treated fluid tailings

The fluid tailings treatment technology approved for commercial operation at Suncor Base Plant is PASS, in which fluid tailings are treated with a coagulant and flocculant before placement in DDA3. The technology is only conditionally approved, subject to conditions included in Suncor Base Plant's *OSCA* and *EPEA* approvals. Suncor Base Plant is also approved to co-deposit treated tailings from DDA1, residual mature fine tailings from pond 8B, and overburden.

Suncor Base Plant reported treating 24.6 Mm^3 of fluid tailings as per its TMP treatment commitments: 23.1 Mm^3 with PASS and 1.6 Mm^3 with co-deposition.

Suncor Base Plant reported that its new and legacy fluid tailings inventories for 2024 were within the approved fluid tailings profiles.

8.1 Fluid Tailings

For 2024, Suncor Base Plant reported a total fluid tailings inventory (new and legacy fluid tailings combined) of 278 Mm^3, up from 270 Mm^3 in 2023.

Volumes reported for 2024 fall within currently approved profiles for new and legacy fluid tailings inventories.

For 2024, Suncor Base Plant reported that 123.7 Mm^3 of fluid tailings met its approved RTR criteria, up from 112.7 Mm^3 in 2023.

The RTR status requires Suncor Base Plant to meet the approved subobjective 1 and 2 criteria (see table 5), which are included in appendix C to *OSCA* approval 8535U, approved November 21, 2024.

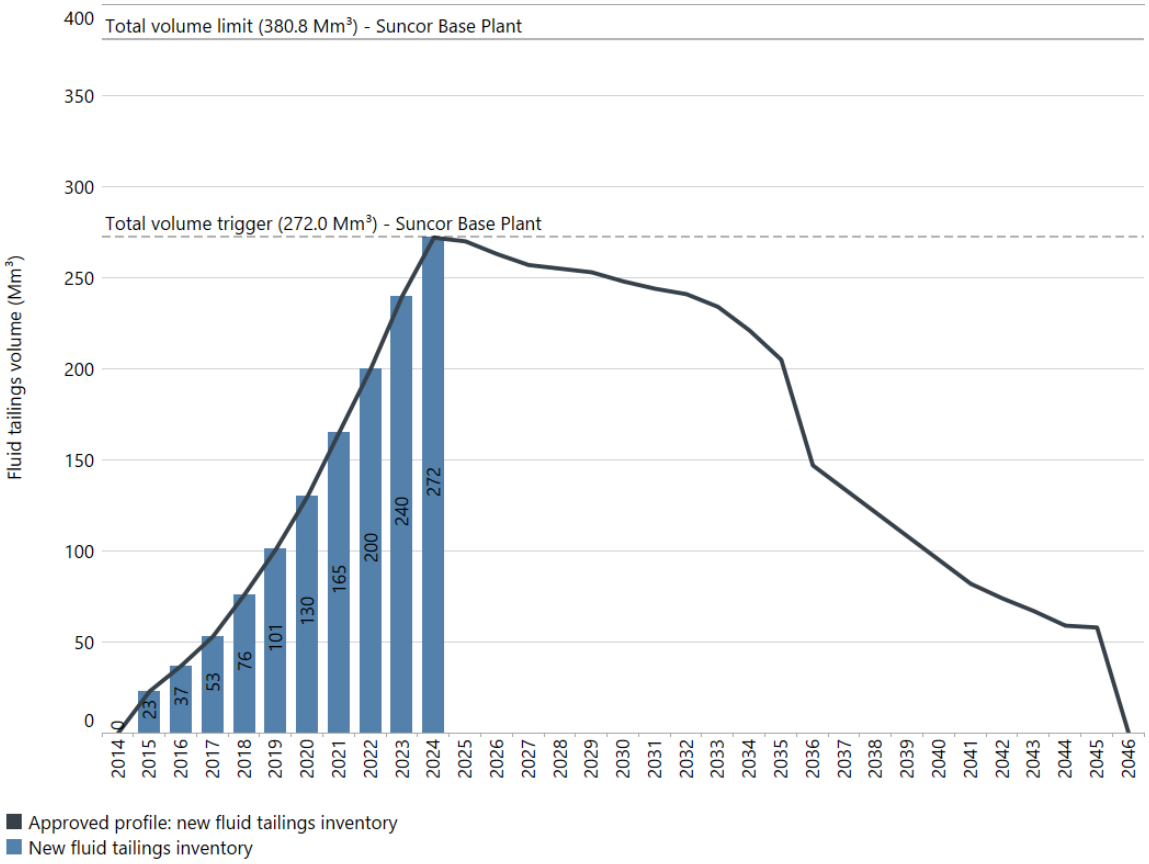
Table 5. RTR criteria for Suncor Base Plant

Deposit	Subobjective	RTR criteria
Pond 5	subobjective 1	Capping with coke and vertical strip drain installation is completed in 2019.
	subobjective 2	Surface water and seepage: The closed-circuit water management system is operating as designed. Groundwater adjacent or in communication with fluid tailings deposits is effectively monitored, reported, managed, and mitigated as required by *EPEA* approval 94-03-00, as amended or renewed.
Pond 6	subobjective 1	Pond 6 mitigation is completed by December 31, 2028.
	subobjective 2	Surface water and seepage: The closed-circuit water management system is operating as designed. Groundwater adjacent or in communication with fluid tailings deposits is effectively monitored, reported, managed, and mitigated as required by *EPEA* approval 94-03-00, as amended or renewed.
Pond 7	subobjective 1	Pond 7 mitigation is completed by December 31, 2033.
	subobjective 2	Surface water and seepage: The closed-circuit water management system is operating as designed. Groundwater adjacent or in communication with fluid tailings deposits is effectively monitored, reported, managed, and mitigated as required by *EPEA* approval 94-03-00, as amended or renewed.
MD9 co-disposal	subobjective 1	Clay-to-water ratio >0.5 in DDA1 based on deposit sampling. Annual overburden to tailings volume ratio >1.
	subobjective 2	Surface water and seepage: The closed-circuit water management system is operating as designed. Groundwater adjacent or in communication with fluid tailings deposits is effectively monitored, reported, managed, and mitigated as required by *EPEA* approval 94-03-00, as amended or renewed.
MD9 south co-disposal	subobjective 1	Clay-to-water ratio >0.5 in DDA1 based on deposit sampling. Annual overburden to tailings volume ratio >1.
	subobjective 2	Surface water and seepage: The closed-circuit water management system is operating as designed. Groundwater adjacent or in communication with fluid tailings deposits is effectively monitored, reported, managed, and mitigated as required by *EPEA* approval 94-03-00, as amended or renewed.
DDA3	subobjective 1	Clay-to-water ratio >0.3 threshold based on deposit sampling. An annual average total suspended solids ≤500 parts per million for expressed water from DDA3 treated tailings.
	subobjective 2	Surface water and seepage: The closed-circuit water management system is operating as designed. Groundwater adjacent or in communication with fluid tailings deposits is effectively monitored, reported, managed, and mitigated as required by *EPEA* approval 94-03-00, as amended or renewed.

8.1.1 New Fluid Tailings

For 2024, Suncor Base Plant reported a new fluid tailings inventory of 272 Mm³ (see figure 7), up from 240 Mm³ in 2023. The approved new fluid tailings inventory for 2024 was 272 Mm³.

Suncor Base Plant has a total volume trigger for new fluid tailings inventory of 272.0 Mm³ and a total volume limit of 380.8 Mm³. Based on data reported in its 2024 TMR, Suncor Base Plant was within its approved new fluid tailings profile and did not exceed its total volume trigger or total volume limit for new fluid tailings in 2024. The total volume trigger represents the maximum approved accumulation of fluid tailings.



Note: Tailings volumes are presented as reported by operators and are subject to change upon further review by the AER, including an assessment of whether volumes meet the RTR criteria.

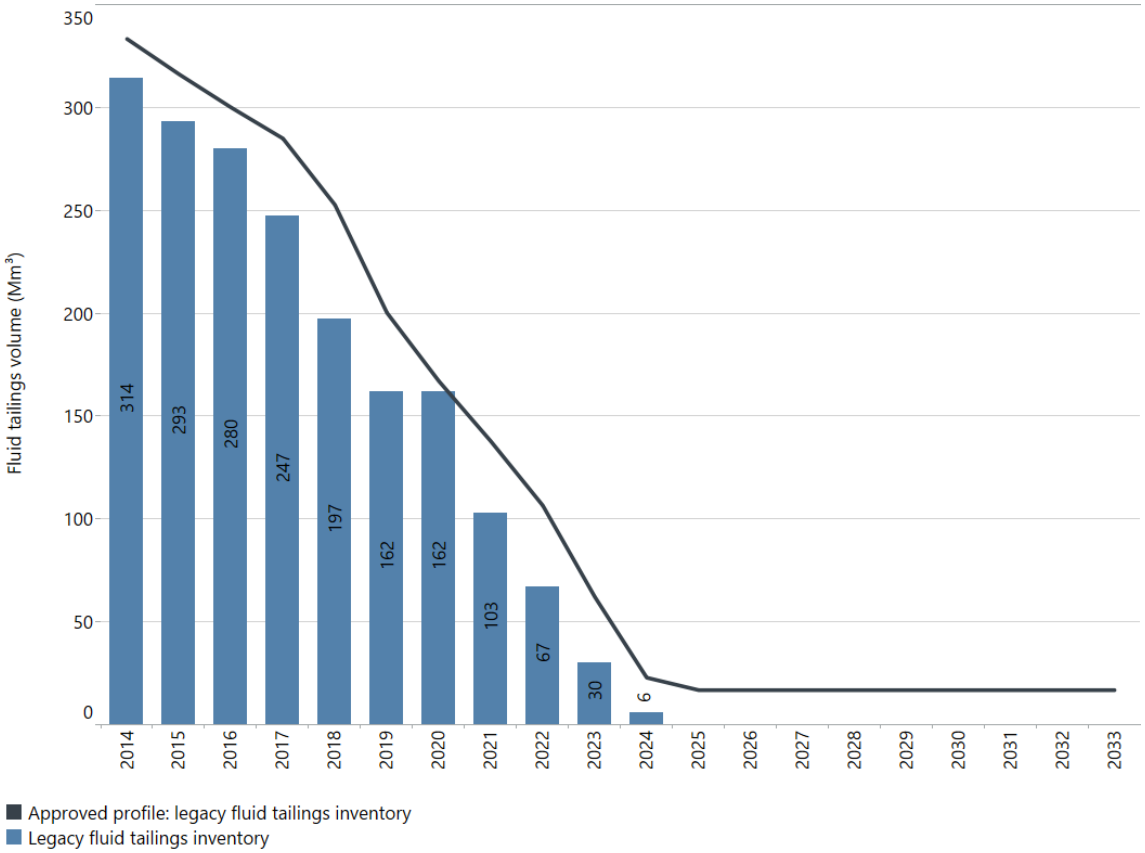
Data are from the site-wide fluid tailings inventory table (appendix 3 of *Directive 085*) submitted annually by operators.

Figure 7. New fluid tailings for Suncor Base Plant, 2014 to 2024

8.1.2 Legacy Fluid Tailings

For 2024, Suncor Base Plant reported a legacy fluid tailings inventory of 6 Mm³ (see figure 8), down from 30 Mm³ in 2023. The approved legacy fluid tailings inventory for 2024 was 6 Mm³.

Based on data reported in its 2024 TMR, Suncor Base Plant was within its approved legacy fluid tailings profile and did not exceed its profile deviation trigger for legacy fluid tailings in 2024.



Note: Tailings volumes are presented as reported by operators and are subject to change upon further review by the AER, including an assessment of whether volumes meet the RTR criteria.

Data are from the site-wide fluid tailings inventory table (appendix 3 of *Directive 085*) submitted annually by operators.

Figure 8. Legacy fluid tailings for Suncor Base Plant, 2014 to 2024

8.2 Volume of Treated Fluid Tailings by Technology

For 2024, Suncor Base Plant reported that 23.1 Mm³ of fluid tailings were treated with PASS in DDA3, and 1.6 Mm³ with co-deposition of tailings with overburden.

As of 2024, Suncor Base Plant reported that 123.7 Mm³ of fluid tailings had achieved RTR status:

- 30.4 Mm³ of fluid tailings in pond 5
- 93.0 Mm³ of fluid tailings in DDA3
- 0.5 Mm³ of fluid tailings in MD9

The RTR volume increased from 112.7 Mm³ reported in 2023.

SIRs were issued for clarity related to treated volumes in MD9 and MD9 South.

8.3 Treatment Options and Continuous Improvement

Suncor Base Plant reported that its tailings treatment technologies are operating as predicted and are meeting performance criteria.

Suncor Base Plant reported no issues with tailings treatment technology in 2024, and that DDA3 operations met expectations. Also, Suncor Base Plant reported that no new tailings improvements were incorporated in 2024.

8.4 Technological Innovation in Fluid Tailings Treatment

Suncor Base Plant reported the following technology research and development efforts for 2024:

- A focused beam reflectance measurement analyzer was used to develop advanced process control logic to optimize polymer dosing.
- Reviewing new injector design for better coagulant mixing and improved injector lifespan.
- Conducted a pond 6 hydraulic coke-capping trial to validate
  - air quality effects,
  - process design assumptions, and
  - geotechnical design assumptions.

Suncor Base Plant reported that the coke-capping trial will continue in 2025. Suncor Base Plant must report the trial results to the AER in its 2025 and 2026 TMRs.

Suncor has provided an annual update on tailings research activities during 2024 in Section 4.3 with a high-level summary on the constructed wetland treatment system pilot project, the pit lake (base mine lake and Lake Miwasin), and hydraulic coke capping on pond 6 and continued its industry collaboration through external forums such as Canada's Oil Sand Innovation Alliance (COSIA).

Refer to Suncor Base Plant's pre-2023 TMRs for more information on technological innovation.

8.5 Regulatory and Management Actions

Suncor Base Plant operates at management level 1 as described in the *TMF* and *Directive 085*.

In 2024, the AER accepted Suncor Base Plant's DDA3 consolidation model update, submitted December 18, 2023, which included an updated DDA3 clay-to-water ratio forecast. Further information regarding consolidation models for each tailings facility is required as part of Suncor Base Plant's integrated life-of-mine plan (LOMP), LMCP, and TMP amendment expected in 2026.

On November 21, 2024, the AER issued *OSCA* approval 8535U with the following changes:

- Revised clause 61(a) extending the submission date of the integrated site-wide LOMP, LMCP, and TMP amendment application for the PASS-based fluid tailings treatment technology from July 2025 to November 2026, as well as making required policy accommodations nonspecific.
- Added clause 61(c), which requires that if a plan listed in clause 61(a) includes pit lakes containing tailings, the amendment application must include a feasibility assessment of an integrated site-wide LOMP, LMCP, and TMP without pit lakes containing tailings, adhering to the current regulatory requirements.
- Other changes to the *OSCA* approval were largely aimed at ensuring the conditions were clear and not duplicative, while maintaining alignment with applicable regulatory requirements and Government of Alberta policy.

SIRs were issued to Suncor Base Plant regarding changes to storage capacity and fluid tailings generation as a consequence of the following operational changes to the approved TMP:

- changes to the SD9 dike 13 south abutment widened sand toe design;
- changes to SD10 dike 15 starter dike and the engineered pond bottom design;
- changes to the North Steepbank extension phase 2 alternative pit design;
- increased oil sands production in 2024, as reported in the *Report on Mining Operations*;
- updated coarse sand placement, as reported in the *2025 Annual Mine Plan*; and
- all other ore sterilization or final pit limit change requests.

8.6 Measurement System Audit Results

Suncor Base Plant did not submit any MSP updates in 2024. Suncor is required to submit an MSP update in 2025.

SIRs were issued to Suncor Base Plant regarding reported changes to the sampling locations in pond 1A and pond 7.

The AER requested the 2023 fluid tailings and clear water zone surface data and completed an initial desktop audit of Suncor Base Plant's fluid tailings and ponded water volumes to verify reported values. Fluid tailings volumes modelled by the AER were within an acceptable margin of error compared with the volumes reported by Suncor Base Plant (see table 6).

Table 6. Reported 2023 fluid tailings volumetric audit results for Suncor Base Plant

Deposit/pond	Reported fluid tailings volumes (Mm^3)	AER estimated fluid tailings volumes (Mm^3)	Reported ponded water volumes (Mm^3)	AER estimated water volumes (Mm^3)
Pond 1A	10.4	10.62	2.0	2.05
Pond 2/3	36.9	37.7	4.0	Not available
Pond 6	32.4	32.53	9.5	Not available
Pond 7	75.8	76.22	28.5	28.60
Pond 8B	12.0	Not available	0.0	Not available
DDA3	0.3	0.71	16.9	18.13
STP	101.5	101.94	21.8	25.07
SD8	0.7	0.48	0.5	0.25
Total	**270.1**	**260.2**	**83.2**	**86.1**

9 Syncrude – Mildred Lake Fluid Tailings Status

In 2024, six tailings facilities were operating at Mildred Lake, and three were either inactive or in late stages of final reclamation (see table 7).

The tailings facilities vary in their primary function, contents, and size. The Mildred Lake settling basin (MLSB) and south west sand storage (SWSS) are the only out-of-pit tailings facilities at the site. The base mine lake (BML) is a demonstration pit lake in the former west in-pit tailings facility, having water-capped tailings.

Table 7. Tailings facilities operating at Syncrude Mildred Lake

Facility	Function	Contents
MLSB	Plant recycle water source Fluid storage Solids storage	Recycle water Fluid tailings FTT Flotation tailings Petroleum coke CST Centrifuge plant centrate
SWSS	Solids storage Fluid storage	Recycle water Fluid tailings CST
BML (demonstration)	Water-capped tailings demonstration Treated tailings deposits	Fresh water Recycle water Sequestered fluid tailings

Facility	Function	Contents
East in-pit (EIP) (final reclamation)	Solids storage	CT CST
South west in-pit (SWIP)	Fluid storage Solids storage Plant recycle water source Treated tailings storage	Recycle water CST CT Fluid tailings CT cyclone overflow
North mine south pond (NMSP)	Fluid storage Solids storage Treated tailings storage Plant recycle water source	CST CT Fluid tailings Recycle water
North mine south pond east (NMSPE) deep cake	Solids storage Treated tailings storage	Centrifuged fluid tailings cake Overburden CST
North mine centre pit-east (NMCP-E)	Fluid storage Solids storage Treated tailings storage	CST Fluid tailings Flocculated tailings Centrifuge fluid tailings cake
W1/SWSS cake (inactive)	Solids storage Treated tailings storage	Centrifuge fluid tailings cake

The fluid tailings treatment technologies approved for commercial operation at Mildred Lake are CT, centrifuge cake (CC), and in-line flocculation (ILF).

In 2024, Mildred Lake treated 15.8 Mm^3 of fluid tailings (1.4 Mm^3 through the CC plant and 14.4 Mm^3 through the ILF plant). This compares with a total targeted volume of 9.1 Mm^3 as per the updated TMP for 2024 through 2026.

Mildred Lake reported that its new and legacy fluid tailings inventories for 2024 were below the approved fluid tailings profiles. The approved profiles were updated as part of the extension granted for the TMP to cover the interim period from 2024 to 2028. The updated profiles reflect the latest tailings pond measurement results from 2024.

9.1 Fluid Tailings

For 2024, Mildred Lake reported a total fluid tailings inventory (new and legacy fluid tailings combined) of 541.9 Mm^3, down from 551.7 Mm^3 in 2023.

Volumes reported for 2024 fall within currently approved profiles for new and legacy fluid tailings inventories.

For 2024, Mildred Lake reported that 54.6 Mm^3 of fluid tailings met its approved RTR criteria, up from 47.2 Mm^3 in 2023.

The RTR status requires Mildred Lake to meet the approved subobjective 1 and 2 criteria (see table 8), which are included in appendix C to *OSCA* approval 8573T, approved April 7, 2025.

There are no approved RTR criteria for densified fluid tailings in the MLSB nor for water-capped fluid tailings.

