A14/SEM/10-002/01/ASUB
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ORIGINAL: Spanish

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MIN-118731

MEMORANDUM TO THE MINISTER

OIL SANDS TAILING PONDS

(For Information)

PURPOSE

To inform you of the environmental impact of oil sands tailing ponds. *(revised Jan. 19, 2009)*

SUMMARY

- Tailing ponds are large bodies of water and sludge-like sediments formed as a result of the hot water process that separates bitumen from sand. Most of the water is trapped in the sediments that make up most of the tailing pond's contents. The water is contaminated with bitumen and other toxics and cannot be released to the natural environment. The surface area and volume of tailing ponds have grown substantially over the past three decades and are expected to continue to grow over the next several decades. These tailings ponds are one of the few man-made features that can be seen from space.

- Tailing ponds have environmental effects on water, land, wildlife and air. Some of these effects are potentially significant. There is considerable international media attention to the environmental performance of the oil sands, and the size and toxicity of the tailing ponds features prominently in that coverage.

- Environment Canada does not issue any approvals for the oil sands projects. There are no federal triggers under the *Canadian Environmental Assessment Act* for Environment Canada. The Department of Fisheries & Oceans and Transport Canada have such triggers that result in those departments issuing either authorizations or permits. Environment Canada participates in the environmental assessment process as a Federal Authority providing scientific, expertise, information and knowledge to the Responsible Authorities (i.e., Fisheries & Oceans and Transport Canada).

- Oil sands projects are subject to various licenses and approvals from several departments and agencies of the Government of Alberta, including the Energy Resources Conservation Board and the Department of the Environment. Under Alberta's *Environmental Enhancement and Protection Act*, an environmental assessment must be completed, and the resulting permit is typically associated with a long list of conditions related to environmental performance. A permit under the *Water Act* is required for withdrawals of surface water. Alberta has a zero-discharge policy for oil sands tailing ponds.

- The Department administers and enforces a number of acts and regulations which could impose some requirements on oil sands tailings ponds. These are the *Fisheries Act*, the *Species at Risk Act*, and the *Migratory Birds Convention Act* and its associated *Migratory Birds Regulations*. In addition, air emissions from tailings ponds could be covered by the *Canadian Environmental Protection Act*, if regulations are put into place.

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CURRENT STATUS

Alberta's oil sands are a strategic energy resource for Alberta and Canada. The oil sands are the largest developed bitumen deposits in the world. The proven oil reserves from them are second in the world only to Saudi Arabia. Small oil sands deposits in northwest Saskatchewan are also being developed. Oil from conventional oil production is falling in Canada, whereas bitumen production is expected to triple by 2020. The production of oil from the oil sands is already over half of Canada's total oil production and this will likely increase to three-quarters of Canadian oil production by 2020.

The separation of bitumen from bitumen-containing sand extracted using open pit mining techniques requires a significant quantity of water. It requires between 2 to 4 barrels of water to create one barrel of synthetic crude oil. After the extraction, the water used is contaminated with hydrocarbons and other substances and is toxic.

Alberta has a policy of zero discharge of this water to the natural environment, so the water must be stored. This water is permanently stored in "tailing ponds", which are large bodies of standing water contained behind man-made dykes or dams that are constructed from sand and overburden excavated as part of the mining process. Some water from the tailing ponds can be recycled for the extraction processes, and additional water requirements are drawn from fresh water sources such as the Athabasca River or possibly in the future from saline groundwater. Based on historical performance, generally the industry has been unable to meet its own predictions for performance of tailings management systems with the result that larger volumes of tailings need to be stored in ponds than has been predicted during regulatory review and approval processes.

There are currently four open-pit oil sands mines operating in northeast Alberta, each with substantial tailings ponds, and a fifth mine has just commenced operations this year. The tailings ponds currently cover an area of about 63,000 acres or 250 km^2 (refer to map in the Annex). Over the next decade or so, it is expected that there will be six new mines and a number of major expansions to existing mines.

ISSUES

Water

The water in the tailings ponds is highly contaminated and not suitable for release to the natural environment without expensive chemical, physical or biological treatment. The toxicity of water is due primarily to high concentrations of naphthenic acids, salts, polycyclic aromatic hydrocarbons and some metals. The water trapped in the fine tailings cannot be treated until it has been separated from the sediments. The industry, in conjunction with Natural Resources Canada and universities, is developing technologies (e.g., "Consolidated Tailings") which reduce the amount of water in the fine material deposited in the tailings ponds.

