

Assessing Toxicity of Treated Oil Sands Process-Affected Water

Experimental Study Design

Treatment and release of wastewaters from industrial, mining, and municipal facilities is practiced throughout the world. Alberta's Tailings Management Framework, under the Lower Athabasca Regional Plan, provides direction to manage fluid tailings from oil sands operations during and after mine operation. Provincial regulators, Alberta Environment and Parks and the Alberta Energy Regulator, are seeking scientific information to inform future decisions around the potential for the release of treated oil sands process water (OSPW) into the Lower Athabasca River.



The Alberta Environment and Parks Chief Scientist oversees the work of a multi-disciplinary Science Team. The Science Team is responsible for overseeing the design and implementation of experiments that will provide information on the toxicity of OSPW treated using Syncrude Canada's coke-slurry treatment process. The science team is also designing and overseeing enhanced monitoring of the Lower Athabasca River. This work includes quantifying baseline conditions, assessing potential effects on the river, and modelling the predicted environmental and human health impacts of treated OSPW release.

Definitions

Oil Sands Process Water (OSPW) – water in tailings ponds that is recycled internally as part of the bitumen extraction process and for material transport including ore and tailings solids.

Mesocosms – are closed system containers that mimic natural environments. They are often used in experiments to assess the conditions under which treated industrial effluents can be safely returned to the environment.

Environmental toxicology – the study of the effects of manufactured chemicals and natural materials on plants and animals, including studies at the cellular level through organisms to communities and ecosystems.

Toxicity – the extent to which a substance can harm plants and animals.

Toxicity effect threshold – the concentration above which a compound is expected to have an adverse effect on plants and animals in the environment.

Acute Toxicity – is the concentration at which exposure over a short period of time has adverse effects on an organism.

Sublethal toxicity – effects that impair growth, survival or maturation but that do not result in the death of a plant or animal.

Setting up the Toxicity Studies

To evaluate the quality of the treated OSPW as a result of Syncrude's OSPW treatment process, a series of environmental toxicology studies, guided and evaluated by a third-party science team are underway. The first report, titled [2019 Toxicity & Mesocosm Studies](#), outlines a suite of laboratory tests and tests using mesocosms to quantify the effectiveness of Syncrude's water treatment process. These experiments are "closed loop", meaning that none of the treated OSPW will be released into the Athabasca River. Rather, all water used in the experiments, including treated OSPW, will be redirected into the existing network of water storage ponds.

What will the experiments test?

The assessment of the treated OSPW as a result of the treatment process will be evaluated by:

- Quantifying how the treatment technology removes chemicals of interest (e.g. dissolved metals, organic compounds, and salts)
- Determining the toxicity of treated OSPW on a broad suite of aquatic life, including algae, insects and other invertebrates such as mussels and fish that live in the Athabasca River.

What do we expect to learn?

We anticipate this testing design will lead to a better understanding of the responses of aquatic species to treated OSPW, including acute and sublethal toxicity

levels. Species, naturally found in the Lower Athabasca River, including fathead minnows and walleye, freshwater mussels and *Daphnia magna* (small crustacean) are part of the design. Defining threshold concentrations of treated OSPW that result in acute or sublethal toxicity are used to determine under what conditions treated OSPW could be released while being protective of the plants and animals that live in the river.

The testing of treated OSPW will inform decision makers on whether OSPW treated with Syncrude's process can be safely returned to the Lower Athabasca River.

Moving from Design to Testing

The testing design is set to be implemented with experiments running in an upcoming field season.

The data analysis and reporting from these experiments will be publically available when completed. The primary analysis of laboratory and mesocosm results will be completed by Environment and Climate Change Canada with support from the consultants engaged to design studies. A final technical report is anticipated in late 2020 or early 2021.

Contact Information

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Additional Information

The full study design, completed by Hatfield Consultants and submitted to the Oil Sands Process Water Science Team, is available at:

Hatfield Consultants. 2019. Ecotoxicity Assessment of Treated Oil Sands Process-Affected Water (OSPW): 2019 Toxicity and Mesocosms Studies. Published by Government of Alberta, Ministry of Environment and Parks. ISBN 978-1-4601-4450-3. Available at: open.alberta.ca/publications/9781460144503.