Table 8. RTR criteria for Syncrude Mildred Lake

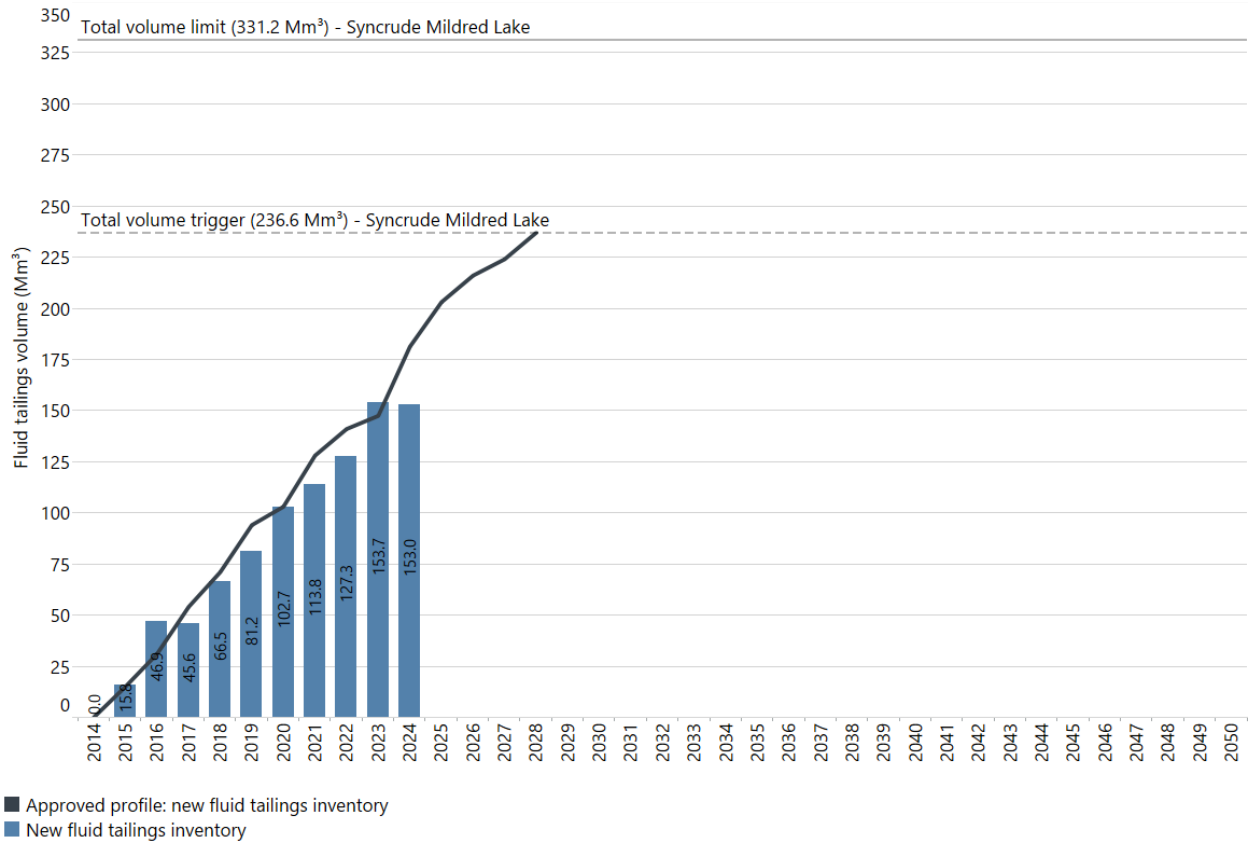
Deposit	Subobjective	RTR criteria
CT	subobjective 1	65% solids content by weight within one year of tailings placement based on deposit sampling. 75% solids content by weight within one year after sand capping of deposit, based on deposit sampling.
	subobjective 2	Groundwater adjacent or in communication with fluid tailings is to be effectively monitored, reported, managed, and mitigated as required by *EPEA* approval 26-03-00, as amended or renewed.
CC deep deposits	subobjective 1	50% solids content by weight within one year of tailings placement based on deposit sampling.
	subobjective 2	Groundwater adjacent or in communication with fluid tailings is to be effectively monitored, reported, managed, and mitigated as required by *EPEA* approval 26-03-00, as amended or renewed.
Flocculated tailings deposits	subobjective 1	50% solids content by weight within one year of tailings placement based on deposit sampling.
	subobjective 2	Groundwater adjacent or in communication with fluid tailings is to be effectively monitored, reported, managed, and mitigated as required by *EPEA* approval 26-03-00, as amended or renewed.

9.1.1 New Fluid Tailings

For 2024, Mildred Lake reported a new fluid tailings inventory of 153.0 Mm^3 (see figure 9), down from 153.7 Mm^3 in 2023. The approved new fluid tailings inventory for 2024 was 181.2 Mm^3.

Mildred Lake has a total volume trigger for new fluid tailings inventory of 236.6 Mm^3 and a total volume limit of 331.2 Mm^3. Based on data reported in its 2024 TMR, Mildred Lake was within its approved new fluid tailings profile and did not exceed its total volume trigger or total volume limit for new fluid tailings in 2024.

The approved new fluid tailings profile was updated as part of the extension granted for the TMP. The profile covers the interim period from 2024 to 2028 and reflects the 2024 tailings pond measurement results.



Note: Tailings volumes are presented as reported by operators and are subject to change upon further review by the AER, including an assessment of whether volumes meet the RTR criteria.

Data are from the site-wide fluid tailings inventory table (appendix 3 of *Directive 085*) submitted annually by operators.

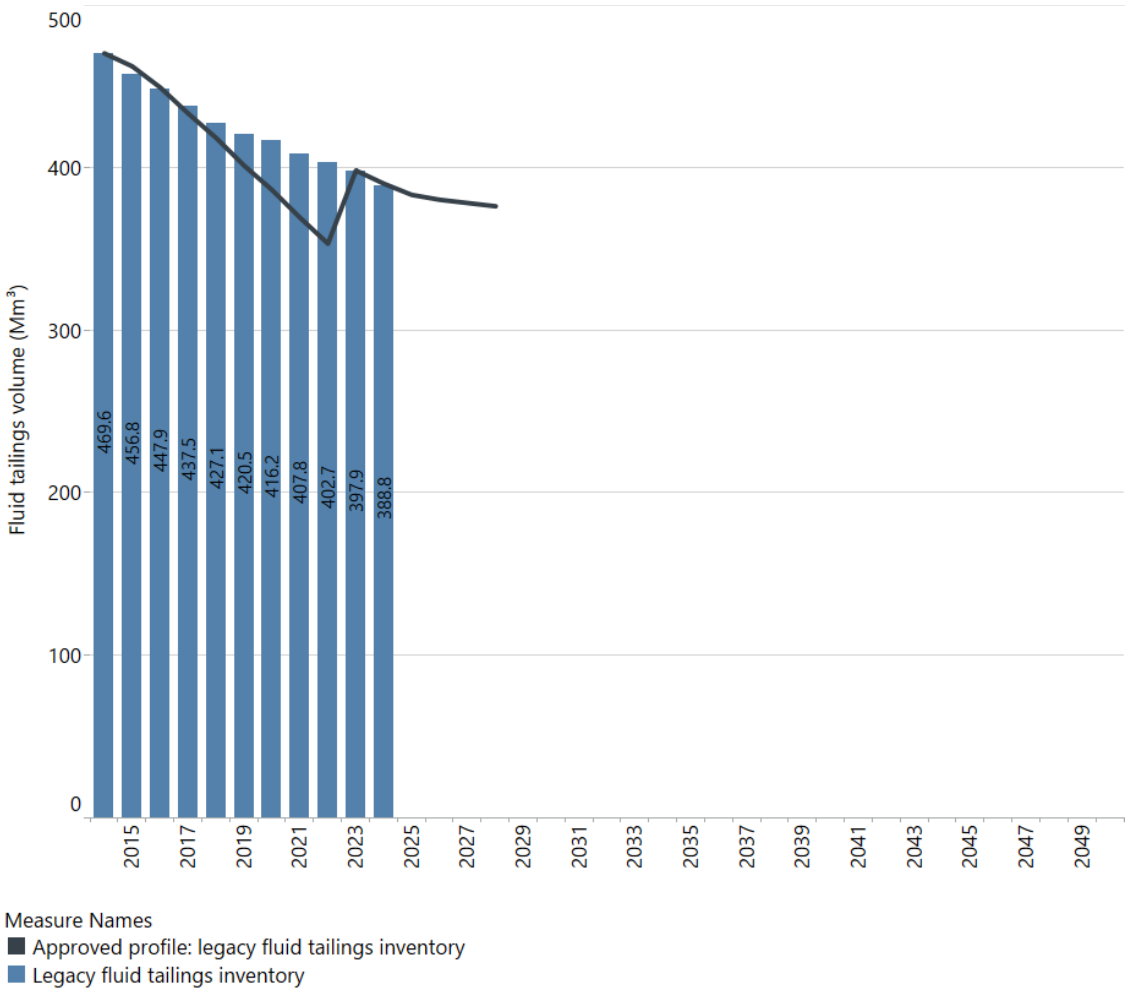
Figure 9. New fluid tailings for Syncrude Mildred Lake, 2014 to 2024

9.1.2 Legacy Fluid Tailings

For 2024, Mildred Lake reported a legacy fluid tailings inventory of 388.8 Mm^3 (see figure 10), down from 397.9 Mm^3 in 2023. The approved legacy fluid tailings inventory for 2024 was 389.9 Mm^3.

Based on data reported in its 2024 TMR, Mildred Lake was within its approved legacy fluid tailings profile and did not exceed its profile deviation trigger for legacy fluid tailings in 2024.

The approved legacy fluid tailings profile was updated as part of the extension granted for the TMP. The profile covers the interim period from 2024 to 2028 and reflects the 2024 tailings pond measurement results.



Note: Tailings volumes are presented as reported by operators and are subject to change upon further review by the AER, including an assessment of whether volumes meet the RTR criteria.

Data are from the site-wide fluid tailings inventory table (appendix 3 of *Directive 085*) submitted annually by operators.

Figure 10. Legacy fluid tailings for Syncrude Mildred Lake, 2014 to 2024

9.2 Volume of Treated Fluid Tailings by Technology

For 2024, Mildred Lake reported that 1.4 Mm³ of fluid tailings were treated through the CC plant, producing 1.2 Mm³ of deposit in NMSPE and NMCP-E, and 14.4 Mm³ of fluid tailings were processed through the floc-T plant, creating 6.4 Mm³ of deposit in NMCP-E. This compares to a total fluid tailings treatment target of 9.1 Mm³. The estimated change in fluid tailings volume resulting from consolidation is 1.0 Mm³.

Mildred Lake was approved to implement CT, CC, and floc-T in 2024.

As of 2024, Mildred Lake reported that 54.6 Mm³ of fluid tailings had achieved RTR status:

- 0.8 Mm³ of fluid tailings in SWIP

- 11.8 Mm^3 of fluid tailings in NMSP
- 36.8 Mm^3 of fluid tailings in NMSPE deep cake
- 5.2 Mm^3 in NMCP-E

The RTR volume increased from 47.2 Mm^3 reported in 2023.

9.3 Treatment Options and Continuous Improvement

Mildred Lake reported that its tailings treatment technologies are operating as expected, and deposits are meeting performance criteria.

Mildred Lake reported no issues with CC or floc-T operations throughout 2024.

Mildred Lake reported developing a block model for the deposits in NMSP to target optimal fluid tailings material for plant feed.

9.4 Technological Innovation in Fluid Tailings Treatment

Mildred Lake reported the following technology and research and development efforts for 2024:

- geotechnical performance of floc-T and straight coarse tailings co-deposition
- polymer development and optimization
- water-capped tailings technology

Syncrude also reported on the environmental performance of fluid tailings treatment technologies.

As per its *EPEA* approval, Mildred Lake submitted various reports pertaining to the BML, tailings research, and its continued industry collaboration through external forums such as COSIA.

Syncrude reported there are no new pilots, prototypes, or demonstrations for fluid tailings treatment technologies. Refer to Mildred Lake 's 2024 TMR for more information on technological innovation.

9.5 Regulatory and Management Actions

Mildred Lake operates at management level 1 as described in the *TMF* and *Directive 085*.

The Mildred Lake fluid tailings profiles for 2024 are based on *OSCA* approval 8573S, which granted Syncrude an extension of the fluid tailings profiles to the end of 2025.

Syncrude submitted an interim TMP update in August 2024 and requested further extension of the fluid tailings profiles to the end of 2028. The AER approved the updated interim profiles in April 2025 (*OSCA* approval 8573T). The approval of the interim profiles was based on the current fluid tailings inventory, expected fluid tailings generation based on production, and existing treatment capacity with approved

technologies, recognizing that MLSB and BML have not been removed from the fluid tailings inventory. Table 9 shows the changes from both approvals.

Syncrude is required to submit a new TMP and LMCP by the end of 2026. No other regulatory management actions were taken during the 2024 reporting period for tailings management operations at Mildred Lake.

Table 9. Interim approved fluid tailings profiles for Syncrude Mildred Lake

Year	New fluid tailings	Legacy fluid tailings	Total fluid tailings
2023	147.4	398.0	545.4
2024	162.0	389.9	551.9
2025	203	383	586
2026	216	380	596
2027	224	378	602
2028	237	376	613

9.6 Measurement System Audit Results

Mildred Lake did not submit an updated MSP in 2024. The MSP provided by Mildred Lake in 2022 was reviewed and was found to be compliant with requirements.

The AER requested the 2023 fluid tailings and clear water zone surface data and completed an initial desktop audit of Mildred Lake's fluid tailings and ponded water volumes to verify reported values. Fluid tailings volumes modelled by the AER were within an acceptable margin of error compared with the reported volumes (see table 10).

In 2024, Syncrude submitted the required fluid tailings and recycle water surveyed volume data. Due to discrepancies in the data provided, the AER did not complete the desktop audit of Mildred Lake's fluid tailings or ponded water volumes for the 2024 reporting year. The AER issued an SIR to clarify the data provided and will report on the comparison in the *2025 Tailings Report*.

Table 10. Reported 2023 fluid tailings volumetric audit results for Syncrude Mildred Lake

Deposit/pond	Reported fluid tailings volumes (Mm^3)*	AER estimated fluid tailings volumes (Mm^3)	Reported ponded water volumes (Mm^3)	AER estimated water volumes (Mm^3)
MLSB	110.5	107.97	8.3	7.98
SWSS	155.2	148.89	19.0	17.88
BML	166.8	168.25	71.3	69.53
SWIP	14.7	12.32	8.6	6.99
NMSP	98.5	92.91	8.4	9.99

Deposit/pond	Reported fluid tailings volumes (Mm^3)*	AER estimated fluid tailings volumes (Mm^3)	Reported ponded water volumes (Mm^3)	AER estimated water volumes (Mm^3)
NMSPE Deep Cake	37.0	36.96	0.0	0.0
NMCP-E	16.0	16.81	6.1	5.96
Total	**598.7**	**584.12**	**121.7**	**118.34**

* Fluid tailings volumes may include RTR tailings.

10 Syncrude – Aurora North Fluid Tailings Status

In 2024, three tailings facilities were operating at Aurora North (see table 11).

The tailings facilities vary in their primary function, contents, and size. The Aurora settling basin (ASB) is the only out-of-pit tailings facility at the mine site. The Aurora east pit (AEP) and the Aurora centre pit north (ACPN) are both in-pit tailings facilities.

Table 11. Tailings facilities operating at Syncrude Aurora North

Facility	Function	Contents
ASB	Plant recycle water source Fluid storage Solids storage FFT source for CT plant	Recycle water CST Flotation tailings FFT CT cyclone overflow
AEP	Fluid storage Solids storage Treated tailings deposit Filter sand source Plant recycle water source	CT CST Recycle water FFT
ACPN	Fluid storage Treated tailings deposit	CT CST Flotation tailings FFT Recycle water

The fluid tailings treatment technology approved for commercial operation at Aurora North is CT.

Aurora North treated 4.6 Mm^3 of fluid tailings in 2024 compared with the 5.4 Mm^3 target, as per its TMP treatment commitments.

Aurora North reported that its new and legacy fluid tailings inventories for 2024 were below the approved fluid tailings profiles.

10.1 Fluid Tailings

For 2024, Aurora North reported a total fluid tailings inventory (new and legacy fluid tailings combined) of 152.3 Mm^3, up from 144.0 Mm^3 in 2023.

Volumes reported for 2024 fall within currently approved profiles for new and legacy fluid tailings inventories.

For 2024, Aurora North reported that 2.8 Mm^3 of fluid tailings met its approved RTR criteria, down from 4.8 Mm^3 in 2023.

The RTR status requires Aurora North to meet the approved subobjective 1 and 2 criteria (see table 12), which are included in appendix C to *OSCA* approval 10781Q, approved April 8, 2025.

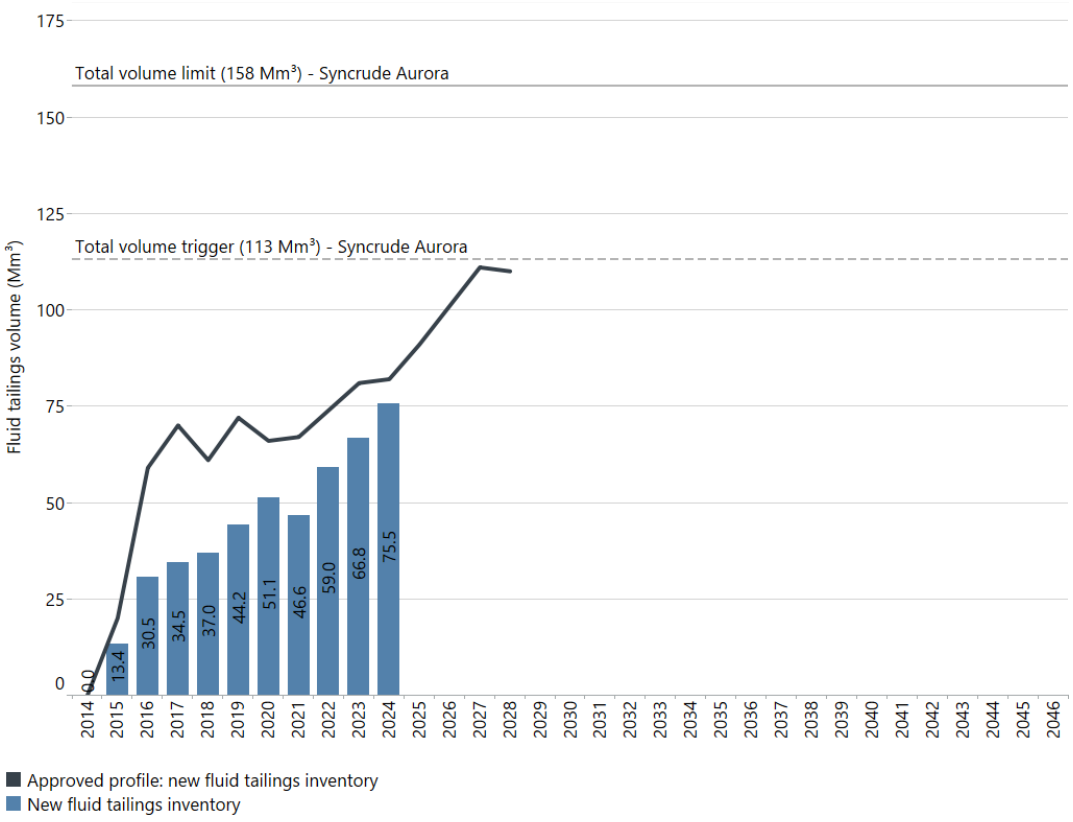
Table 12. RTR criteria for Syncrude Aurora North

Deposit	Subobjective	RTR criteria
CT deposits	subobjective 1	65% solids by weight within one year of tailings placement based on deposit sampling.
		75% solids by weight within one year after sand capping of deposit based on deposit sampling.
	subobjective 2	Groundwater adjacent or in communication with fluid tailings is to be effectively monitored, reported, managed, and mitigated as required by *EPEA* approval 26-03-00, as amended or renewed.

10.1.1 New Fluid Tailings

For 2024, Aurora North reported a new fluid tailings inventory of 75.5 Mm^3 (see figure 11), up from 66.8 Mm^3 in 2023. The approved new fluid tailings inventory for 2024 was 82.4 Mm^3.

Aurora North has a total volume trigger for new fluid tailings inventory of 113 Mm^3 and a total volume limit of 158 Mm^3. Based on data reported in its 2024 TMR, Aurora North was within its approved new fluid tailings profile and did not exceed its total volume trigger or total volume limit for new fluid tailings in 2024.



Note: Tailings volumes are presented as reported by operators and are subject to change upon further review by the AER, including an assessment of whether volumes meet the RTR criteria.

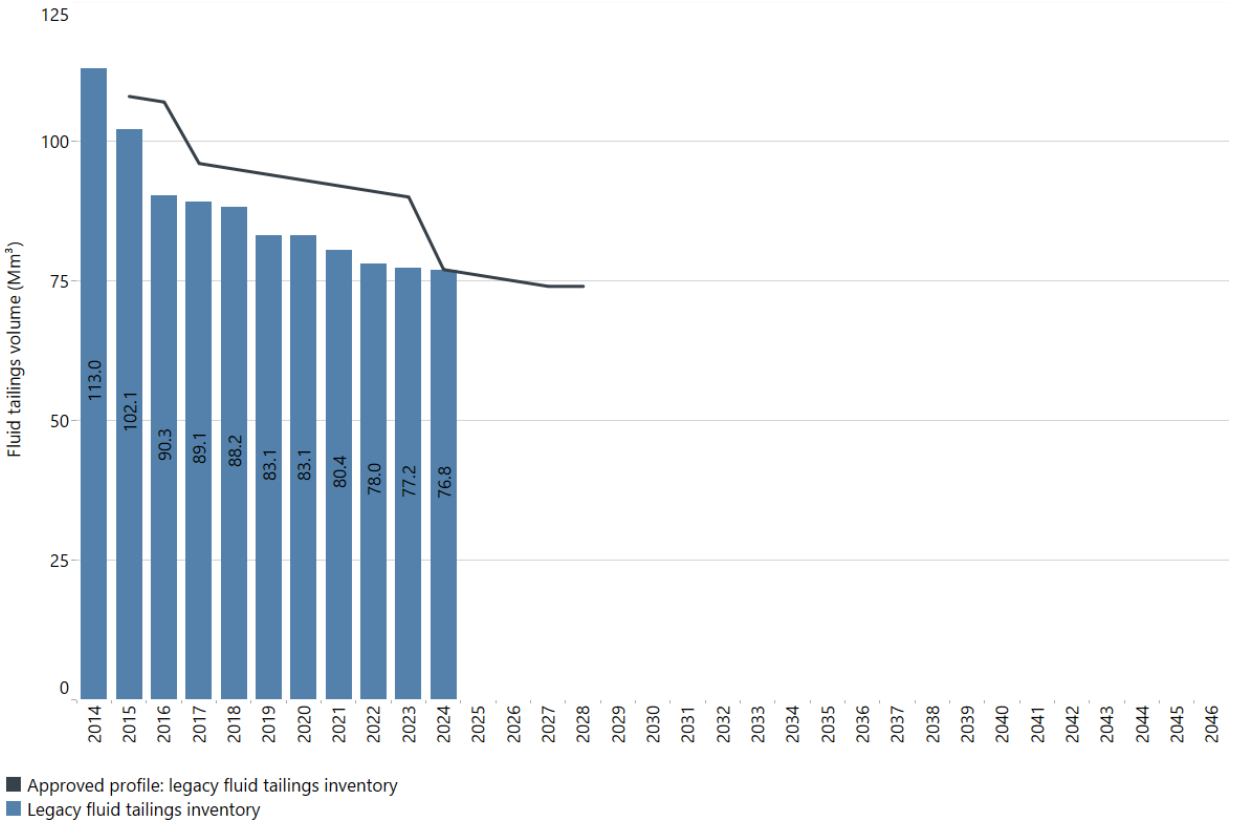
Data are from the site-wide fluid tailings inventory table (appendix 3 of *Directive 085*) submitted annually by operators.