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Adding a surface layer of 3 to 5 metres or more of fresh water to the tailings ponds has been proposed by industry as a viable mitigation measure for tailings, but such an approach has not yet been commercially demonstrated to segregate toxic tailings from the overlying fresh water. One issue is that after 15 to 20 years the sediments of tailings ponds began to generate methane gas bubbles that could re-suspend tailings and prevent settling and potentially mix fine tailings into this proposed water cap.

A December 2008 report by the environmental group Environmental Defence estimated that liquid contents (water plus toxics) of the tailing ponds are seeping out at a rate of 11 million litres per day in 2007, growing to over 72 million litres per day within a decade. This was estimated by using industry data from their environmental assessment submissions and allowing for the industry-proposed concept that the lakes "seal" themselves over time though the deposition of fine particles (which may not be a completely impermeable seal).

Seepage would not likely be directly into surface waters, but move first into groundwater. It may take decades to reach surface waters. In their environmental assessments, many oil sands companies acknowledge that this may occur. Natural Resources Canada possesses considerable technical expertise in this area, and is reviewing the validity of Environmental Defence's conclusions.

Wood Buffalo National Park is downstream of the oil sands developments. Environment Canada samples the Athabasca River at the southern boundary of Wood Buffalo National Park every month; however, this is a small, funding-limited program associated with identifying cumulative effects of pulp mill. It does not at present test for particular parameters (e.g., naphthenic acids and possibly others) which could be used as definitive indicators for oil sands related activities, but tend to be expensive to test for. The samples are used to monitor several total and dissolved metals, including arsenic, chromium and lead. Although some results exceed Canadian Council of Ministers of the Environment's *Canadian Water Quality Guidelines for the Protection of Aquatic Life* (i.e., for lead, copper, iron, aluminum and zinc), the high levels of metals are attributed to sediment loading in the river and they cannot be traced to deposition from oil sands tailings ponds.

Land Reclamation

The reclamation of the land covered by tailing ponds depends on the ability to contain fine particles present in tailings ponds and to eliminate toxicity of overlying water and associated sediments for their return to the natural environment. Research into reclamation of tailings ponds water through chemical, physical and biological (e.g., constructed wetlands) treatment is underway through industry-sponsored initiatives in university, government, and industry laboratories. To date, very little (0.2%) of the total mined land has been certified as reclaimed by the Government of Alberta, although industry claims that they have reclaimed up to 30% to some level of natural environment. The criteria for certifying land as being reclaimed are the subject of ongoing debate.

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Many stakeholders doubt the ability of industry to reclaim tailings ponds to some degree of natural environment following closure of mining operations. Questions are often raised by stakeholders as to whether industry is committing sufficient resources to research and development in this area. The Alberta Energy Resource Conservation Board recently proposed requirements to decrease the ratio of wet to dry fine particles in the discharge to the tailing ponds, with a final requirement expected soon. These requirements will likely require the widespread adoption of the Consolidated Tailings technology or a similar type of technology.

Wildlife

Habitat loss from oil sands development (including the creation of tailings ponds) is currently the greatest concern to migratory birds (particularly the whooping crane) and to the woodland caribou due to severe challenges for landscape restoration and reclamation. By combining the various estimates of the loss of birds from mining and in-situ operations (including tailings ponds), a recent report by the Natural Resources Defence Council projects a cumulative impact over the next 30 to 50 years ranging from a low of about 6 million birds lost to as high as 166 million birds lost. Modelling by the Cumulative Environmental Management Association (CEMA) has indicated that the herds of woodland caribou in the region will be significantly affected by the development of in-situ facilities and their extensive linear disturbances (there are no herds in the surface mining area of the oil sands).

Birds that land on tailings ponds can also become oiled or ingest toxic material, both of which can be detrimental or fatal. Tailing ponds can become biological traps for species, as passing or migrating birds mistake them for natural bodies of water. Some endangered and threatened species of migratory birds are also known to occur and migrate over the oil sands tailings ponds. Examples include Whooping Cranes and Peregrine Falcons. The recent report by the Natural Resources Defence Council estimated an annual mortality of 8,000 to 100,000 birds due to direct bird contact with tailings ponds (a part of the overall oil sands impact noted above). The report also anticipated that a doubling of tailings ponds would increase projections to 17,000 to 300,000 birds. Experts in Canadian Wildlife Service concluded that estimates of landings on tailings ponds are reasonable, but such estimates of mortality are highly speculative.