Figure 11. New fluid tailings for Syncrude Aurora North, 2014 to 2024

10.1.2 Legacy Fluid Tailings

For 2024, Aurora North reported a legacy fluid tailings inventory of 76.8 Mm^3 (see figure 12), down from 77.2 Mm^3 in 2023. The approved legacy fluid tailings inventory for 2024 was 76.8 Mm^3.

Based on data reported in its 2024 TMR, Aurora North was within its approved legacy fluid tailings profile and did not exceed its profile deviation trigger for legacy fluid tailings in 2024.



Note: Tailings volumes are presented as reported by operators and are subject to change upon further review by the AER, including an assessment of whether volumes meet the RTR criteria.

Data are from the site-wide fluid tailings inventory table (appendix 3 of *Directive 085*) submitted annually by operators.

Figure 12. Legacy fluid tailings for Syncrude Aurora North, 2014 to 2024

10.2 Volume of Treated Fluid Tailings by Technology

For 2024, Aurora North reported that 4.6 Mm³ of fluid tailings were treated through the CT process, producing 17.3 Mm³ of CT beach in AEP. This compares with the 5.4 Mm³ target for fluid tailings and 17.0 Mm³ of CT beach as per the TMP.

As of 2024, Aurora North reported that 2.8 Mm³ of fluid tailings had achieved RTR status in the AEP, a decrease from 4.8 Mm³ reported in 2023.

The AER has requested additional information to better understand the reduction in the RTR volume.

10.3 Treatment Options and Continuous Improvement

Aurora North reported that its tailings treatment technology is operating as expected, and deposits are meeting performance criteria and remain aligned with long-term closure and reclamation objectives.

Aurora North reported processing 85% of its fluid tailings target outlined in its latest TMP and cited the following reasons for the shortfall:

- Extreme cold weather in February caused the CT plant to freeze.
- The mine was shut down for three weeks in April because of a pigging event.
- In October, a hoist cable on the fluid tailings dredge failed.

In response, the AER has requested an assessment of CT performance compared with the TMP for 2025.

10.4 Technological Innovation in Fluid Tailings Treatment

Aurora North reported the following technology and research and development efforts for 2024:

- Evaluated the available tailings coagulants for use in the CT and floc-T processes.
- Evaluated the risk of CT segregation at lower sand-to-fines ratio (SFR) due to higher-fines ore.
- Explored CT coagulant dosages to improve CT deposit performance.
- Continued to support research and development efforts into proving water-capped tailings technology at the BML.

As per its *EPEA* approval, Aurora North submitted various reports pertaining to the BML, its tailings research, and continued industry collaboration through external forums such as COSIA. Refer to Aurora North's 2024 TMR for more information on technological innovation.

10.5 Regulatory and Management Actions

Aurora North operates at management level 1 as described in the *TMF* and *Directive 085*.

Syncrude submitted an interim TMP update in August 2024 that was approved by the AER in April 2025. Syncrude is required to submit a new TMP and LMCP by the end of 2026.

No regulatory management actions were taken during the 2024 reporting period for tailings management operations at Aurora North.

10.6 Measurement System Audit Results

Aurora North did not submit an updated MSP in 2024.

The AER completed a desktop audit of Aurora North's 2024 reporting year fluid tailings and ponded water volumes to verify reported values. Fluid tailings and ponded water volumes modelled by the AER were within an acceptable margin of error compared with the volumes reported by Aurora North (see table 13).

Table 13. Reported 2024 fluid tailings volumetric audit results for Syncrude Aurora North

Deposit/pond	Reported fluid tailings volumes (Mm^3) *	AER estimated fluid tailings volumes (Mm^3)	Reported ponded water volumes (Mm^3)	AER estimated water volumes (Mm^3)
ASB	80.0	80.1	35.6	36.0
AEP	59.4	61.8	27.3	28.5
ACPN	15.6	15.3	8.6	8.8
Total	**155.0**	**157.2**	**71.5**	**73.3**

* Fluid tailings volumes may include RTR tailings.

11 Canadian Natural Upgrading Limited – Muskeg River Mine Fluid Tailings Status

In 2024, six tailings facilities were operating at the Muskeg River mine (see table 14).

The tailings facilities vary in their primary function, contents, and size. The external tailings facility (ETF) is the only out-of-pit tailings facility at the site. All other facilities are in-pit cells (IPC).

Table 14. Tailings facilities operating at CNUL Muskeg River

Facility	Function	Contents
ETF	Fluid and solid tailings storage	TSRU NPD type (TT, CST, TSRU) AFD CST TT
IPC1	Fluid and solid tailings storage Recycle water source	CST TSRU Recycle water
IPC2	Fluid and solid tailings storage	Fluid tailings TT
IPC3	Fluid and solid tailings storage	NPD type
IPC4	Fluid and solid tailings storage	TT and CST mixed deposit CFFT AFD
IPC6	Fluid and solid tailings storage	AFD TSRU/CST

The fluid tailings treatment technologies approved for commercial operation at Muskeg River mine are

- AFD
- CST
- TT
- TSRU
- NPD type (comprising TT, CST, and TSRU)

Muskeg River treated 32.6 Mm^3 of fluid tailings as per its TMP treatment commitment.

Muskeg River reported that its new and legacy fluid tailings inventories for 2024 were within the approved fluid tailings profiles.

11.1 Fluid Tailings

For 2024, Muskeg River reported a total fluid tailings inventory (new and legacy fluid tailings combined) of 146.8 Mm^3, up from 144.7 Mm^3 in 2023.

Volumes reported for 2024 fall within currently approved profiles for new and legacy fluid tailings inventories.

For 2024, Muskeg River reported that 23.8 Mm^3 of fluid tailings met its approved RTR criteria, up from 6.7 Mm^3 in 2023. The increase is partially due to deposits in IPC3 achieving RTR criteria in Year 5.

The RTR status requires Muskeg River to meet the approved subobjective 1 and 2 criteria (see table 15), which are included in appendix C to *OSCA* approval 8512O.

Table 15. RTR criteria for CNUL Muskeg River

Deposit	Subobjective	RTR criteria
NPD type (co-deposition of TT with TSRU tailings, WT, and CST)	subobjective 1	70% solids by weight within five years of tailings placement based on deposit sampling.
	subobjective 2	Groundwater adjacent or in communication with fluid tailings deposits is effectively monitored, reported, managed, and mitigated as required by *EPEA* approval 00020809-02-00, as amended or renewed.
AFD	subobjective 1	50% solids by weight within one year of tailings placement based on deposit sampling. 75% solids by weight within five years of final tailings placement based on deposit sampling.
	subobjective 2	Groundwater adjacent or in communication with fluid tailings deposits is effectively monitored, reported, managed, and mitigated as required by *EPEA* approval 00020809-02-00, as amended or renewed.
TT/CST mixed deposit	subobjective 1	60% solids by weight within three years of tailings placement based on deposit sampling. 70% solids by weight within five years of tailings placement based on deposit sampling.
	subobjective 2	Groundwater adjacent or in communication with fluid tailings deposits is effectively monitored, reported, managed, and mitigated as required by *EPEA* approval 00020809-02-00, as amended or renewed.

Deposit	Subobjective	RTR criteria
TSRU/CST mixed deposit	subobjective 1	60% solids by weight within three years of tailings placement based on deposit sampling. 70% solids by weight within five years of tailings placement based on deposit sampling.
	subobjective 2	Groundwater adjacent or in communication with fluid tailings deposits is effectively monitored, reported, managed, and mitigated as required by *EPEA* approval 00020809-02-00, as amended or renewed.
CFFT/CST mixed deposit	subobjective 1	60% solids by weight within three years of tailings placement based on deposit sampling. 70% solids by weight within five years of tailings placement based on deposit sampling.
	subobjective 2	Groundwater adjacent or in communication with fluid tailings deposits is effectively monitored, reported, managed, and mitigated as required by *EPEA* approval 00020809-02-00, as amended or renewed.

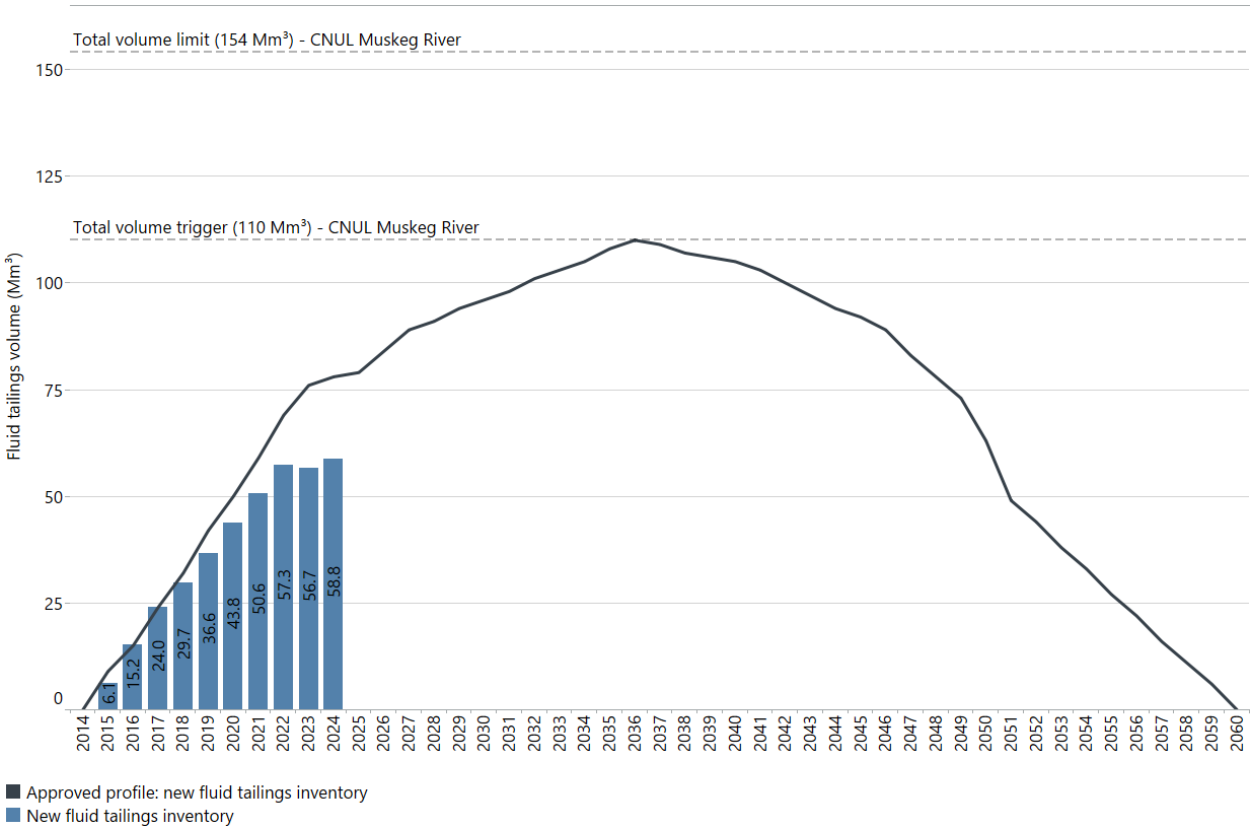
There are no approved RTR criteria for ILF at Muskeg River, as it was in the pilot phase in the reporting year.

The AER is working with CNUL to follow up on the modelling interpretation and boundary conditions for the fluid tailings calculation. An SIR has been issued on this matter, and the results of the review will be provided in the 2025 TMR.

11.1.1 New Fluid Tailings

For 2024, Muskeg River reported a new fluid tailings inventory of 58.8 Mm^3 (see figure 13), up from 56.7 Mm^3 in 2023. The approved new fluid tailings inventory for 2024 was 78 Mm^3.

Muskeg River has a total volume trigger for new fluid tailings inventory of 110 Mm^3 and a total volume limit of 154 Mm^3. Based on data reported in its 2024 TMR, Muskeg River was within its approved new fluid tailings profile and did not exceed its total volume trigger or total volume limit for new fluid tailings in 2024.



Note: Tailings volumes are presented as reported by operators and are subject to change upon further review by the AER, including an assessment of whether volumes meet the RTR criteria.

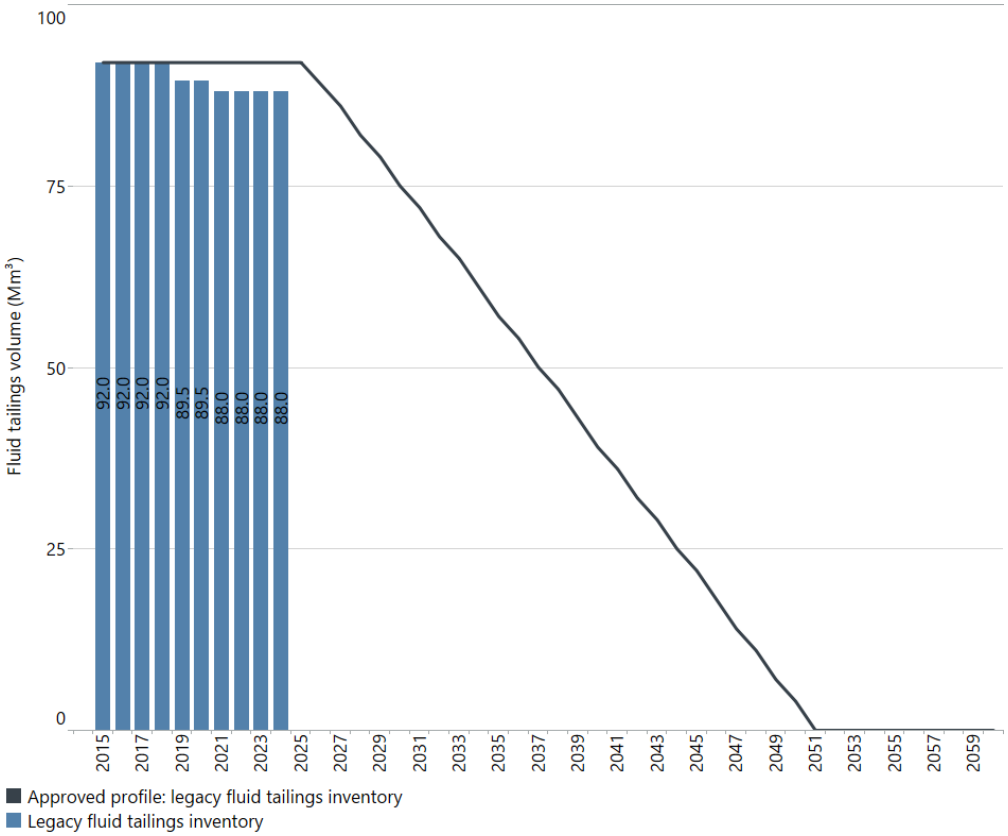
Data are from the site-wide fluid tailings inventory table (appendix 3 of *Directive 085*) submitted annually by operators.

Figure 13. New fluid tailings for CNUL Muskeg River, 2014 to 2024

11.1.2 Legacy Fluid Tailings

For 2024, Muskeg River reported a legacy fluid tailings inventory of 88.0 Mm^3 (see figure 14), unchanged from 2023. The approved legacy fluid tailings inventory for 2024 was 92.0 Mm^3.

Based on data reported in its 2024 TMR, Muskeg River was within its approved legacy fluid tailings profile and did not exceed its profile deviation trigger for legacy fluid tailings in 2024.



Note: Tailings volumes are presented as reported by operators and are subject to change upon further review by the AER, including an assessment of whether volumes meet the RTR criteria.

Data are from the site-wide fluid tailings inventory table (appendix 3 of *Directive 085*) submitted annually by operators.

Figure 14. Legacy fluid tailings for CNUL Muskeg River, 2014 to 2024

11.2 Volume of Treated Fluid Tailings by Technology

For 2024, Muskeg River reported alignment between the treatment performance and their TMP targets (see table 16).

Table 16. Volume of treated fluid tailings by technology for CNUL Muskeg River

Facility	Tailings description	Planned treatment volume (Mm^3)	Actual treatment volume (Mm^3)	AER assessment
ETF	CST/WT	12.7	13.1	In alignment
IPC1	CST/WT	0.0	0.3	In alignment
IPC2	CST/WT	4.3	4.0	In alignment
IPC3	CST/WT	1.5	5.1	Follow up required
IPC3	CST/WT	4.7	4.6	In alignment
IPC4	CST/WT	41.6	54.9	Follow up required
IPC4	TT/WT	5.3	6.4	In alignment
IPC6	CST/WT	26.0	2.5	Follow up required
IPC6	TSRU/CST	2.9	2.6	In alignment

As of 2024, Muskeg River reported that 23.8 Mm^3 of fluid tailings had achieved RTR status:

- 1.2 Mm^3 of AFD in ETF
- 16.7 Mm^3 of CST/TSRU in IPC3
- 5.9 Mm^3 of TT/CST in IPC4

The RTR volume increased from 6.6 Mm^3 reported in 2023.

11.3 Treatment Options and Continuous Improvement

Muskeg River reported that its approved tailings treatment technologies are operating as expected. Deposits are meeting performance criteria and remain aligned with long-term closure and reclamation objectives.

Muskeg River reported continuous improvement in the CFFT/CST mixed deposit tailings treatment technology. CNUL conducted multi-scale trials in 2024 to assess how sand content might improve CFFT consolidation properties. An alternative polymer was tested at the Jackpine mine centrifuge plant units 3 and 4. The test determined that a dosage of 900 g/t dry solids at a 0.4% concentration had a similar flocculation quality as the current polymer dosage of 1000 g/t at a 0.4% concentration.

Using this alternative polymer, approximately 120 000 dry tonnes of fluid tailings were treated, producing 192 000 m^3 of CFFT at 45% solids. CFFT from both polymer treatments was deposited into the Jackpine mine ETF, forming a CFFT/CST mixed deposit, with subsequent CST deposition. CNUL reported that, regardless of the polymer used, the performance of the CFFT/CST mixed deposit is expected to be the same.

CNUL will continue to investigate the CFFT/CST mixed deposit and report on performance in the annual TMR. The results will optimize the formation of mixed deposits and inform closure design.

Muskeg River reported no issues with tailings treatment technology in 2024.

11.4 Technological Innovation in Fluid Tailings Treatment

In 2024, CNUL continued its research at the Muskeg River and Jackpine mines for the following pilots:

- fluid tailings consolidation: casing project
- soft deposit capping: CC test cell capping
- CFFT and CST mixed deposit continuous improvement

Muskeg River received approval on November 3, 2023, to continue the ILF FT/CST mixing pilot in 2024 and 2025, which included building and operating a new pilot facility in IPC4.

The consolidation test results showed that ILF FT/CST mixed deposits and CFFT/CST mixed deposits with similar void ratios and SFRs have similar compressibility, while ILF FT/CST material has greater hydraulic conductivity. Consequently, an ILF FT/CST mixed deposit is expected to consolidate to a similar magnitude of ultimate settlement faster than CFFT/CST mixed deposits with similar initial void ratios and SFRs.

The reported performance of the Muskeg River and Jackpine mine deposits has exceeded expectations. Deposits at the Muskeg River and Jackpine mines are both achieving an average of approximately 70% solids content within one year. (The current Jackpine mine ILF RTR criteria is 60% solids content by weight in three years, and 70% in five years.) The AER will continue to monitor this performance and ensure the approved profile reflects the actual treatment capacity. Muskeg River is expected to submit an ILF RTR application in 2025.

In December 2024, as required by their *EPEA* approvals, CNUL and CNRL submitted a joint tailings research and development report that included technology development at the Muskeg River, Jackpine, and Horizon mines.

CNUL continues its industry collaboration through external forums such as COSIA.

In 2024, initial research results from the CNUL tailings biogeochemical testing were provided in the TMR. The research is investigating the risk of acid rock drainage (ARD) potential of TSRU tailings. CNUL reported that the initial results indicate that localized ARD conditions may develop above the phreatic surface in active TSRU tailings beaches. Howeverthe results also indicate that these acidic conditions in the beaches are not likely to persist once the beaches are submerged during tailings cell infilling. CNUL indicated that, where possible, future TSRU tailings will be deposited below the phreatic surface of tailings cells at closure to limit or eliminate the oxidation of sulphide minerals. The AER will work closely with CNUL on the potential implementation of current and future learnings to address the potential acid-generating material in tailings deposits.

Refer to the Muskeg River mine and Jackpine mine 2024 TMRs for more information on technological innovation.

11.5 Regulatory and Management Actions

Muskeg River operates at management level 1 as described in the *TMF* and *Directive 085*.

Muskeg River requested changes to the IPC5 base-of-feed levelling (BOFL) plan on November 27, 2023, which the AER approved on January 12, 2024. The request was to update the 2021 authorization IPC5 BOFL activity to address geotechnical stability and the quaternary liner.

The AER authorized Muskeg River to proceed with the BOFL construction, which increases the volume of non-tailings material in IPC5 from 10% to 12.5% to accommodate updates in geotechnical design and planning.

The AER initiated a desktop inspection of Muskeg River's fluid tailings volume for IPC3 in response to the modelling content presented to the AER during the tailings annual pre-field inspection presentation. The AER issued an SIR requesting additional measurement information because material meeting the definition of fluid tailings was presented as meeting RTR. The AER will continue to work with Muskeg River to understand the material that was presented.

11.6 Measurement System Audit Results

Muskeg River submitted an updated MSP in December 2024 that aligned with the updated approvals, the TMP submitted in April 2022, and the responses to the AER's November 2024 SIR.

The AER requested the 2023 fluid tailings and clear water zone surface data and completed an initial desktop audit of Muskeg River's fluid tailings and ponded water volumes to verify reported values. Fluid tailings volumes modelled by the AER were within an acceptable margin of error compared with the volumes reported by Muskeg River (see table 17).

In 2024, the AER requested additional data for clarification and will report on the comparison in 2025.

Table 17. Reported 2023 fluid tailings volumetric audit results for CNUL Muskeg River

Deposit/pond	Reported fluid tailings volumes (Mm^3)	AER estimated fluid tailings volumes (Mm^3)	Reported ponded water volumes (Mm^3)	AER estimated water volumes (Mm^3)
ETF	18.9	18.84	0.0	Not available
Upper AFD (ETF)	1.0	Not available	Not available	Not available
IPC1	27.7	27.73	10.0	10.73
IPC2	48.3	48.29	9.0	8.94
IPC3	33.7	33.68	1.4	1.41
IPC4N	14.3	14.35	2.9	2.88
IPC4S	0.8	0.80	0.1	0.07
Total	**144.7**	**144.68**	**23.4**	**24.02**

12 Canadian Natural Upgrading Limited – Jackpine Mine Fluid Tailings Status

In 2024, five tailings facilities were operating at the Jackpine mine (see table 18).

The tailings facilities vary in their primary function, contents, and size. The ETF-W and ETF-E comprise the ETF. The ETF and sand cell 2 (SC2) are the only out-of-pit tailings facilities at the site. IPC1 and fluid cell 1 (FC1) are in-pit facilities.

Table 18. Tailings facilities operating at CNUL Jackpine

Facility	Function	Contents
ETF-western (ETF-W)	Treated tailings (TT/CST, and CFFT/CST) Storage Recycle water storage	TT/CST CFFT/CST Centrate Recycle water
ETF-eastern (ETF-E)	Fluid and solid tailings storage CST deposited for cell construction and Beaching activities to build containment Recycle water source	Fluid tailings CST Recycle water
SC2	Fluid and solid tailings storage CST deposited for cell construction and Beaching activities to build containment Recycle water transfer to ETF	Fluid tailings CST
FC1	Fluid and solid tailings storage CST deposited for cell construction and Beaching activities to build containment ILF treated tailings storage for piloting purposes Recycle water transfer to ETF	Fluid tailings CST ILF Recycle water
IPC1	Fluid and solid tailings storage Treated tailings (TT/CST, and CFFT/CST) storage Recycle water transfer to ETF	WT CST

The fluid tailings treatment technologies approved for commercial operation at the Jackpine mine are

- TT/CST mixed deposit,
- CFFT/CST mixed deposit,
- AFD, and
- ILF FT/CST mixed deposit.

Jackpine treated 4.2 Mm^3 of fluid tailings, exceeding its TMP treatment commitment of 1.4 Mm^3, breakdown as follows:

- TT in ETF: 2.0 Mm^3 (0.0 Mm^3 planned)
- TT in FC1: less than 0.05 Mm^3 (1.4 Mm^3 planned)
- CFFT in ETF: 2.2 Mm^3 (0.0 Mm^3 planned)

Jackpine reported that its new and legacy fluid tailings inventories for 2024 were within the approved fluid tailings profiles.

12.1 Fluid Tailings

For 2024, Jackpine reported a total fluid tailings inventory (new and legacy fluid tailings combined) of 27.2 Mm^3, up from 24.9 Mm^3 in 2023.

Volumes reported for 2024 fall within currently approved profiles for new and legacy fluid tailings inventories.

For 2024, Jackpine reported that 2.0 Mm^3 of fluid tailings met its approved RTR criteria, down from 4.9 Mm^3 in 2023.

The RTR status requires Jackpine to meet the approved subobjective 1 and 2 criteria (see table19), which are included in appendix C to *OSCA* approval 9756K. There are no assigned RTR criteria for SC2.

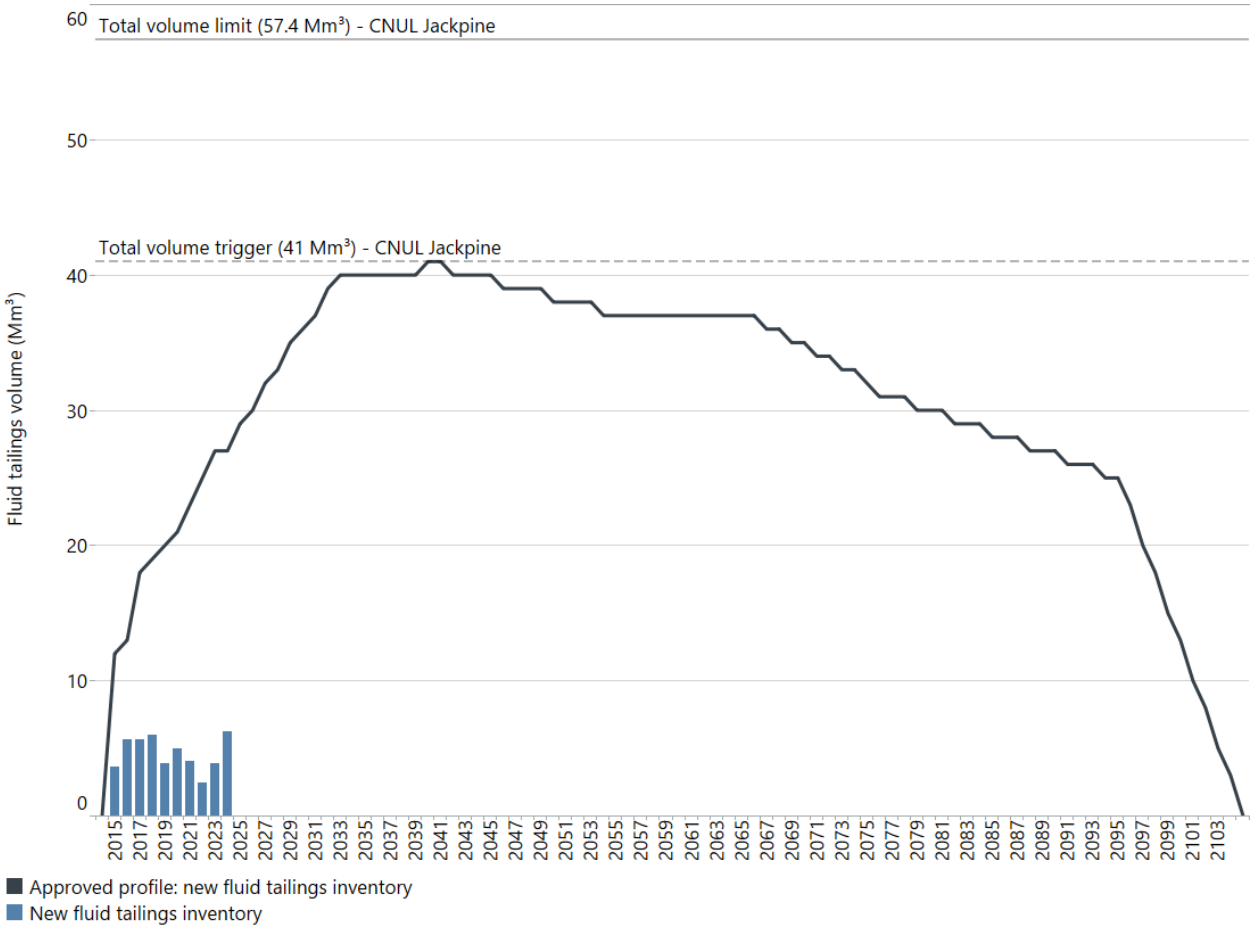
Table 19. RTR criteria for CNUL Jackpine

Deposit	Subobjective	RTR criteria
CFFT/CST mixed deposits	subobjective 1	60% solids by weight within three years of tailings placement based on deposit sampling. 70% solids by weight within five years of tailings placement based on deposit sampling.
	subobjective 2	Groundwater adjacent or in communication with fluid tailings deposits is to be effectively monitored, reported, managed, and mitigated as required by *EPEA* approval 00153125-01-00, as amended or renewed.
TT/CST mixed deposit	subobjective 1	70% solids by weight within five years of tailings placement based on deposit sampling.
	subobjective 2	Groundwater adjacent or in communication with fluid tailings deposits is to be effectively monitored, reported, managed, and mitigated as required by *EPEA* approval 00153125-01-00, as amended or renewed.
AFD deposit	subobjective 1	50% solids by weight within one year of tailings placement, based on deposit sampling. 75% by weight within five years of tailings placement, based on deposit sampling.
	subobjective 2	Groundwater adjacent or in communication with fluid tailings deposits is to be effectively monitored, reported, managed, and mitigated as required by *EPEA* approval 00153125-01-00, as amended or renewed.

12.1.1 New Fluid Tailings

For 2024, Jackpine reported a new fluid tailings inventory of 6.2 Mm^3 (see figure 15), up from 3.9 Mm^3 in 2023. The approved new fluid tailings inventory for 2024 was 27 Mm^3.

Jackpine has a total volume trigger for new fluid tailings inventory of 41 Mm^3 and a total volume limit of 57.4 Mm^3. Based on data reported in its 2024 TMR, Jackpine was within its approved new fluid tailings profile and did not exceed its total volume trigger or total volume limit for new fluid tailings in 2024.



Note: Tailings volumes are presented as reported by operators and are subject to change upon further review by the AER, including an assessment of whether volumes meet the RTR criteria.

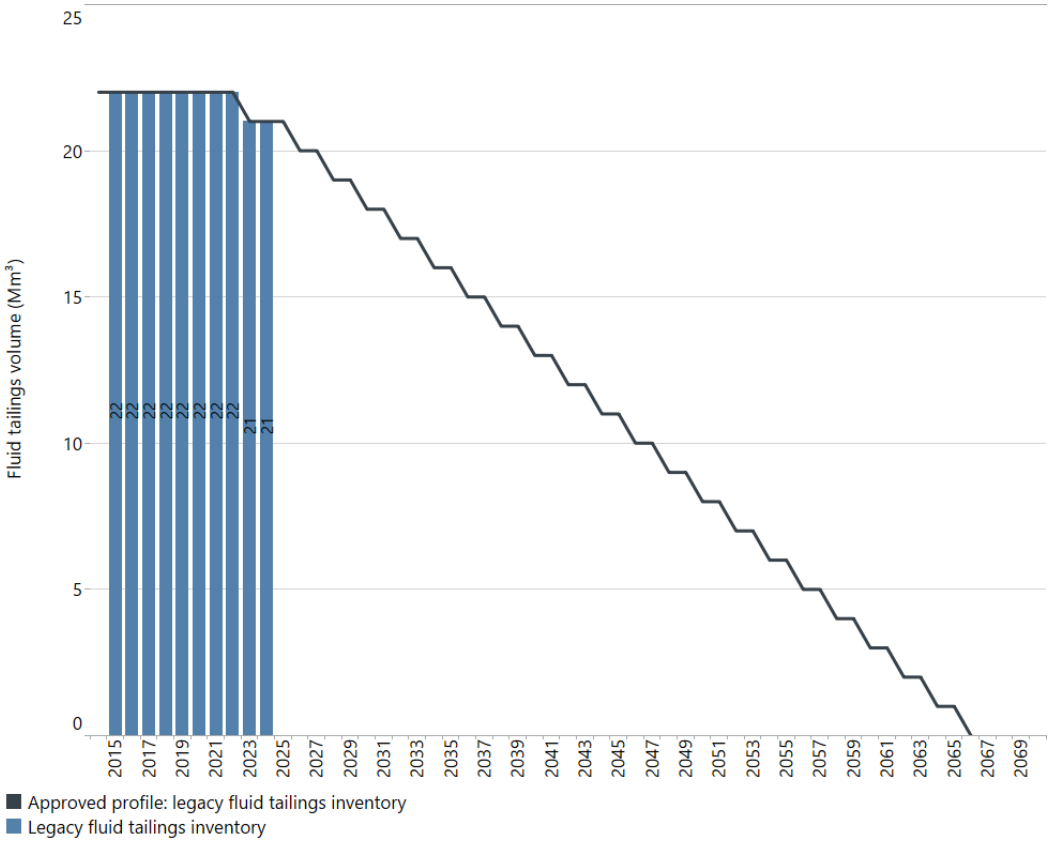
Data are from the site-wide fluid tailings inventory table (appendix 3 of *Directive 085*) submitted annually by operators.

Figure 15. New fluid tailings for CNUL Jackpine, 2014 to 2024

12.1.2 Legacy Fluid Tailings

For 2024, Jackpine reported a legacy fluid tailings inventory of 21 Mm^3 (see figure 16), unchanged from 2023. The approved legacy fluid tailings inventory for 2024 was 21 Mm^3.

Based on data reported in its 2024 TMR, Jackpine was within its approved legacy fluid tailings profile and did not exceed its profile deviation trigger for legacy fluid tailings in 2024.



Note: Tailings volumes are presented as reported by operators and are subject to change upon further review by the AER, including an assessment of whether volumes meet the RTR criteria.

Data are from the site-wide fluid tailings inventory table (appendix 3 of *Directive 085*) submitted annually by operators.

Figure 16. Legacy fluid tailings for CNUL Jackpine, 2014 to 2024

12.2 Volume of Treated Fluid Tailings by Technology

For 2024, Jackpine reported that 2.2 Mm^3 of fluid tailings were treated with TT/CST co-mixing and CFFT/CST co-mixing in the ETF. The total deposition volumes per treatment technology are:

- 2.0 Mm^3 of TT into the ETF
- 2.2 Mm^3 of CFFT into the ETF

TT were deposited in FC1 starting in December 2024. Reporting of FC1 TT/CST mixed deposit will start in 2025.

No RTR was claimed for the ILF FT/CST mixed deposit in 2024, as the RTR criteria were under review.

For 2024, Jackpine reported that 2 Mm^3 of fluid tailings had achieved RTR status:

- 1.7 Mm^3 of CFFT/CST in the ETF
- 0.3 Mm^3 of TT/CST in the ETF

The RTR volume decreased from 4.9 Mm^3 reported in 2023.

12.3 Treatment Options and Continuous Improvement

Jackpine reported that its tailings treatment technologies are operating as expected, and deposits are meeting performance criteria and remain aligned with long-term closure and reclamation objectives.

Jackpine reported that both centrifuge units were shutdown, ending CFFT deposition in October 2024. The CFFT/CST mixed deposit that formed after the 2024 tailings investigation will be assessed in 2025.

Jackpine reported no issues with their tailings treatment technologies in 2024. No concerns with treatment capacity were reported in 2024.

12.4 Technological Innovation in Fluid Tailings Treatment

CNUL pursues technological innovation in fluid tailings management at both the Muskeg River and Jackpine mines. The findings are applicable to both sites. See section 8.4.4 for details on the current technological research.

12.5 Regulatory and Management Actions

Jackpine operates at management level 1 as described in the *TMF* and *Directive 085*.

In 2024, Jackpine was required to provide an update on the consolidation model for the ETF under condition 41 of their approval. The next consolidation model updates are in 2027 for FC1 and IPC1.

On December 5, 2024, Jackpine applied for commercial approval for the ILF FT/CST mixed deposit treatment technology, associated RTR criteria, and a change to the IPC1 deposition strategy.

During the administrative review, the AER was concerned with the wording of the proposed subobjective 2 criteria. The application remained under review into 2025. The transition to commercial-scale ILF production at Jackpine is expected to start in 2026 in IPC1.

12.6 Measurement System Audit Results

Jackpine submitted an updated MSP in December 2024 that aligned with the updated approvals, the TMP submitted in April 2022, and the responses to the AER's November 2024 SIR.

The AER requested the 2023 fluid tailings and clear water zone surface data and completed an initial desktop audit of Jackpine's fluid tailings and ponded water volumes to verify reported values. Fluid tailings volumes modelled by the AER were within an acceptable margin of error compared with the volumes reported by Jackpine (see table 20).

In 2024, the AER requested additional data for clarification and will report on the comparison in 2025.

Table 20. Reported 2023 fluid tailings volumetric audit results for CNUL Jackpine

Deposit/pond	Reported fluid tailings volumes (Mm^3)	AER estimated fluid tailings volumes (Mm^3)	Reported ponded water volumes (Mm^3)	AER estimated water volumes (Mm^3)
ETF	18.1	18.13	7.8	7.82
SC2	5.5	5.51	2.2	2.17
FC1	2.3	2.29	7.1	7.15
IPC1	0.0	Not available	6.3	Not available
Total	**25.9**	**25.92**	**23.4**	**23.44**

13 Canadian Natural Resources Limited – Horizon Mine Fluid Tailings Status

In 2024, two tailings facilities were operating at Horizon (see table 21).

The tailings facilities vary in their primary function, contents, and size. ETF/DDA1 is the only out-of-pit tailings facility at the site.

Table 21. Tailings facilities operating at CNRL Horizon

Facility	Function	Contents
ETF/DDA1	Fluid and solid tailings storage Recycle water source	NST (eNST, esNST) NRU Recycle water
DDA2	Fluid and solid tailings storage	NST (eNST, esNST)

The fluid tailings treatment technologies approved for commercial operation at Horizon are NST, eNST, and esNST.

Horizon treated 145.5 Mm^3 of fluid tailings as per its TMP treatment commitment.

Horizon reported that its new and legacy fluid tailings inventories for 2024 were within the approved fluid tailings profiles.

13.1 Fluid Tailings

For 2024, Horizon reported a total fluid tailings inventory (new and legacy fluid tailings combined) of 152.4 Mm^3, up from 148.5 Mm^3 in 2023.

Volumes reported for 2024 fall within currently approved profiles for new and legacy fluid tailings inventories.

For 2024, Horizon reported that 84.7 Mm^3 of fluid tailings met its approved RTR criteria, down from 87.8 Mm^3 in 2023. Horizon reports individual components of incremental RTR volumes in units of million tonnes and total RTR volume in Mm^3, resulting in a need to isolate the fines component. The AER has adjusted the accepted RTR volumes to reflect only the estimated fines component of the RTR tailings volume in Mm^3. The AER has accepted 11.5 Mm^3 of fluid tailings as having met approved RTR in 2024, down from 11.6 Mm^3 in 2023.

The RTR status requires Horizon to meet the approved subobjective 1 and 2 criteria (see table 22), which are included in appendix C to *OSCA* approval 9752O, approved February 3, 2025.

There are no approved RTR criteria for the NRU tailings and NRU treated tailings (NRUTT).

Table 22. RTR criteria for CNRL Horizon

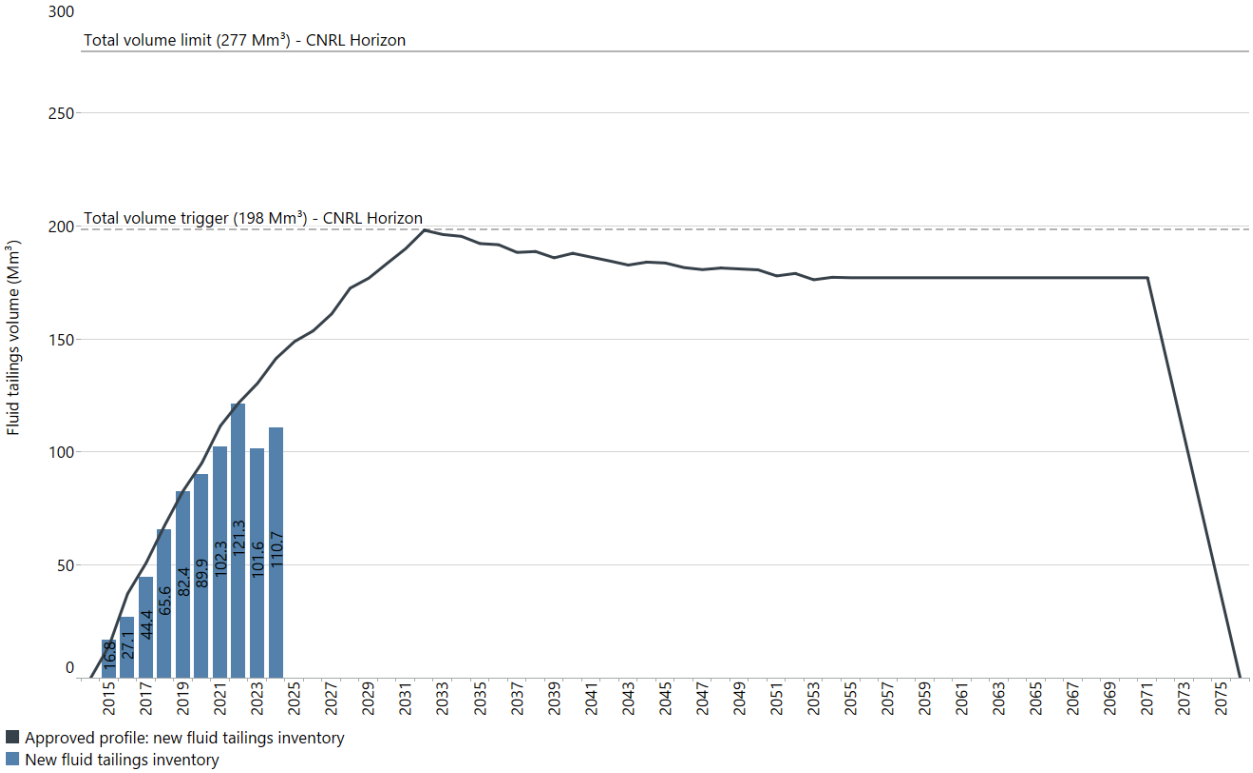
Deposit	Subobjective	RTR criteria
ETF/DDA1, DDA2, DDA3, DDA4/5, DDA6, DDA7, DDA8 and DDA9	subobjective 1	70% solids by weight within one year of tailings placement, based on deposit sampling. 75% solids by weight within five years of starting backfilling*.
	subobjective 2	Groundwater is monitored as required by *EPEA* approval 00149968-01-00, as amended or renewed.

* Where backfilling is defined as the approximate final 5% of the planned NST deposition for each DDA.

13.1.1 New Fluid Tailings

For 2024, Horizon reported a new fluid tailings inventory of 110.7 Mm^3 (see figure 17), up from 101.6 Mm^3 in 2023. The approved new fluid tailings inventory for 2024 was 141.3 Mm^3.

Horizon has a total volume trigger for new fluid tailings inventory of 198 Mm^3 and a total volume limit of 277 Mm^3. Based on data reported in its 2024 TMR, Horizon was within its approved new fluid tailings profile and did not exceed its total volume trigger or total volume limit for new fluid tailings in 2024.



Note: Tailings volumes are presented as reported by operators and are subject to change upon further review by the AER, including an assessment of whether volumes meet the RTR criteria.