In April 2008, approximately 500 migratory ducks became oiled and died when they landed on a tailings pond at Syncrude's Aurora mine. The company's normal noise-making deterrent equipment was not functioning at the time. This is the largest single number of birds reported oiled in past years, and the incident became international news. It should also be noted that small numbers of bird losses have been documented in the tailings ponds for many years, even with bird deterrents in place.

Air

Any hydrocarbons (bitumen, extraction solvents or diluent) not recovered in the mining process generally end up in the tailings ponds. Heating from the sun, surface agitation from the wind and microbial breakdown of these residual hydrocarbons results in emissions to the atmosphere.

Tailings ponds are an important source of emissions of smog-forming volatile organic compounds, methane (a greenhouse gas) and benzene (a toxic, carcinogenic volatile organic

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compound) from oil sands mines, accounting for more than 70% of a facility's total. In 2006, this represented approximately 100,000 tonnes of emissions of volatile organic compounds and methane to the atmosphere; however, these emissions estimates are calculated from emission factors derived from limited observations and actual emissions may in fact be larger.

CONSIDERATIONS

Media Attention

There is considerable international media attention to the environmental performance of the oil sands, and the size and toxicity of the tailing ponds features prominently in that coverage. The environmentalist's message of Canada's "dirty oil" has gained significant attention abroad.

Alberta Regime

Oil sands projects are subject to various licenses and approvals from several departments and agencies of the Government of Alberta. Prominent among those is the need for a license from the Energy Resources Conservation Board, the provincial energy regulator. The Board imposes several performance and reporting requirements, for example on sulfur recovery and proposed performance requirements for oil sands tailings.

Under Alberta's *Environmental Enhancement and Protection Act*, an environmental assessment must be completed, and the resulting permit is typically associated with a long list of conditions related to environmental performance (water removal, water quality of non-tailing pond discharges, land and land reclamation, air emissions standards, environmental equipment performance, solid waste). A permit under the *Water Act* is required for withdrawals of surface water. Alberta has an enforceable requirement for oil sands tailing ponds that does not allow companies to discharge any untreated water. Other permits regulate use of crown land, infrastructure and other aspects of a project.

Environment Canada's Authorities

Because the tailing ponds do not discharge into fish-bearing bodies of water, Environment Canada has not regulated tailings ponds through the *Fisheries Act* (although it might be able to if it there was seepage from the tailing ponds into fish-bearing bodies of water). As a result, the Department does not actively monitor tailings management systems or the ponds themselves. However, Environment Canada administers and enforces a number of acts and regulations which could impose some requirements over oil sands tailing ponds. These are the *Fisheries Act*, the *Species at Risk Act*, and the *Migratory Birds Convention Act* and its associated *Migratory Birds Regulations*. In addition, releases of toxics substances from tailings ponds (either to the air or to water) could be covered by the *Canadian Environmental Protection Act*. Many toxics substances found in tailing ponds (e.g., VOCs, PAHs, benzene) are on Schedule 1 of CEPA, but currently there are no federal regulations to control their releases from tailings ponds. Under the Clean Air Regulatory Agenda, the feasibility of a regulated code of practice for reducing fugitive emissions from tailing ponds is to be assessed.

Environment Canada does not issue any approvals for the oil sands projects. There are no federal triggers under the *Canadian Environmental Assessment Act* for Environment Canada. The

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Department of Fisheries & Oceans and Transport Canada have such triggers that result in those departments issuing either authorizations or permits. Environment Canada participates in the environmental assessment process as a Federal Authority providing scientific, expertise, information and knowledge to the Responsible Authorities (i.e., Fisheries & Oceans and Transport Canada). As well, the Province of Alberta issues approvals for oil sands projects.

The Department has only limited science capacity related to tailings management. However, broad questions of water use and protection of surface water quality related to the oil sands industry are of interest to the Department.

Ian Shugart

c.c.: Associate Deputy Minister

Attachments (2)

Revised January 19, 2009