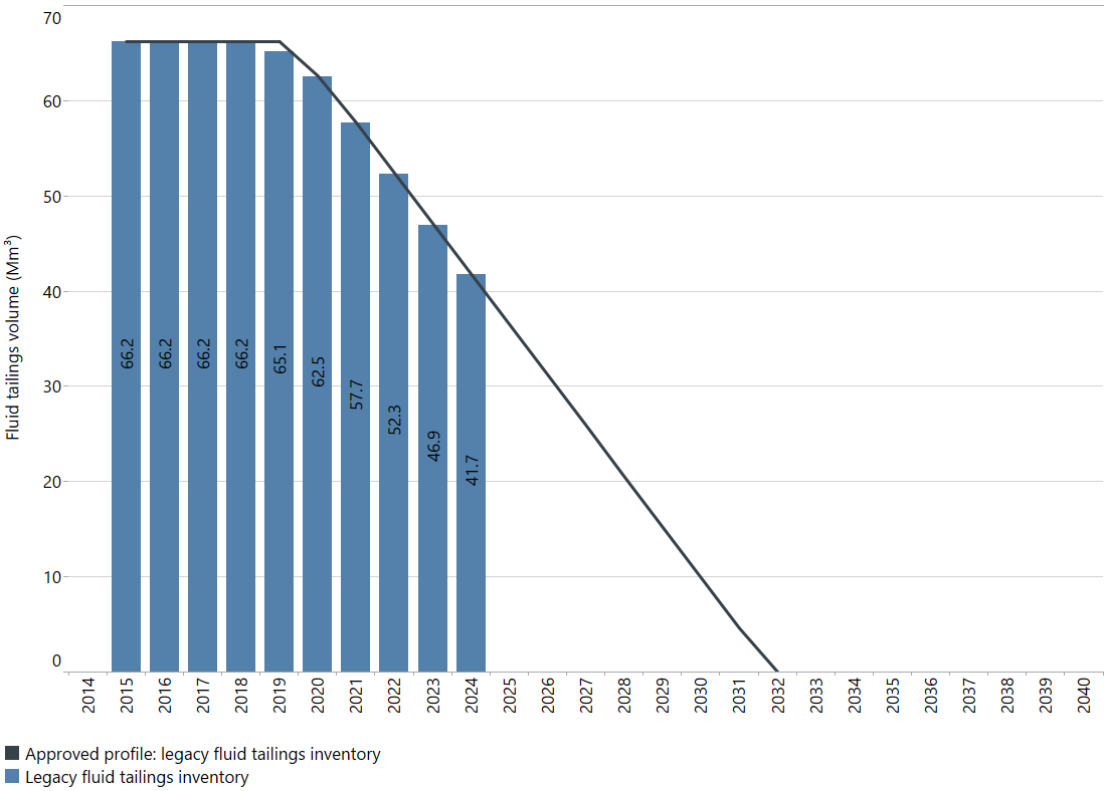
Data are from the site-wide fluid tailings inventory table (appendix 3 of *Directive 085*) submitted annually by operators.

Figure 17. New fluid tailings for CNRL Horizon, 2014 to 2024

13.1.2 Legacy Fluid Tailings

For 2024, Horizon reported a legacy fluid tailings inventory of 41.7 Mm^3 (see figure 18), down from 46.9 Mm^3 in 2023. The approved legacy fluid tailings inventory for 2024 was 41.8 Mm^3.

Based on data reported in its 2024 TMR, Horizon was within its approved legacy fluid tailings profile and did not exceed its profile deviation trigger for legacy fluid tailings in 2024.



Note: Tailings volumes are presented as reported by operators and are subject to change upon further review by the AER, including an assessment of whether volumes meet the RTR criteria.

Data are from the site-wide fluid tailings inventory table (appendix 3 of *Directive 085*) submitted annually by operators.

Figure 18. Legacy fluid tailings for CNRL Horizon, 2014 to 2024

13.2 Volume of Treated Fluid Tailings by Technology

For 2024, Horizon reported that 138.5 Mm³ of fluid tailings were treated with NST treatment technology in DDA2.

For 2024, Horizon reported that 84.7 Mm³ of fluid tailings had achieved RTR status:

- 1.3 Mm³ of fluid tailings in ETF/DDA1
- 83.4 Mm³ of fluid tailings in DDA2

The RTR volume decreased from 87.9 Mm³ reported in 2023.

13.3 Treatment Options and Continuous Improvement

Horizon reported that its tailings treatment technologies are operating better than expected, and deposits are meeting performance criteria.

Horizon reported the following technology issues, mitigations, and continuous improvements for the tailings treatment technology in 2024:

- Maximizing the underflow density in the thickener. Since the target flocculation may not be optimal to produce the highest-density underflow in all feed scenarios, a new flocculant was trialed to improve underflow density without affecting overflow water quality. Additionally, since the thickener underflow density is dependent on feed properties, rates, and mechanical safeguards, advanced process control was implemented and refined for thickeners. The improved thickener underflow density is expected to result in a higher NST density.
- Enhancing eNST and esNST to optimize polymer addition to improve performance at deposit locations.
  - The polymer skid has capacity limitations in certain process conditions; therefore, a lower molecular weight polymer was trialed to reduce the viscosity of the solution and mitigate pressure drop. This improvement aims to maximize the operation of eNST/esNST products.
  - The polymer skid addition is based on manual sampling, which lacks real-time responsiveness. The optimization of dosage by development of regression to predict product quality and fines capture is expected to reduce slurry segregation upon deposition and increase fines capture on the beach.
- Improving eNST and esNST by increasing fluid tailings harvesting. For certain process conditions, fluid tailings harvesting can be limited; therefore, the SFR target was reduced from 4.0 to 3.75. This change is intended to increase fluid tailings capture without compromising settling performance.

Horizon reported the following performance improvements in 2024:

- Year-end NST on-specification density performance in 2024 was 91.1%. This was the highest level achieved since startup and exceeded the TMP target of 85%. Horizon reported a change to the expected treatment capacity based on the improvements. The expected treatment capacity was improved in 2024.
- Production of enhanced NST products, specifically esNST, achieved more than 60% runtime.
- The NRUTT facility will be upgraded to recover residual solvent (naphtha) and bitumen from the NRU tailings stream. Construction is underway, and commissioning is expected in late 2027.

13.4 Technological Innovation in Fluid Tailings Treatment

Throughout 2024 Horizon continued their research in the following areas:

- modified AFD
- NRU treatment
- Horizon tailings biogeochemical evaluation project:
  - Tailings Associated Metal Leaching-ARD
  - Tailings Associated Biogenic Gas Production
  - Horizon Biogeochemical Field Monitoring Program

- -tailings capping studies:
  - tailings consolidation assessments
  - NST capping project: four-year meso-scale column study
  - NST reclamation field trial vegetation research
- pit lake research
  - demonstration pit lake (Mesocosms)
  - BML
  - Lake Miwasin demonstration pit lake

CNRL plans to implement NRUTT technology to reduce biogeochemical risks associated with NRU tailings by recovering residual solvent (i.e., naphtha) and bitumen from the NRU tailings stream.

Refer to Horizon's 2024 TMR, appendices C and D, for more information on technological innovation.

In December 2024, as required by their *EPEA* approvals, CNRL and CNUL submitted a joint tailings research and development report that included technology development at the Muskeg River, Jackpine, and Horizon mines.

CNRL continues its industry collaboration through external forums such as COSIA.

13.5 Regulatory and Management Actions

Horizon operates at management level 1 as described in the *TMF* and *Directive 085*.

Horizon submitted an NST vegetation field trial to the AER for approval on May 27, 2024. The AER reviewed the proposal and determined that *EPEA* requirements were not met, and that an *EPEA* amendment application would be required for the proposed pilot location at plant site waste area 4. On January 30, 2025, the AER issued a letter to Horizon noting the following concerns from its review:

- Tailings materials would be placed in an area that has not been assessed or designated for tailings deposition.
- The area of the proposed pilot is not integrated with the existing closed-circuit water management system.
- The monitoring and mitigation measures in the proposal appear to be reactive. The AER noted that further background monitoring and proactive mitigation could be attained through enhancements to the groundwater monitoring well network in the area adjacent to the proposed pilot.

Furthermore, the AER stated the following expectations in its letter:

- The volume of NST moved from its final location cannot be claimed as RTR and must be quantified and incorporated back into the fluid tailings profile.

- Horizon should ensure NST material sourced from DDA2 is extracted using an approach that minimizes segregation and alteration of the materials to maintain the physical and chemical characteristics of the NST material at the pilot location.
- The coke material proposed for this pilot requires a separate sterilization application under *OSCA*.
- Horizon must submit an updated dump design of plant site waste area 4 for review and authorization before executing the pilot.

The AER awaits Horizon's decision to either find a different pilot location or to submit an *EPEA* amendment application in 2025.

An application for modifications to the NRUTT facility was submitted to the AER in June 2024 and approved on December 20, 2024.

OSCA approval 9752M requires Horizon to submit an updated TMP to the AER by June 30, 2024. Horizon requested an extension to June 30, 2025, to support a cohesive regulatory review. The AER requires alignment between the LMCP, TMP, *EPEA,* and *Water Act* approval renewals due to the interrelated nature of mine development, which sets the foundation for tailings management and closure, conservation, and reclamation. The AER approved an extension to August 1, 2025, to align with *Water Act* and *EPEA* application submittals.

13.6 Measurement System Audit Results

Horizon submitted an updated MSP in December 2024 to align with updated approvals and the proposed amendments to NST RTR subobjectives 1 and 2 performance criteria submitted in 2023 and 2024.

The AER requested the 2023 fluid tailings and clear water zone surface data and completed an initial desktop audit of Horizon's fluid tailings and ponded water volumes to verify reported values. Fluid tailings volumes modelled by the AER were within an acceptable margin of error compared with the volumes reported by Horizon (see table 23).

In 2024, the AER requested additional data for clarification and will report on the comparison in 2025.

Table 23. Reported 2023 fluid tailings volumetric audit results for CNRL Horizon

Deposit/Pond	Reported fluid tailings volumes (Mm^3)	AER estimated fluid tailings volumes (Mm^3)	Reported ponded water volumes (Mm^3)	AER estimated water volumes (Mm^3)
ETF/DDA1	144.0	144.93	17.5	16.96
DDA2	4.3	0.04	1.6	1.77
Total	**148.3**	**145.0**	**19.1**	**18.72**

14 Imperial Oil Resources Limited – Kearl Fluid Tailings Status

In 2024, three tailings facilities were operating at the Kearl mine (see table 24).

The tailings facilities vary in their primary function, contents, and size. The east external tailings area (EETA) and west external tailings area (WETA) are out-of-pit tailings facilities. In-pit tailings area 1 (ITA1) is the only in-pit facility at the site.

Table 24. Tailings facilities operating at Imperial Kearl

Facility	Function	Contents
EETA	Fluid storage Solids storage	TT CST ILF/eILF
WETA	Fluid storage Solids storage	CST Flotation tailings TSRU tailings
ITA1	Fluid storage Solids storage	CST TSRU

The fluid tailings treatment technology approved for commercial operation at Kearl is the Kearl fine tailings treatment (KFTT) process, where fluid tailings and flotation tailings are combined and processed through a thickener.

Kearl treated 13.1 Mm^3 of fluid tailings through the KFTT process and a further 5.9 Mm^3 through the ILF and eILF pilot facilities for a total of 19.0 Mm^3 compared with its TMP treatment target of 19.6 Mm^3.

Kearl reported that its new fluid tailings inventories for 2024 were within the approved fluid tailings profile.

14.1 Fluid Tailings

For 2024, Kearl reported a total fluid tailings inventory (all new fluid tailings) of 123.9 Mm^3, up from 112.9 Mm^3 in 2023.

Volumes reported for 2024 fall within the approved profile for new fluid tailings in effect in 2024.

Kearl did not report any volumes as having met RTR in 2024 due to the environmental protection order (EPO) issued in 2023 and ongoing investigation.

The RTR status requires Kearl to meet the approved subobjective 1 and 2 criteria (see table 25), which are included in appendix C to *OSCA* approval 10829. There are no approved RTR criteria for ILF/eILF.

Table 25. RTR criteria for Imperial Kearl

Deposit	Subobjective	RTR criteria
EETA	subobjective 1	65% solids content by weight within one year of treated fluid tailings placement based on deposit sampling.
	subobjective 2	Groundwater is monitored in accordance with *EPEA* approval 00046586-01-00, as amended or renewed.

14.1.1 New Fluid Tailings

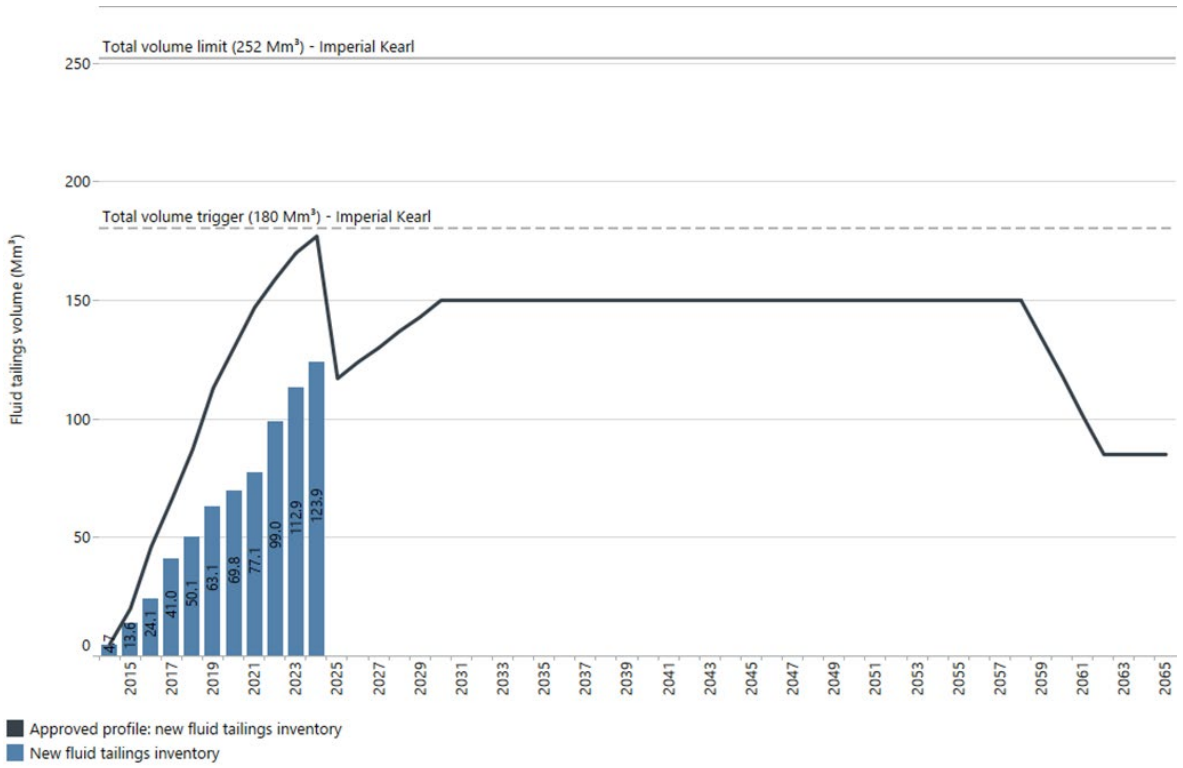
For 2024, Kearl reported a new fluid tailings inventory of 123.9 Mm^3 (see figure 19), up from 112.9 Mm^3 in 2023. The approved new fluid tailings inventory for 2024 was 177.0 Mm^3.

The fluid tailings inventory reflects the following actions:

- The volumes of fluid tailings in the WETA southeast area were confirmed based on sampling and analysis in 2024. Kearl provided corrected site-wide fluid tailings volumes for 2019 to 2024.
- Kearl voluntarily returned all tailings previously determined as meeting RTR criteria to the fluid tailings profile for failing to meet the intent of subobjective 2.

In response to an SIR issued by the AER, Kearl noted a discrepancy in the reported volumes of fluid tailings in the EETA. When delineating the TT contribution from ILF/eILF, the volume of ILF/eILF was mistakenly added to the total volume of TT (it was already included in the measured value). Kearl provided corrected site-wide fluid tailings volumes for 2022 to 2024 to the AER.

Kearl has a total volume trigger for new fluid tailings inventory of 180 Mm^3 and a total volume limit of 252 Mm^3 for 2024. Based on data reported in its 2024 TMR, Kearl was within its approved new fluid tailings profile and did not exceed its total volume trigger or total volume limit for new fluid tailings in 2024.



Note: Tailings volumes are presented as reported by operators and are subject to change upon further review by the AER, including an assessment of whether volumes meet the RTR criteria.

Data are from the site-wide fluid tailings inventory table (appendix 3 of *Directive 085*) submitted annually by operators.

Figure 19. New fluid tailings for Imperial Kearl, 2014 to 2024

14.1.2 Legacy Fluid Tailings

Kearl does not have any legacy fluid tailings (i.e., fluid tailings in storage before January 1, 2015). The small amount of fluid tailings on the site in 2014 is considered new fluid tailings to simplify fluid tailings management and reporting.

14.2 Volume of Treated Fluid Tailings by Technology

For 2024, Kearl reported that 13.1 Mm^3 of fluid tailings were treated through the KFTT process. A further 5.9 Mm^3 of fluid tailings were treated through the ILF and eILF processes, totalling 19.0 Mm^3 treated in 2024. This compares with the target volume of 19.6 Mm^3 (97% of target).

Kearl was approved to implement and produce ILF/eILF on a pilot basis without approved RTR criteria. Imperial is required to provide RTR criteria for the ILF/eILF technologies in 2025.

As of 2024, Kearl reported that a total of 37.6 Mm^3 of TT had been produced through the thickeners, and 36.6 Mm^3 (97.3 %) achieved subobjective 1 RTR status. In comparison, in 2023, 30.5 Mm^3 of TT was produced through the thickeners, and 27.6 Mm^3 (90.5%) achieved subobjective 1 status. ILF/eILF and CST were co-deposited with TT in the EETA.

14.3 Treatment Options and Continuous Improvement

Kearl reported that its tailings treatment technologies are operating as expected, and deposits are meeting subobjective 1 performance criteria and remain aligned with long-term closure and reclamation objectives.

In 2024, Kearl made the following improvements to the fluid tailings removal and treatment facilities to address operational challenges:

- Installed new piping systems to interconnect the various FFT supply sources to all fines treatment processes.
- Implemented an improved primary separation cell middlings withdrawal method to improve flotation tailings feed to the thickeners.
- Implemented improvements to the thickener underflow pump and piping systems.
- Installed a second dredge in the WETA to boost treatment capacity.

Kearl reported that these changes resulted in improved fines treatment performance. Kearl also reported on the following ongoing improvements:

- co-deposition of CST-TT and ILF-TT
- maintaining a smaller pond in the TT deposit to leverage the effect of conditions in the subaerial area
- gravity drainage of low-solids content material into the EETA

14.4 Technological Innovation in Fluid Tailings Treatment

Throughout 2024, Kearl piloted and studied ILF and eILF, and the effects of co-depositing these streams with TT and CST. Results show that the deposits are consolidating well, reaching nearly 80% solids with an average SFR of 1.92. The AER granted an extension of the pilot program to September 2025 and expects Kearl to submit an RTR application in 2025.

Kearl submitted a tailings research report as per its *EPEA* approval and continued its industry collaboration through external forums such as COSIA.

Refer to Kearl's 2024 TMR for more information on technological innovation.

14.5 Regulatory and Management Actions

Because of the active EPO issued to Imperial in February 2023 and the ongoing investigation, the AER cannot determine the management level for Kearl's tailings operation at this time. Once the AER concludes its formal investigation, the AER will take the following actions:

- Review and decide on fluid tailings volumes that meet approved RTR criteria.
- Determine the appropriate management level classification for Kearl's tailings operation.
- Use any regulatory instruments, including regulatory tools and enforcement actions, it deems appropriate, depending on the classification of the management level.
- Formally communicate to Imperial the decision regarding its RTR criteria compliance status, the classification of the management level of its tailings operation, and the applicable regulatory and enforcement actions.

In August 2024, the AER imposed an administrative penalty and issued terms and conditions in response to the seepage incident at Kearl. Imperial continues to monitor and manage seepage as per the sampling and monitoring plan and the source control and containment plan required by the EPO. As of December 2024, the remaining components of the investigation were ongoing.

In February 2024, AER inspectors observed discoloured water seepage and erosion features at the base of the tailings dike at the north end of the WETA. The AER issued a notice of noncompliance directing Imperial to develop an action and mitigation plan. The plan was submitted, and remedial work was completed.

The AER conducted a site tailings inspection in June of 2024. No issues of concern were found.

In 2025, a new fluid tailings profile was issued as part of *OSCA* approval 10829P for the mine and tailings management plan integrated application submitted in 2022. The new profile is substantially lower than the previous profile. The total volume trigger and limit were revised accordingly.

Revised subobjective 2 criteria have been included in Kearl's *OSCA* approval 10829P. Imperial plans to submit new subobjective 1 RTR criteria for the treated deposits in the EETA and for ILF/eILF in 2025.

14.6 Measurement System Audit Results

Kearl submitted an updated MSP in January 2024 to account for tailings placement in ITA1 and to document changes in the QA/QC program. The AER expects Kearl to update the MSP in 2025 to account for the revised subobjective 2 criteria in the amended *OSCA* approval (2025) and for the subobjective 1 RTR criteria for ILF/eILF deposits.

The AER requested the 2023 fluid tailings and clear water zone data and initiated an initial desktop audit of Kearl's fluid tailings and ponded water volumes to verify reported values. Fluid tailings volumes modelled by the AER were within an acceptable margin of error compared with the volumes reported by Kearl (see table 26).

Table 26. Reported 2023 fluid tailings volumetric audit results for Imperial Kearl

Deposit/Pond	Reported fluid tailings volumes (Mm^3)	AER estimated fluid tailings volumes (Mm^3)	Reported ponded water volumes (Mm^3)	AER estimated water volumes (Mm^3)
WETA	63.0	63.04	14.0	11.24
EETA	3.0	1.12	1.0	0.10
TT deposit area	38.0	Not available	Not available	Not available
ITA1	0.4	0.50	3.8	1.25
Total	**104.4**	**102.67**	**18.50**	**12.59**

Kearl provided original survey data in 2024, and the AER completed a desktop audit of Kearl's fluid tailings and ponded water volumes for WETA, EETA, and ITA1. The AER issued an SIR to understand the discrepancy in reported fluid tailings for WETA, to request the TT deposit data, and to clarify the TT deposit modelling extents. In response, Imperial stated that a review completed by a third-party consultant estimated 16 Mm^3 of fluid tailings are present beneath the TSRU deposited in the southeast corner of WETA. Regarding the requested TT deposit data, Kearl did not provide the data; therefore, the reported fluid tailings volumes remain unverified. Additionally, Imperial identified discrepancies in their reported fluid tailings volumes in the TT deposit area and provided revised volumes to the AER in their SIR response.

Table 27. Reported 2024 fluid tailings volumetric audit results for Imperial Kearl

Deposit/pond	Reported fluid tailings volumes (Mm^3)	AER estimated fluid tailings volumes (Mm^3)	Reported ponded water volumes (Mm^3)	AER estimated water volumes (Mm^3)
WETA	73.7*	58.4	15.4	13.19
EETA	3.4	3.31	0.1	0.0
TT deposit area	37.6	Not available	Not available	Not available
ITA1	9.2	8.10	3.8	9.46
Total	**123.9**	**107.41**†	**19.3**	**22.65**

* The reported volume for WETA includes 16 Mm^3 of fluid tailings beneath the TRSU deposit.

† AER estimated fluid tailings total includes the reported estimate for the TT deposit area.

Fluid tailings volumes modelled by the AER were within an acceptable margin of error compared with the reported volumes for WETA, EETA, and ITA1. The AER will address the 2024 data for the TT deposit area in the *2025 Tailings Report*.

15 Suncor – Fort Hills Fluid Tailings Status

In 2024, three tailings facilities were operating at Suncor Fort Hills (see table 28).

The tailings facilities vary in their primary function, contents, and size. The out-of-pit tailings area (OPTA) and the out-of-pit tailings area east stage 1 (OES1) are the out-of-pit tailings facilities at the site.

Suncor Fort Hills commenced fluid tailings placement in the south pit tailings area (SPTA) in 2024, reporting that at the time of the 2024 field assessment, 7.7 Mm^3 of fluid tailings had been transferred from OPTA into SPTA. Suncor Fort Hills prioritized OPTA dike construction and transferring fluid tailings into the in-pit SPTA to manage fluid containment. Consequently, OES1 construction was limited, with minimal fluid placed in the OES1 facility to operate the fluid transfer barge.

Table 28. Tailings facilities operating at Suncor Fort Hills

Facility	Function	Contents
OPTA	Fluid and solid tailings storage Recycle water source	CST TT TSRU Untreated fluid tailings Recycle water Tailings water
OES1	Fluid and solid tailings storage	CST Fluid tailings Tailings water
SPTA	Fluid tailings storage	Untreated fluid tailings Recycle water Tailings water

The fluid tailings treatment technology approved for commercial operation at Suncor Fort Hills is PASS, in which fluid tailings are treated with a coagulant and flocculant before placement in the final storage location. The technology is only conditionally approved, subject to conditions included in Suncor Fort Hills' *OSCA* and *EPEA* approvals. Suncor Fort Hills reported not treating fluid tailings in 2024 in alignment with its TMP treatment commitment.

Suncor Fort Hills reported that its new fluid tailings inventory for 2024 was within the approved fluid tailings profile.

15.1 Fluid Tailings

For 2024, Suncor Fort Hills reported a total fluid tailings inventory (all new fluid tailings) of 82 Mm^3, up from 64 Mm^3 in 2023.

Volumes reported for 2024 fall within the currently approved profile for new fluid tailings.

Suncor Fort Hills will start treating fluid tailings in 2026. As such, for 2024, Suncor Fort Hills did not report any fluid tailings meeting its approved RTR criteria.

The RTR status requires Suncor Fort Hills to meet the approved subobjective 1 and 2 criteria (see table 29), which are included in appendix C to *OSCA* approval 9241K, approved April 11, 2024.

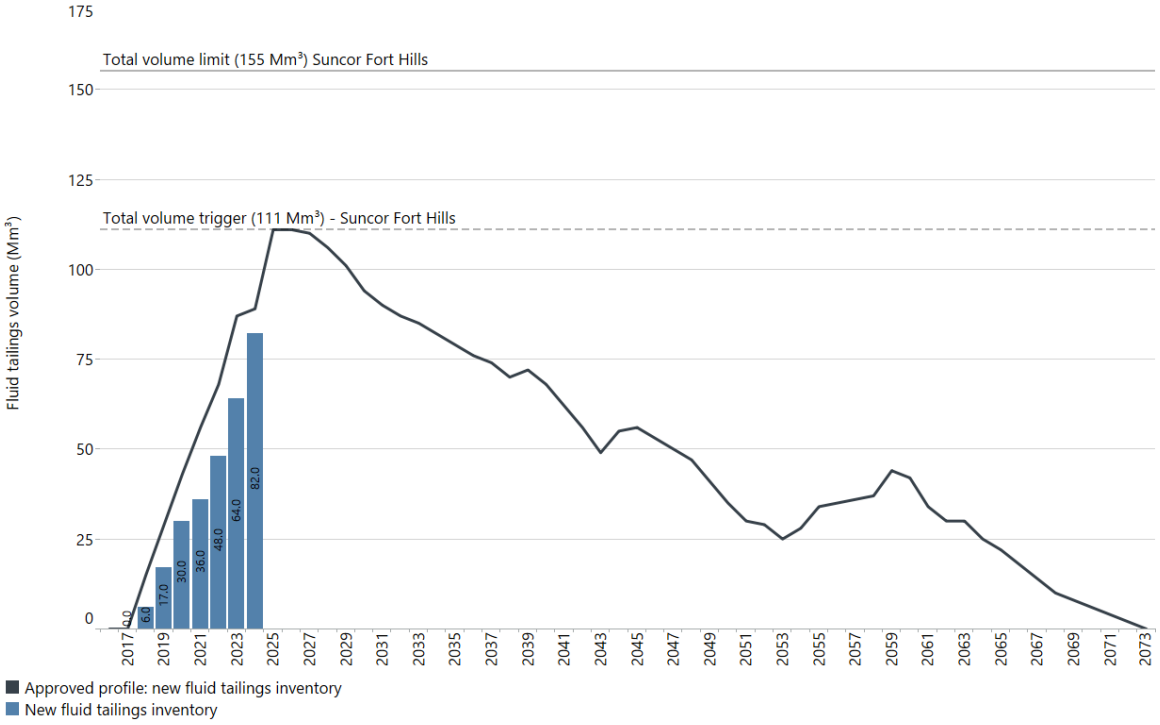
Table 29. RTR criteria for Suncor Fort Hills

Deposit	Subobjective	RTR criteria
All PASS deposits	subobjective 1	Clay-to-water ratio threshold >0.3 based on deposit sampling. An annual average total suspended solids <500 milligrams per litre (mg/L) for expressed water from DDA treated tailings.
	subobjective 2	Surface water and seepage: The closed-circuit water management system is operating as designed. Groundwater adjacent or in communication with fluid tailings deposits is effectively monitored, reported, managed, and mitigated as required by *EPEA* approval 151469-01-00, as amended or renewed.

15.1.1 New Fluid Tailings

For 2024, Suncor Fort Hills reported a new fluid tailings inventory of 82 Mm^3 (see figure 20), up from 64 Mm^3 in 2023. The approved new fluid tailings inventory for 2024 was 89 Mm^3.

Suncor Fort Hills has a total volume trigger for new fluid tailings inventory of 111 Mm^3 and a total volume limit of 155 Mm^3. Based on data reported in its 2024 TMR, Suncor Fort Hills was within its approved new fluid tailings profile and did not exceed its total volume trigger or total volume limit for new fluid tailings in 2024.



Note: Tailings volumes are presented as reported by operators and are subject to change upon further review by the AER, including an assessment of whether volumes meet the RTR criteria.

Data are from the site-wide fluid tailings inventory table (appendix 3 of *Directive 085*) submitted annually by operators.

Figure 20. New fluid tailings for Suncor Fort Hills, 2014 to 2024

15.1.2 Legacy Fluid Tailings

Suncor Fort Hills does not have any legacy fluid tailings (i.e., fluid tailings in storage before January 1, 2015).

15.2 Volume of Treated Fluid Tailings by Technology

In 2024, the AER approved Suncor Fort Hills to start fluid tailings treatment using PASS in 2026.

For 2024, Suncor Fort Hills reported that no fluid tailings had achieved RTR status.

15.3 Treatment Options and Continuous Improvement

Suncor Fort Hills reported that its fluid tailings treatment and placement in a DDA has not started.

SIRs posed in 2024 concerning the continuous improvement of fluid tailings deposition were adequately addressed. The Suncor Fort Hills 2024 TMR did not provide any additional information about technical innovation; however, the AER expects improved reporting in 2025 with material deposition in the SPTA. SIRs were posed in 2025 related to the 2024 transfer of fluid tailings from OPTA to SPTA.

15.4 Technological Innovation in Fluid Tailings Treatment

Suncor Fort Hills reported not performing any field demonstrations in 2024.

Suncor Fort Hills submitted its end pit lake research and development report as per its *EPEA* approval and continued its industry collaboration through external forums such as COSIA.

Refer to Suncor Fort Hills' 2019, 2020, and 2021 TMRs for more information on technological innovation.

15.5 Regulatory and Management Actions

Suncor Fort Hills operates at management level 1 as described in the *TMF* and *Directive 085*.

On February 9, 2022, Suncor Fort Hills submitted the Fort Hills integrated project amendment (IPA) application, requesting to update the Suncor Fort Hills mine, tailings, and LMCPs and adjust the project boundaries to accommodate infrastructure supporting mine development. The application also proposed RTR criteria, a fluid tailings profile, a total volume trigger, and a total volume limit.

On January 25, 2024, Suncor Fort Hills submitted an addendum to the IPA application that included the relocation of the DDA and changes to seepage management elements along the shared boundary between the Fort Hills south pit and the Aurora west pit north.

The AER approved the application and addendum on April 11, 2024, and issued *OSCA* approval 9241K with the following conditions:

- Submit an integrated site-wide mine plan and TMP by September 30, 2024, that provides additional details regarding 2024 to 2028 mining activities.
- Submit an integrated site-wide LOMP and TMP by September 30, 2025, that provides details for 2025 until the end-of-mine life and other requirements listed in condition 36 of *OSCA* approval 9241K.

As part of the *OSCA* approval 9241K decision, the AER repealed the need for Suncor Fort Hills to conduct a demonstration to test the performance of phase 1 of the PASS technology in a deep deposit, based on the performance to date at Suncor's Base Plant operation.

Pursuant to *OSCA* approval 9241K clause 36(a), on July 31, 2024, Suncor Fort Hills submitted an integrated site-wide mine and TMP for 2024 to 2028. The submission was not intended to seek approval for the changes to the integrated plans; however, the AER still found the submission deficient in fulfilling the clause 36(a) requirements. In lieu of resubmitting the integrated TMP, Suncor Fort Hills was given the option to include the required information as part of a subsequent application.

The July 31, 2024, TMP did not include several components of the plan requirements. Therefore, on October 15, 2024, the AER issued a notice of incomplete submissions to Suncor Fort Hills pursuant to *OSCA* approval 9241K clauses 25 and 26, requiring Suncor Fort Hills to provide (one year prior to placement of tailings in each new tailings deposition area) a plan that updates tailings management in each tailings area. The July 31, 2024, TMP did not include several components of the plan requirements. No additional management actions were required in 2024. Suncor Fort Hills fulfilled the terms of its approval conditions on January 31, 2025, with the submission of IPA applications pursuant to *OSCA*, *EPEA*, and the *Water Act*. These amendment applications are still under review by the AER.

The AER approved several other applications for changes to the mine plan in 2024 that affected the TMP; however, the scope and cumulative effects of the changes are under consideration as part of the five-year amendment applications and will be addressed in the 2025 report.

15.6 Measurement System Audit Results

Suncor Fort Hills submitted an MSP update in October 2024. The updates reflect changes to the tailings scheme as part of the IPA application approved on April 11, 2024. The MSP also included revisions to the format of the site-wide water balance, which is submitted annually with the TMP.

SIRs were issued on the 2024 report regarding changes to sampling locations within OPTA and OES1.

The AER requested the 2023 fluid tailings and clear water zone surface data and initiated an initial desktop audit of Suncor Fort Hills' fluid tailings and ponded water volumes to verify reported values. Fluid tailings volumes modelled by the AER were within an acceptable margin of error compared with the volumes reported by Suncor Fort Hills (see table 30).

Table 30. Reported 2023 fluid tailings volumetric audit results for Suncor Fort Hills

Deposit/Pond	Reported fluid tailings volumes (Mm^3)	AER estimated fluid tailings volumes (Mm^3)	Reported ponded water volumes (Mm^3)	AER estimated water volumes (Mm^3)
OPTA	63.3	63.11	7.2	6.19
OES1	0.3	0.3	0.3	0.10
Total	**63.6**	**63.4**	**7.5**	**6.3**

16 Summary

Tailings management under *Directive 085* continued in 2024. Operators were required to start full *Directive 085* reporting in the 2018 reporting year. All eight operating oil sands mines had approved TMPs in place by the end of 2019. Seven of the eight operating oil sands mines submitted TMP amendments in 2022 and 2023. CNRL Horizon submitted a TMP amendment in 2025.

The AER assessed the MSPs submitted by the operators related to determining whether the physical properties of tailings deposits are on a trajectory to support future stages of activity (subobjective 1 in *Directive 085*, fluid tailings volumetric calculations, laboratory testing).

In addition, the AER assessed the groundwater monitoring portion of subobjective 2 in *Directive 085* (i.e., the need to minimize the effects that tailings deposits have on the surrounding environment, ensuring deposits will not compromise the ability to reclaim the area to a locally common, diverse, and self-sustaining ecosystem). The AER continues to assess MSPs to determine whether they address subobjective 2 related to water quality characterization and the measurement of chemicals of potential concern and may issue additional SIRs in the future.

In 2022, the AER clarified the *Directive 085* water quality characterization and reporting requirements for tailings surface water. The operators included sampling and characterization of water overlying treated tailings deposits and fluid tailings ponds in their 2024 TMRs.

In 2024, the AER continued following up on the initial 2023 audit to validate regional fluid tailings and water volumes. The AER is continually refining the fluid tailings auditing program.

Tailings MSPs are living documents that are regularly updated to reflect current best practices and operations. Operators must notify the AER of all plan changes.

The tailings volumes in this report are presented as reported by operators and are subject to change upon further review of fluid tailings volumes, including assessment of whether they meet RTR criteria.

The total volume of fluid tailings (new and legacy tailings combined) on oil sands mine sites in the Athabasca oil sands region increased between 2014 and 2024. New and legacy fluid tailings inventories are projected to continue increasing based on the combined approved fluid tailings profiles. The total regional volume of fluid tailings remains below the new and legacy fluid tailings profiles for all operators combined.

The regional volume of water in tailings ponds decreased from 2014 to 2017, then increased until 2020. The maximum regional volume of water in tailings ponds was 479.3 Mm^3 in 2020. The regional total volume of water in tailings ponds decreased to 380.7 Mm^3 in 2024. The decrease may be because of water recycling and a return to average regional rainfall volumes.

Based on the fluid tailings volumes reported in the 2024 annual reports submitted by the operators, all operators were at or below their approved new fluid tailings profiles. All operators were at or below their total volume triggers and total volume limits.

All operators were at or below their legacy fluid tailings profiles in 2024. Syncrude Mildred Lake was above its legacy fluid tailings profile from 2017 to 2022 and its new fluid tailings profile in 2023. All operators, including Syncrude Mildred Lake, were below their 20% deviation triggers for new and legacy fluid tailings.

No change in management level (as described in *Directive 085*) was required for any operators, based on the 2024 TMR submissions, because their volumes were within the total allowable volume triggers and limits.

In 2023, the AER issued an EPO to Imperial Kearl under *EPEA* due to a seepage event and a separate industrial wastewater storage pond overflow. The AER initiated a formal investigation related to the incidents. In 2024, the AER imposed an administrative penalty and issued the terms and conditions in response to the seepage incident. Imperial continues to monitor and manage seepage as required by the EPO. As of the end of 2024, the remaining components for investigation were ongoing, and the AER continues to review the information gathered. Should the review indicate Imperial has not met and maintained its approved subobjective 2 RTR criteria, the AER will determine the appropriate management level and management responses.

Where information was insufficient for the AER to verify operator data or analyses, the AER issued requests for clarification or additional data. Responses to requests that were not received or reviewed before finalizing this report were not included. Requests for clarification or additional data are part of an ongoing iterative process between the AER and operators. Operators require time to collect data, complete analyses, or review calculations before submitting responses to the AER. This report only includes information that was available at the time of writing. Responses may lead to changes in reported data or analyses from previous years, which will be reflected in the 2025 report.

Operators continue to develop and pilot new technologies to treat fluid tailings and report on improvements in tailings treatment technologies. The AER will review and evaluate technologies and deposit designs that show promise for treating and reducing fluid tailings volumes. The AER expects future submissions and applications regarding updated TMPs to include

- research and monitoring information that resolves outstanding risks and uncertainties about reclaiming treated fluid tailings deposits (including settlement, capping, and capping material availability);
- justification for RTR criteria and trajectories proposed for the demonstrated fluid tailings treatment technologies that will allow operators to achieve their targeted range of ecosites;

- justification that fluid tailings inventory profile requirements can be met; and
- a feasible alternative to water capping at sites wherever it has been proposed as a treatment.

The TMF states that the approved fluid TMPs must be reviewed by the AER every five years or as necessary over the course of the mine life. This review will ensure that the profiles and thresholds are in line with projections and reflect current technology, new knowledge, and continuous improvement

17 Future Major Submissions

The AER will continue public reporting and ensure the transparency of fluid tailings monitoring data received from operators. Future AER reports on tailings management will

- evaluate regional performance against the TMF's outcomes and objectives and
- identify operators that are performing well and those that need to make improvements (in accordance with *Directive 085*).

Future submissions from operators are required in the coming years that will inform evaluations of regional and individual operations' tailings management performance. These reports include the following:

- Syncrude Mildred Lake:
  - December 31, 2026: an updated TMP
  - December 31, 2026: an alternative technology plan for the treatment of fluid tailings placed in the BML
  - December 31, 2026: an assessment of RTR criteria and the trajectory for fluid tailings in water-capped deposits
- Suncor Base Plant:
  - October 31, 2025: updated pond 6 and pond 7 TMPs
  - December 31, 2025: an updated plan for SD8 that transitions from operations to decommissioning, closure, and abandonment
  - November 20, 2026: an integrated mine, tailings, and closure plan
- CNUL Muskeg River mine:
  - An updated TMP one year before fluid or treated tailings are placed in a tailings facility
  - October 28, 2027: a feasible alternative tailings treatment technology and implementation plan to create a water-capped deposit
  - April 30, 2027: an integrated mine, tailings, and closure plan
- CNUL Jackpine mine:
  - An updated TMP one year before fluid or treated tailings are placed in a tailings facility
  - October 28, 2027: a feasible alternative tailings treatment technology and implementation plan to create a water-capped deposit

  - April 30, 2027: an integrated mine, tailings, and closure plan
- CNRL Horizon:
  - An updated TMP one year before fluid or treated tailings are placed in a tailings facility
  - August 1, 2025: an updated TMP
  - December 22, 2026: an updated consolidation model for the ETF/DDA1 and DDA2
- Imperial Kearl
  - An updated TMP one year before fluid or treated tailings are placed in a tailings facility
  - September 30, 2025: revised RTR criteria for EETA ILF and TT co-deposition
  - June 30, 2026: RTR criteria for the existing treated deposits in the EETA
  - October 14, 2027: updated TMP that aligns with the LMCP
  - 2028: consolidation model updates for the operational phase of each facility
- Suncor Fort Hills:
  - April 30, 2026: an integrated site-wide LOMP and TMP.

Appendix 1 Tailings Treatment Technologies

Thin-Lift Drying

Thin-lift drying is a process whereby fluid tailings are removed from tailings ponds and mixed with additives that bind the particles in the fluid tailings together. The fluid tailings with additives are then thinly spread over a large area. Gravity and capillary action allow the water to drain away, and ambient conditions (evaporation and freeze-thaw cycles) facilitate the drying of fluid tailings within a few weeks. Once dry, another layer, or "lift," is added, and the process is repeated.

Suncor Base Plant uses thin-lift drying technology before moving treated fluid tailings that meet the initial drying area ready-to-reclaim (RTR) criteria to the final placement location. This technology is referred to as a tailings reduction operation by Suncor and as atmospheric fines drying (AFD) by Canadian Natural Upgrading Limited (CNUL) Muskeg River mine. AFD is also approved for use at Jackpine mine. Operators are targeting a terrestrial closure with wetlands for their deposits.

Thickened Tailings as Initial Treatment

Tailings thickening is a process in which fluid tailings from bitumen extraction plants are sent to a thickener where flocculants are added to bind the smaller particles together, creating thickened tailings (TT). The warm water released from the tailings is recycled back to the extraction plant. The process is an initial stage of fluid tailings treatment, and operators employ different secondary stages of treatment and placement of TT for treated fluid tailings deposits. Suncor Fort Hills, CNUL Muskeg River, CNUL Jackpine, and Imperial Kearl use conventional thickeners to produce a TT stream, with some variations. Operators use the following as a second stage of treatment:

- CNUL Muskeg River is co-depositing TT, tailings solvent recovery unit (TSRU) tailings, whole tailings (WT), and coarse sand tailings (CST) in a single deposit, creating a north-pool-deposit type.
- CNUL Jackpine is co-depositing TT, WT, and CST in a single deposit, creating a mixed deposit type.
- Imperial Kearl treats TT with a secondary polymer addition before placement in its tailings deposit.

Operators are targeting a terrestrial closure with wetlands for their deposits and are required to provide updated modelling for the deposits. Suncor Fort Hills does not have an approved closure plan for its TT.

Nonsegregating Tailings and Composite Tailings Deposits

Nonsegregating tailings (NST) technology requires the use of a thickener. The TT is mixed with sand from the extraction plant and a coagulant. The mixture is then placed into a tailings deposit.

Composite tailings (CT) are like NST, but instead of using TT, fluid tailings from ponds are mixed with sand from the extraction plant and a coagulant. The mixture is then placed in a tailings deposit.

Canadian Natural Resources Limited (CNRL) Horizon uses NST technology. CT is used by Syncrude Aurora North and at CNUL Muskeg River, with some variations. Although CT is approved for use at Syncrude Mildred Lake, it is no longer used.

CNRL Horizon, Syncrude, and CNUL are targeting a terrestrial closure with wetlands for their deposits and are required to provide updated modelling and RTR trajectory for the deposits.

Fluid Tailings Centrifugation

Fluid tailings centrifugation is a process whereby fluid tailings are removed from the tailings ponds, and a flocculant is added to bind the small particles together. The mixture is pumped into a centrifuge where the water is spun out. The dewatered tailings are placed in a deposit.

Syncrude Mildred Lake and CNUL Jackpine use fluid tailings centrifugation at their sites.

CNUL has begun to co-mix centrifuge material with CST, enhancing performance through improved consolidation. The RTR criteria have been modified to consist of centrifuge/CST mixed deposits.

Both operators are targeting a terrestrial closure with wetlands for their deposits.

In-Line Flocculation

In-line flocculation (ILF) is a process where a polymer flocculant is added to the tailings stream to bind clay particles into larger groupings (flocs or flocculent), which may settle more rapidly upon discharge. A coagulant is often added to neutralize the charge on clay particles before adding the flocculant.

The challenges using ILF include maintaining flocculant dosage for varying input properties, such as solids and clay content, flow rate, and optimizing the level of mixing to blend the polymer with the tailings.

Syncrude uses ILF at Mildred Lake. ILF is operational in the demonstration phase at CNUL Jackpine, CNUL Muskeg River, and Imperial Kearl.

ILF can be applied to terrestrial or aquatic closure scenarios.

Permanent Aquatic Storage Structure

Suncor is demonstrating the performance of a new treatment technology in its commercial-scale implementation of the permanent aquatic storage structure (PASS) technology. Phase 1 is the initial treatment of fluid tailings with a coagulant and a flocculant. The treated mixture is placed in a deposit. The AER has approved the implementation of phase 1 only, subject to approval conditions for managing uncertainties and long-term reclamation risks, since performance assumptions have not been verified at the scale and complexity of Suncor's DDA3.

Water-Capped Tailings

Water-capped tailings is a technology currently in the demonstration and experimental phase at Syncrude and Suncor. Water capping involves placing water above untreated tailings (Syncrude base mine lake at Mildred Lake) or treated tailings (phase 1 PASS-treated tailings in Suncor demonstration pit lake at the Suncor Base Plant) to create a water-capped deposit (e.g., a water-capped pit lake) as a landscape feature.

The proposed water capping of untreated or treated fluid tailings at oil sands mines is not authorized by the AER because the technology is subject to further assessment, research, and future policy. Except for the identified demonstrations, all tailings management plan approvals prohibit the creation of a water-capped pit lake. The AER's decision about water-capped pit lakes, including their prohibition and the need for feasible alternative tailings treatment technologies, is provided in the water-capping technology section of the tailings management plan decision reports and in operator approvals.

Appendix 2 Tailings Field Inspection Summaries

Summary of the AER 2024 Tailings Field Inspection for Suncor Base Plant

Summary of the AER 2024 Tailings Field Inspection for Syncrude Mildred Lake and Aurora North

Summary of the AER 2024 Tailing Field Inspection for CNUL Muskeg River Mine

Summary of the AER 2024 Tailings Field Inspection for CNUL Jackpine Mine

Summary of the AER 2024 Tailings Field Inspection for CNRL Horizon

Summary of the AER 2024 Tailings Field Inspection for Imperial Kearl

Summary of the AER 2024 Tailings Field Inspection for Suncor Fort Hills

Summary of the AER 2024 Tailings Site Inspection for Suncor Base Plant

TAILINGS FACILITIES INSPECTION
Suncor Base Plant – MD9 South

Project	Base Plant	**OSCA Approval**	8535T	**Inspection Date**	2024-09-16
Facility Owner	Suncor	**Fluid Containment Types**	Overburden; Tailings	**Company staff**	[redacted]
Life Cycle Phase	Operating / Construction	**Inspection Type**	Proactive / Annual	**AER Inspector/Staff**	[redacted]

Observations

Component	Observations	Photos
Facility operation	No visible concerns. Material is trafficable, but wet. No apparent change from 2023.	Photo 1



Photo 01 – MD9 South overburden/treated tailings co-deposition dumping locations

Observations

Component	Observations	Photos
Facility operation	No visible concerns. No apparent change from 2023.	Photo 2
Presence of hydrocarbon	No hydrocarbon visible	
Containment	No visible concerns	
Exposed vegetation in pond	No visible concerns	



Photo 02 – South Tailings Pond beach and barge access

Observations

Component	Observations	Photos
Facility Operation	On-going dewatering/draining of facility Visible exposed vegetation in pond. No visible bitumen No visible containment concerns	Photo 3



Photo 03a – Dewatering on Pond 8B. Visible vegetation is ongoing concern.



Photo 03b – Dewatering Pond 8B. Water collection structure. New since previous inspection.

Suncor Base Plant - Dedicated Disposal Area 3

Observations

Component	Observations	Photos
Facility Operation	No visible bitumen. No visible containment concerns. No visible concerns.	Photo 4



Photo 04 – DDA 3. No visible concerns

Suncor Base Plant – Sand Dump 8

Observations

Component	Observations	Photos
Facility Operation	No visible containment concerns Presence of bitumen mat	Photo 5



Photo 05 – **Sand Dump 8**. Storage pond/water return pumps (upper image); primary collection/settling pond (lower image)

Suncor Base Plant – Pond 7

Observations

Component	Observations	Photos
Facility Operation	No visible containment concerns. Monitor for anticipated amendment application in 2025.	Photo 6



Photo 05 – Pond 7

Summary of the AER 2024 Tailings Site Inspection for Syncrude Mildred Lake and Aurora North

TAILINGS FACILITY INSPECTION

Centrifuge Cake and ILF Plants

Inspection Result **Compliant**

Project	Mildred Lake	**OSCA Approval**	8573S	**Inspection Date:**	2024-07-18
Facility Owner	Suncor Energy (Syncrude) Operating Inc (SESOI)	**Fluid Containment Types**	OSPW, FT, ILF, CT, Centrifuge Cake, CST	**Company staff**	[redacted]
Life Cycle Phase	Operating / Construction	**Inspection Type**	Proactive	**AER Inspector/Staff**	[redacted]

Observations

Component	Observations	Photos
NMSP	• Observed the fluid tailings barge system in operation	
NMSP-cake	• Observed the deposit is close to full	
NMCP-E	• Observed the inline flocculation tailings active placement • Due to heavy smoke, the placement of other streams was not visible	

Access to MLX site	• Observed the bridge and other infrastructures being constructed	
MLSB	• Observed coke line for placement	
North Mine approximate to McKay River	• Observed the progress of dewatering and overburden removal P	
Chemtrade plant	• Observed the location of Chemtrade plant	
General Comments	• Due to heavy smoke caused by wildfire, the visibility was severely compromised • Rating of **Compliant** given for those areas inspected only, not possible to inspect all tailings facilities and deposits in one day	

Findings: Observation, non-conformance, safety deficiency, or critical safety deficiency

Type of finding	Description	Compliance
Observation	No visible concerns	Compliant

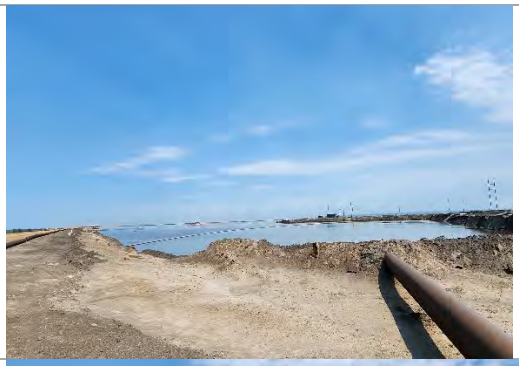
TAILINGS FACILITY INSPECTION

CT Plant and Deposition Areas

Inspection Result **Compliant**

Project	Aurora North	**OSCA Approval**	10781P	**Inspection Date:**	2024-07-16
Facility Owner	Suncor Energy (Syncrude) Operating Inc (SESOI)	**Fluid Containment Types**	Composite Tailings	**Company staff**	[redacted]
Life Cycle Phase	Operating / Construction	**Inspection Type**	Proactive	**AER Inspector/Staff**	[redacted]

Observations

Component	Observations	Photos
AEP	• Observed the CT storage status	
ASB	• Observed the pond status	
ASB-seepage collection pond	• Observed the location and layout	

East of AEP	• Observed the release point	
General Comments	• Inspection result is “Compliant” based on the areas inspected	

Findings: Observation, non-conformance, safety deficiency, or critical safety deficiency

Type of finding	Description	Compliance
Observation	No visible concerns	Compliant

Summary of the AER 2024 Tailings Site Inspection for CNUL Muskeg River Mine

TAILINGS FACILITY INSPECTION
Canadian Natural Upgrading Ltd.
Muskeg River Mine

Inspection Result
Compliant

Project	Muskeg River Mine	**OSCA Approval**	8512O	**Inspection Date:**	2024-06-19
Facility Owner	Canadian Upgrading Limited	**Fluid Containment Types**	Fluid tailings and process affected water	**Company staff**	[redacted]
Life Cycle Phase	Operating / Construction	**Inspection Type**	Proactive	**AER Inspector/Staff**	[redacted]

Observations

Component	Observations	Photos
Active Deposition into Facility	• IPC 1 - CST is the main tailings stream being deposited, while only an 'emergency out' for TSRU is being placed resulting in insignificant beach development). Lowest priority cell for deposition. • IPC 3 – CST currently depositing into IPC 3. • IPC 4 –TT/CST deposition location, separation dike over topped. • IPC 4S – ILF/CST deposition for treatment technology demonstration. • ETF – CST is the main tailings stream pouring into the ETF for the final infilling of ETF, still scheduled to be completed by 2026. It was noted the execution of infilling activities are also still going as planned, with little to no mitigation activities required.	Photos 2-9
Active Withdrawal from Facility	• The ETF is the identified next facility to come to closure. The status is still on track for completion by 2026. Discussion regarding the IPC 3 facility potentially being the next facility closure.	Photos 9
Beach Above Water	• IPC 1 – Observed orange-coloured spots on beaches, noted it had been raining for a few days before inspection. Testing has been completed, and results are pending. Looking at September or December for presentation, CNUL to confirm. • IPC 3 – Yellow beaches were not observed to be extensive as in 2023 in this facility. Observed both the TSRU capped and uncapped beach and "TSRU mat." • Discussions indicated with the extension of the beach above water, more AFD cells will be created as a contingency measure.	Photos 1-9

Beach Below Water	• The beach below water was still being pushed up to surface. No change coloration or vegetation was observed in/on the exposed material. In 2024 there appeared to be less pushed up volume from last year, suggesting the operational approach of utilizing the floating backhoe to maintain feed to the dredge to feed tailings treatment (i.e., AFD) is performing well. It was noted that the siphon bay will be infilled before completing the main pond to ensure all non-CST/FT is put into the main pond and sent for treatment.	Photos 9
Tailings Containment	• No concerns regarding containment were noted.	Photos 1, and 3-9
Potential Wildlife Attractants	• No concerns regarding islands along the mid to north sections of the ETF. No birds were noted at the ETF during the tailings inspection. Information shared with our wildlife SME via EPEA coordinator.	Photo 9
Presence of Hydrocarbons / Bitumen	• Presence of bitumen observed along the edges of the ponds. No notable volume change in visual presence noted.	Photos 3-5
Instrumentation / Testing (condition of/access to)	• Existing: Consolidation data on the ETF is still collected through settlement plates. • Subobjective 2 observations via groundwater wells being followed-up through EPEA. • IPC 4 - ILF pilot observations of flocculant production, beach development, and next steps are in alignment with pilot submission. Did not observe the toe of the ILF deposit slope holding a shape like 'advancing lava' as was observed with the JPM pilot. Clear (low solids content) runoff was observed running down and away from the ILF deposit. The ILF material was deposited into itself. The volcano like mound shape was not as pronounced as it was observed with the JPM ILF pilot.	Photo 5-7
TMP	• Newly approved TMP milestones being met operationally. No observed concerns. Also, proof of treated tailings deposit performance provided via a loaded CAT 785 (155 ton) haul truck parked on top of a 3 – 5 m cap of CST in IPC 3.	Photo 1
OSCA / OSCR / EPEA	• No alignment concerns noted for Subobjective 1. • Subobjective 2 alignment still under review.	Photo 1-9

Findings: Observation, non-conformance, safety deficiency, or critical safety deficiency

Type of finding	Description	Compliance
Observation	Field conditions match reported tailings management activities.	Compliant
Observation	Status of Subobjective 2	Requires Follow-up



Photo 01 – IPC 3 NPD Type capped deposit



Photo 02 – IPC 3 TSRU deposit beach colouration (orange spots)



Photo 03 – IPC 3 deposit BAW development North Pool Type, TSRU capped/uncapped and TSRU mat Beach Above Water (North Pool Deposit Type consists of TSRU, TT, CST, WT)



Photo 04 – IPC 3 deposit BAW development North Pool Type, TSRU capped/uncapped and TSRU mat Beach Above Water (North Pool Deposit Type consists of TSRU, TT, CST, WT)



Photo 05 – IPC 4S TT/CST deposit beach development



Photo 06 – IPC 4N CST deposit beach development



Photo 07 –IPC 4S ILF pilot discharge



Photo 08 – IPC 4S ILF pilot discharge and beach development



Photo 09 – West side/south view of MRM ETF BBW material pushed above pond elevation

Summary of the AER 2024 Tailing Site Inspection for CNUL Jackpine Mine

TAILINGS FACILITY INSPECTION
Canadian Natural Upgrading Ltd.
Jackpine Mine

Inspection Result
Compliant

Project	Jackpine Mine	**OSCA Approval**	9756 K	**Inspection Date:**	2024-06-20
Facility Owner	Canadian Upgrading Limited	**Fluid Containment Types**	Fluid tailings and process affected water	**Company staff**	[redacted]
Life Cycle Phase	Operating / Construction	**Inspection Type**	Proactive	**AER Inspector/Staff**	[redacted]

Observations

Component	Observations	Photos
Active Deposition into Facility	• DDA 1/ETF West CFFT/CST deposition was active during the inspection. Beach development progressing as described.	Photos 1 - 3
Active Withdrawal from Facility	• N/A	Photos N/A
Beach Above Water	• DDA 1/ETF West beach developing as reported. • FC 1 – Placed CST capped ILF pilot deposit.	Photos 1, 3, and 6
Beach Below Water	• No items identified during inspection.	Photos N/A
Tailings Containment	• No concerns with tailings containment development as per depositional or planning purposes identified.	Photos 2-6
Potential Wildlife Attractants	• No items of concerns Identified in the tailings facilities.	Photo N/A
Presence of Hydrocarbons / Bitumen	• Presence of bitumen observed along the edges of the ponds. No notable volume change in visual presence noted.	Photos 5
Instrumentation / Testing (condition of/access to)	• Subobjective 2 observations via groundwater wells being followed-up through EPEA. • FC1 ILF pilot observations were of the CST capped beach.	Photo 5
TMP	• No alignment or performance issues noted during Inspection.	Photo N/A

OSCR / EPEA	• Alignment with groundwater report to ensure alignment with Subobjective 2.	Photo N/A

Findings: Observation, non-conformance, safety deficiency, or critical safety deficiency

Type of finding	Description	Compliance
Observation	Alignment with groundwater report to ensure alignment with Subobjective 2 via EPEA.	Follow-up Required



Photo 01 – Northwest CFFT deposition line DDA 1/ETF West



Photo 02 – North containment structure DDA 1/ETF West



Photo 03 – DDA 1/ETF West north view - TT deposition line and TT/CFFT beach development



Photo 04 – SC 1/ETF East pond



Photo 05 – DDA 1/ETF West CFFT/CST and TT/CST beach development



Photo 06 – FC 1 ILF pilot area (CST cap)

Summary of the AER 2024 Tailings Site Inspection for CNRL Horizon

TAILINGS FACILITY INSPECTION
Canadian Natural Resources Ltd.
Horizon Mine

Inspection Result
Compliant

Project	Horizon Mine	**OSCA Approval**	9752 M	**Inspection Date:**	2024-06-18
Facility Owner	Canadian Resources Limited	**Fluid Containment Types**	Fluid tailings and process affected water	**Company staff**	[redacted]
Life Cycle Phase	Operating / Construction	**Inspection Type**	Proactive	**AER Inspector/Staff**	[redacted]

Observations

Component	Observations	Photos
Active deposition into facility	• NST lnes actively discharging into DDA 2. Long beaches and small main pond are being maintained. This is as reported. • NRU actively being deposited into the ETF to an elevation of 395.5m	Photos 4-6
Active withdrawal from facility	• N/A	Photos N/A
Beach above water	• The NST beaches in DDA 2 were observed to be developing as expected. Long and shallow slopes. Cutting was noted but the line had recently been flushed, thus, NOT a deposition performance issue. • ETF uncapped NRU beach not showing as much yellow colour on the beaches. Note, it was raining for a few days before inspection.	Photos 4-6
Beach below water	• No concerns observed in ETF or DDA 2.	Photos N/A
Tailings Containment	• It was reported that Dike 29 construction is on schedule for timing of required pouring benches for DDA 2. • ETF NRU beaches were being deposited to 395.5 m elevation, with the final dike elevation at 396 m. • ETF south end ditching relocation and trespass needs additional information including the correction of the trespass. This to be followed up by Public Lands SMEs. • ETF Siphon Bay weir extension was executed and appeared to be functioning well. 2 m	Photos 1-6
Potential Wildlife Attractants	• 2 maps were presented which still had a few locations that might be of concern in the next 3 years of pond elevation changes. Follow-up, if required, will be through EPEA.	Photo N/A
Presence of hydrocarbons / bitumen	• No concerns with the amount of bitumen present in tailings storage facilities.	Photos N/A

Instrumentation / Testing (condition of/access to)	• A visit to the proposed NST vegetation pilot was visited. Surface drainage direction for pilot needs clarification, also how other locations were deemed unfit for the pilot also requires clarification. These items will be followed up via the proposal review process. • MAFD pilot site. The deposit was less than 1 m thick and next steps is to do a trafficability test with equipment and no sand cap.	Photo 2, 8-10
TMP	• Clarification regarding containment storage capacity and contingency are required. Follow-up will be addressed via TMR SIRs.	Photo 2, 4-6
OSCR /EPEA	• Clarification on NST vegetation pilot location; and • Clarification on fluid tailings storage capacity and contingency. • Subobjective 2 status.	Photo 1-6

Findings: Observation, non-conformance, safety deficiency, or Critical safety deficiency

Type of finding	Description	Compliance
Observation	• Clarification on NST vegetation pilot location; Follow-up via pilot submission review.	Follow-up Required
Observation	• Clarification on FT storage capacity and contingency. Follow-up via TMR review.	Follow-up Required
Observation	• Clarification on status of Subobjective 2. Follow-up via Groundwater Report Review (EPEA).	Follow-up Required



Photo 01 – ETF Fluid Transfer System components

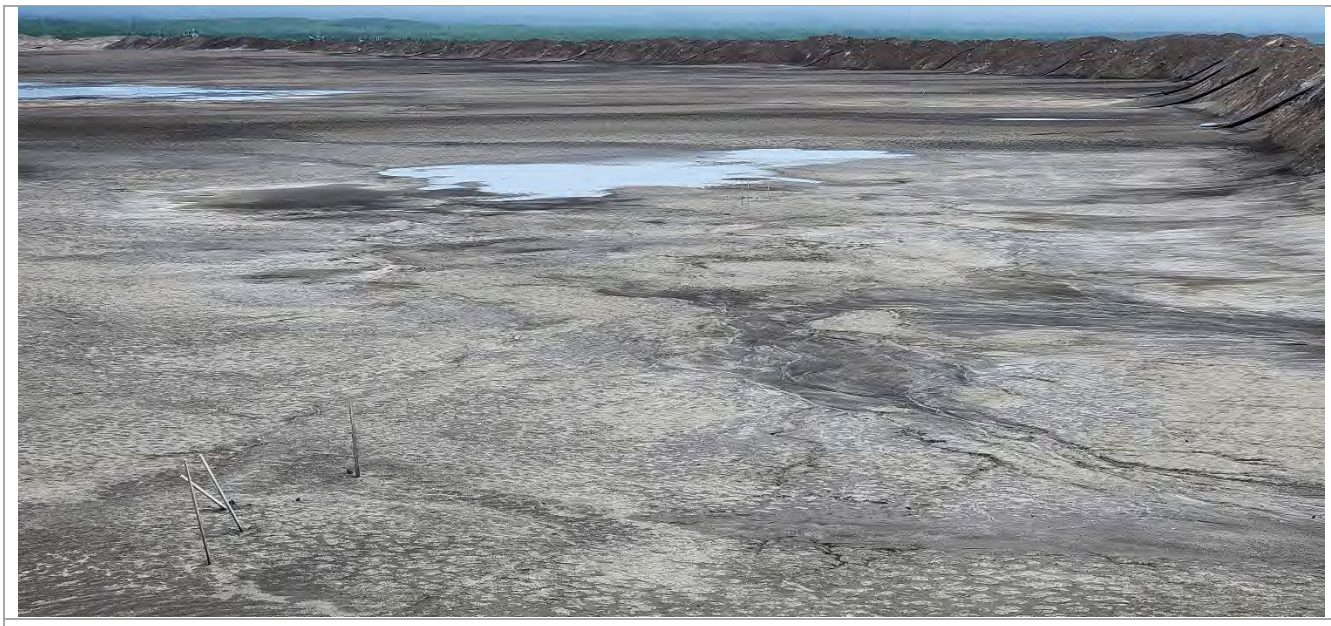


Photo 02 – ETF MAFD trial location and ETF containment in the north end



Photo 03 – ETF Siphon Bay weir extension area



Photo 04 – DDA 2 NST 2 active deposition stream location



Photo 05 – DDA 2 NST 2 active deposition stream location



Photo 06 – DDA 2 NST beach development



Photo 07 – ETF south end ditching relocation lease boundary trespass



Photo 08 – Proposed NST capping pilot area (westward view



Photo 09 – Proposed NST capping pilot area (northeast view toward Raw Water Pond)



Photo 10 – Tar River Valley NST beach (eliminated location for NST vegetation pilot.

Summary of the AER 2024 Tailings Site Inspection for Imperial Kearl

TAILINGS FACILITY INSPECTION

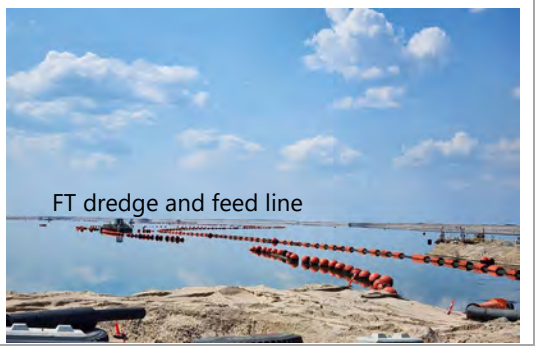
EETA, WETA, ITA1

Inspection Result

Compliant

Project	Kearl	**OSCA Approval**	10829M	**Inspection Date:**	2023-07-15
Facility Owner	Imperial Oil Resources	**Fluid Containment Types**	Fluid tailings and process affected water	**Company staff**	[redacted]
Life Cycle Phase	Operating / Construction	**Inspection Type**	Proactive	**AER Inspector/Staff**	[redacted]

Observations

Component	Observations	Photos
EETA	Witnessed the following: • TT/ILF discharging from South of EETA • CST line present at the west side of EETA	 
WETA	Witnessed the following: • TSRU beach • FT dredging and feed lines to the eILF treatment	

ITA1	Witnessed the following: • Slurry wall being installed • TSRU tailings discharging in ITA1	  TSRU line
General Comments	• Compliant with the approved tailings plan	

Findings: Observation, non-conformance, safety deficiency, or critical safety deficiency

Type of finding	Description	Compliance
Observation	No visible concerns	Compliant

Summary of the AER 2024 Tailings Site Inspection for Suncor Fort Hills

TAILINGS FACILITY INSPECTION
Fort Hills – OPTA and OPTA East

Project	Fort Hills Oil Sands Project	**OSCA Approval**	9241K	**Inspection Date:**	2024- 09-17
Facility Owner	Suncor	**Fluid Containment Types**	Fluid tailings and process affected water	**Company staff**	[redacted]
Life Cycle Phase	Operating / Construction	**Inspection Type**	Proactive / Annual	**AER Inspector/ Staff**	[redacted]

Observations

Component	Observations	Photos
Active deposition into facility	OPTA East - No active deposition in OPTA East during inspection. OPTA - Coarse tailings cell construction. Standard procedures. OPTA – Froth treated tailings deposition. Standard procedures	Photo 1 Photo 3 Photo 5
Presence of hydrocarbons / bitumen	Visible hydrocarbon in OPTA in coarse tailings. Ongoing recovery issues. No impact to tailings performance.	Photo 3
Beach above water	No visible concerns in OPTA or OPTA East	
OPTA East Collection Pond with Secondary Clarification Facility	Secondary pond noted in 2023 has been removed. Standard operations at Collection Pond	Photo 4
Beach below water	No visible concerns in OPTA or OPTA East	
Containment	No visible concerns in OPTA. East buttress under construction to support ongoing OPTA raises. Undisturbed land adjacent to future OPTA East Phase 2. Area of higher interest for monitoring in future inspections.	Photo 6
Exposed vegetation in pond	No visible concerns in OPTA or OPTA East	
Erosion Protection	No concerns noted	

Note: Images saved in SharePoint Fort Hills 2024 Tailings Field Inspection folder for improved clarity, as needed.



Photo 1 – **OPTA East Phase 1** looking Northeast. Secondary settling/clarification pond noted in 2023 has been removed. No further concerns noted.



Photo 2 – **OPTA Toe Berm** looking South. Construction ongoing. No concerns noted.



Photo 3 – **OPTA** looking west (right) to south-west (left) into facility. Active cell construction. Significant bitumen in tailings.



Photo 4 – **Ramp to OPTA East Collection Pond** looking west. No issues noted.



Photo 5 – Froth Treated Tailings Pour and Jetty. Looking north-east (left) to east (right). No issues noted.



Photo 6 – Future OPTA East Phase 2 construction area. Looking East. Proximity to undisturbed land noted.

TAILINGS FACILITY INSPECTION
Fort Hills – SPTA and South Pit

Project	Fort Hills Oil Sands Project	**OSCA Approval**	9241K	**Inspection Date:**	2024- 09-17
Facility Owner	Suncor	**Fluid Containment Types**	Fluid tailings and process affected water	**Company staff**	[redacted]
Life Cycle Phase	Operating / Construction	**Inspection Type**	Proactive / Annual	**AER Inspector/ Staff**	[redacted]

Component	Observations	Photos
Active deposition into facility	Fluid transfer to South Pit Tailings Area (SPTA). No access to view active deposition area. No concerns noted.	Photo 6
Presence of hydrocarbons / bitumen	Visible hydrocarbon in OPTA	Photo 6
Beach above water	No beaches under construction	Photo 6
Beach below water	No beaches under construction	Photo 6
Containment	No visible concerns in SPTA. Monitor south side in future inspection for potential scheme boundary issues. North buttress under construction	Photo 7
Exposed vegetation in pond	No visible concerns	
Erosion Protection	Deposit all in-pit. No concerns.	

Note: Images saved in SharePoint Fort Hills 2024 Tailings Field Inspection folder for improved clarity, as needed.



Photo 06 – South Pit Tailings Area. Looking south-west (left) to north-west (right). No access to fluid discharge area. No visible issues.



Photo 07 – South Pit. Looking west (left) to north-west (right). Ongoing construction of containment buttress. No visible issues.

APPENDIX A – Inspection Handout from Suncor Fort Hills

OPTA Layout and Inspection Viewpoints Map



Fort Hills Site Layout Map



Appendix 3 Fluid Tailings Volume Data

Project	Facilities /pond	Fluid tailings (Mm^3) 2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Suncor Base Plant	Pond 1A	10.1	10.1	10.1	10.1	10.4	10.4	10.4	10.4	10.4	10.4	10.4
	Pond 2/3	38.3	35.0	30.7	32.7	33.6	29.8	37.3	36.9	36.9	36.9	36.9
	Pond 5	18.4	18.4	20.2	-	-	-	-	-	-	-	-
	Pond 6	35.2	34.5	35.0	35.5	36.5	37.0	37.0	37.0	32.4	32.4	32.4
	Pond 7	68.9	69.9	74.5	74.2	73.8	79.3	77.4	75.1	76.9	75.8	79.2
	DDA1 (Pond 8A)	0.3	0.3	0.0	-	-	-	-	-	-	-	-
	DDA3	-	-	-	-	-	-	21.1	1.3	0.5	0.3	0.7
	Pond 8B	38.5	38.9	36.8	38.9	20.9	14.5	12.5	12.6	11.9	12.0	10.6
	STP	101.0	105.0	105.4	105.7	95.8	90.7	95.9	93.5	97.1	101.5	104.8
	SD8	3.4	4.0	3.7	3.2	2.3	0.9	0.8	1.5	0.5	0.7	1.8
	SD9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.8
	Total	**314.1**	**316.1**	**316.4**	**300.3**	**273.3**	**262.6**	**292.4**	**268.3**	**266.6**	**270.0**	**277.6**
Syncrude Mildred Lake	MLSB	177.6	168.1	167.5	141.5	141.2	137.1	133.7	121.2	115.5	110.5	110.1
	SWSS	71.0	80.9	94.2	112.5	116.3	123.1	137.7	137.1	138.5	155.2	149.1
	BML	182.6	182.6	177.4	175.1	172.9	171.5	171.5	169.1	167.7	166.8	166.7
	EIP	3.3	1.7	1.4	2.0	1.3	0.8	0.1	0.1	0.0	0.0	-
	SWIP junior	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	SWIP major	33.7	39.4	35.5	37.2	43.6	35.5	28.5	23.6	25.6	14.7	18.2

Project	Facilities /pond	Fluid tailings (Mm^3) 2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
	NMSP/ NMSPW major	1.4	3.6	16.0	16.2	18.1	37.8	51.5	73.9	91.4	98.5	92.1
	NMSPE	N/A	N/A	3.4	4.3	7.3	-	-	-	-	-	-
	NMSPE deep cake	N/A	N/A	5.8	13.3	13.9	19.7	25.6	28.7	37.3	37.0	37.0
	NMCP-E	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	16.0	23.0
	Total	**469.6**	**476.3**	**501.2**	**502.1**	**514.6**	**525.5**	**548.6**	**553.7**	**576.0**	**598.7**	**596.2**
Syncrude Aurora North	ASB	83.1	77.6	74.7	72.3	70.4	75.6	86.0	79.1	93.9	89.8	80.0
	AEPN-E	27.5	38.7	43.5	51.1	50.2	42.5	34.0	24.7	6.8	N/A	N/A
	AEPN-W	2.4	3.1	2.1	0.3	0.0	0.0	-	-	-	-	-
	AEP (AEPS)	N/A	8.4	10.9	13.2	12.6	18.9	23.8	28.9	40.3	59.0	59.4
	ACPN	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	15.6
	Total	**113.0**	**127.9**	**131.2**	**136.9**	**133.2**	**137.0**	**143.8**	**132.7**	**141.0**	**148.8**	**155.0**
CNUL Muskeg River	ETF	62.4	63.7	58.3	57.9	51.7	50.4	43.1	36.3	31.0	19.9	8.3
	SEA	0.5	0.8	1.5	1.3	0.2	0.0	-	-	-	-	-
	IPC1	23.0	24.3	32.8	31.5	31.4	30.8	30.3	30.1	30.3	27.7	28.1
	IPC2	N/A	N/A	N/A	N/A	26.5	28.1	30.0	32.4	35.9	48.3	52.2
	IPC2A	N/A	N/A	6.8	7.7	N/A	N/A	N/A	N/A	N/A	-	-
	IPC2B	2.1	5.6	9.5	12.5	N/A	N/A	N/A	N/A	N/A	-	-
	IPC3	N/A	N/A	0.8	5.7	11.9	16.8	29.9	39.8	41.2	33.7	32.6
	IPC4N	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5.7	14.3	24.6
	IPC4S	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.2	0.8	1.0

Project	Facilities /pond	Fluid tailings (Mm^3) 2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
	Total	**88.0**	**94.4**	**109.7**	**116.6**	**121.7**	**126.1**	**133.3**	**138.6**	**145.3**	**144.7**	**146.8**
CNUL Jackpine	ETF-W (DDA1)	6.8	12.0	7.8	11.7	12.8	12.5	11.0	N/A	N/A	N/A	N/A
	ETF-E (SC1)	12.8	10.6	11.2	9.4	8.6	8.1	10.3	N/A	N/A	N/A	N/A
	ETF (ETF-W and ETF-E)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	19.0	17.1	18.1	15.9
	SC2	N/A	1.0	2.4	5.7	5.2	4.1	4.6	5.8	5.5	5.5	6.5
	FC1	N/A	N/A	2.8	1.6	1.4	1.2	1.1	1.2	1.8	2.3	1.7
	IPC1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	2.0
	Total	**19.6**	**23.6**	**24.2**	**28.4**	**28.0**	**25.9**	**27.0**	**26.0**	**24.4**	**25.9**	**26.1**
CNRL Horizon	ETF/DDA 1	66.2	82.1	99.5	114.5	131.8	146.7	146.4	155.3	162.9	144.0	150.1
	DDA2	-	-	-	-	-	-	3.5	2.3	7.1	4.3	1.7
	Total	**66.2**	**82.1**	**99.5**	**114.5**	**131.8**	**146.7**	**149.9**	**157.6**	**170.0**	**148.3**	**151.8**
Imperial Kearl	WETA	4.7	13.6	24.1	39.3	46.5	55.1*	62.1*	62.0*	59.0*	63.0	73.7
	EETA	N/A	-	-	0.4	1.0	2.5	3.0*	2.0	2.0	3.0	3.4
	West TT panel	N/A	N/A	-	0.8	1.5	4.5	9.9*	6.1*	6.0*	38.0*	37.6
	East TT panel	N/A	N/A	-	0.5	1.1	-	-	-	-	-	-
	ITA1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.4	9.2
	Total	**4.7**	**13.6**	**24.1**	**41.0**	**50.1**	**63.1†**	**69.8†**	**77.1†**	**99.0†**	**112.9†**	**123.9†**
Suncor Fort Hills	OPTA	-	-	-	-	6.0	17.0	30.0	36.0	48.0	63.3	74.6
	OES1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	0.3	0.0
	SPTA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	7.7
	Total	**-**	**-**	**-**	**-**	**6.0**	**17.0**	**30.0**	**36.0**	**48.0**	**63.6**	**82.3**

Project	Facilities /pond	Fluid tailings (Mm^3) 2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Industry total		**1075.2**	**1134.0**	**1206.3**	**1239.8**	**1258.7**	**1303.9**	**1394.8**	**1390.0**	**1470.3**	**1512.9**	**1559.7**

N/A: Not applicable

Tailings volume totals in this table may not match the company reports due to rounding. Data provided by operators in their TMRs were only to one decimal place.

Tailings volumes for 2017 year-end are estimates based on midyear survey data and estimates based on production from end of surveys to 2017 year-end, except for Suncor.

Syncrude Mildred Lake and Aurora North volumes for 2018 are as-measured volumes, not year-end projections as provided by the other operators.

Imperial Kearl volumes for 2019 are year-end projections, not as-measured volumes, as provided by the other operators.

Some volumes above may include RTR volumes. Suncor Base Plant pond 5, DDA3, and MD9 data do not include RTR fluid tailings.

Variances for monitoring requirements were granted to operators in 2020 due to COVID-19. As a result, there was a mix of measured and estimated volumes for 2020. Pond surveys were not conducted for Imperial Kearl, Syncrude Mildred Lake, and Syncrude Aurora. Reduced pond surveys were completed for Suncor Base Plant, CNUL Muskeg River mine, CNUL Jackpine mine and CNRL Horizon.

Tailings volumes are presented as reported by operators and are subject to change upon further review by the AER, including assessing volumes that meet the RTR criteria.

[*]Fluid tailings volumes are as originally reported in the annual TMR for the reporting year. These values are known to be outdated. The AER has not been provided with corrected fluid tailings volumes.

[†]Imperial Kearl provided the AER with corrected site-wide fluid tailings volumes.

Appendix 4 Water Volume Data

		Water (Mm^3)										
Project	**Pond**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Suncor Base Plant	Pond 1A	2.1	2.1	2.5	2.5	2.2	2.2	2.2	2.2	2.2	2.0	2.0
	Pond 2/3	5.0	2.6	4.8	1.9	2.1	5.8	3.8	4.0	4.0	4.0	4.0
	Pond 5	N/A	N/A	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-
	Pond 6	6.0	6.9	6.9	5.7	7.1	7.3	7.3	7.3	9.5	9.5	9.5
	Pond 7	49.3	40.4	41.7	37.1	42.7	33.5	36.9	35.8	32.1	28.5	25.6
	DDA1 (Pond 8A)	N/A	N/A	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-
	DDA3	-	-	-	8.1	7.4	12.6	17.4	21.6	19.2	16.9	18.9
	Pond 8B	43.3	39.1	42.3	30.8	28.6	10.4	7.3	0.0	0.0	0.0	-
	STP	19.0	13.7	17.6	24.4	26.2	32.1	30.6	36.6	34.9	21.8	18.0
	SD8	1.5	1.5	3.4	0.9	1.7	0.7	0.9	1.1	0.5	0.5	0.7
	SD9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.1
	Total	**126.2**	**106.3**	**119.3**	**111.4**	**118.0**	**104.6**	**106.4**	**108.6**	**102.4**	**83.2**	**78.8**
Syncrude Mildred Lake	MLSB	5.6	10.8	3.4	7.5	8.3	10.0	8.1	10.8	10.8	8.3	5.7
	SWSS	34.0	42.6	47.5	48.4	43.9	48.4	33.0	29.5	29.5	19.0	25.3
	BML	57.4	55.7	60.2	63.6	67.1	70.5	69.5	71.6	71.6	71.3	73.0
	EIP	0.2	0.5	1.2	0.7	0.0	0.0	0.1	0.0	0.0	0.0	-
	SWIP junior	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	SWIP major	14.0	13.9	20.9	19.2	14.6	14.9	19.5	14.6	14.6	8.6	0.0
	NMSP/NMSPW major	15.3	14.7	2.5	0.6	6.2	12.1	39.2	30.1	30.1	8.4	20.8
	NMSPE	N/A	N/A	1.7	4.1	7.4	-	-	-	-	-	-
	NMSPE deep cake	N/A	N/A	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	NMCP-E	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6.1	16.8
	Total	**126.5**	**138.2**	**137.4**	**144.1**	**147.5**	**155.9**	**169.4**	**156.6**	**156.6**	**121.7**	**141.6**

		Water (Mm^3)										
Project	**Pond**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Syncrude Aurora North	ASB	50.5	38.9	40.1	37.9	43.2	37.2	27.4	32.5	22.5	25.0	35.6
	AEPN-E	20.0	7.5	0.1	1.6	4.8	6.0	3.8	1.8	0.1	NA	-
	AEPN-W	0.3	0.8	0.1	0.0	0.0	0.0	-	-	-	-	-
	AEP (AEPS)	1.0	28.3	27.7	21.4	27.4	35.1	61.9	62.8	75.0	65.8	27.3
	ACPN	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	8.6
	Total	**71.8**	**75.5**	**68.0**	**60.9**	**75.4**	**78.3**	**93.1**	**97.1**	**97.6**	**90.8**	**71.5**
CNUL Muskeg River	ETF	2.8	1.7	0.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	SEA	0.4	0.1	0.4	0.8	0.2	0.0	-	-	-	-	-
	IPC1	4.6	6.4	8.4	7.9	9.6	9.8	10.5	9.9	9.7	10.0	8.2
	IPC2	N/A	N/A	N/A	N/A	8.4	7.6	4.4	13.1	13.1	9.0	4.0
	IPC2A	N/A	N/A	0.3	1.0	N/A	N/A	N/A	N/A	N/A	N/A	-
	IPC2B	2.0	0.7	2.1	4.2	N/A	N/A	N/A	N/A	N/A	N/A	-
	IPC3	N/A	N/A	1.6	2.1	2.4	3.0	7.6	4.9	1.6	1.4	0.0
	IPC4N	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	9.9	2.9	8.3
	IPC4S	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.3	0.1	0.9
	Total	**9.8**	**8.9**	**13.3**	**16.3**	**20.6**	**20.4**	**22.5**	**27.9**	**34.6**	**23.4**	**21.4**
CNUL Jackpine	ETF-W (DDA1)	0.4	0.0	0.1	0.4	0.0	0.0	0.0	N/A	N/A	N/A	N/A
	ETF-E (SC1)	17.0	10.1	6.4	4.9	7.1	8.0	9.6	N/A	N/A	N/A	N/A
	ETF (ETF-W and ETF-E)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	12.4	8.3	7.8	6.7
	SC2	2.4	4.9	3.6	0.5	2.2	4.0	1.2	1.1	2.2	2.2	1.8
	FC1	N/A	N/A	0.7	6.4	6.7	7.8	7.6	9.2	10.0	7.1	6.4
	IPC1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6.3	7.4
	Total	**19.8**	**15.0**	**10.8**	**12.2**	**16.0**	**19.8**	**18.4**	**22.7**	**20.5**	**23.4**	**22.3**
CNRL Horizon	ETF/DDA1	33.0	30.0	33.0	28.2	31.1	17.0	28.0	21.2	19.7	17.5	28.0

		Water (Mm^3)										
Project	**Pond**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
	DDA2	-	-	-	-	-	-	2.0	4.0	4.0	1.6	2.8
	Total	**33.0**	**30.0**	**33.0**	**28.2**	**31.1**	**17.0**	**30.0**	**25.2**	**23.7**	**19.1**	**30.8**
Imperial Kearl	WETA	21.3	27.4	18.4	17.3	18.0	20.1	23.8	16.0	14.0	14.0	15.4
	EETA	N/A	0.3	0.8	1.7	0.5	2.3	2.1	1.0	1.0	1.0	0.1
	West TT panel	N/A	N/A	0.5	0.4	0.1	0.3	0.9	0.0	0.0	-	-
	East TT panel	N/A	N/A	0.2	0.3	0.1	-	-	-	-	-	-
	ITA1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	7.0	3.8
	Total	**21.3**	**27.7**	**19.9**	**19.7**	**18.7**	**22.7**	**26.8**	**17.0**	**15.0**	**22.0**	**19.3**
Suncor Fort Hills	OPTA	-	-	-	-	3.0	5.7	12.7	16.6	13.0	7.2	7.2
	OES1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.5	0.3	0.3
	SPTA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.1
	Total	**-**	**-**	**-**	**-**	**3.0**	**5.7**	**12.7**	**16.6**	**13.5**	**7.5**	**7.6**
Industry total		**408.4**	**401.6**	**401.7**	**392.8**	**430.3**	**424.4**	**479.3**	**471.7**	**463.9**	**391.1**	**393.3**

N/A: Not applicable.

Water volume totals in this table may not match the company reports due to rounding. Data provided by operators in their TMRs were only to one decimal place.

Variances for monitoring requirements were granted to operators in 2020 due to COVID-19. As a result, there was a mix of measured and estimated volumes for 2020. Pond surveys were not conducted for Imperial Kearl, Syncrude Mildred Lake, and Syncrude Aurora. Reduced pond surveys were completed for Suncor Base Plant, CNUL Muskeg River mine, CNUL Jackpine mine and CNRL Horizon.

Water volumes for 2024 are measured, presented as reported by operators, and are subject to change upon further review by the AER.