Oil Sands: The Case for Caution Script

Slide 1. (SES logo)
Slide 2. The Saskatchewan Environmental Society has prepared this presentation to point out some of the concerns that are being raised about the oil sands, or tar sands, industry and its coming expansion into Saskatchewan. It seems as if we're having trouble curbing the world's appetite for oil, and the conventional sources that we've been relying on in the past are getting scarcer and more expensive to extract. The oil sands represent a big potential alternative supply, and oil companies can make a lot of money by developing this non-renewable resource. But there are also environmental risks that lead us to recommend a very cautious approach to development of Saskatchewan's oil sands.
Slide 3. Let's start by defining what we're talking about. Oil sand is a thick, sticky form of crude oil, an unconventional kind of petroleum deposit. It's a dense mixture of sand, clay, water and tarry material that's found underground in many countries but existing in extremely large quantities in Canada, especially in northern Alberta.
Slide 4. This is what a handful of oil sand or tar sand looks like.
Slide 5. If you looked at a single grain of oil sand, you would see that it's composed of a grain of sand with a layer of water around it, coated with a layer of very sticky tar called bitumen. So you need to remove the material from underground and to separate the bitumen from the sand before it can be further processed into a usable product.
Slide 6. Canada has a lot of the world's oil supply. The circle graph at the left shows the yellow piece that is Canada's share of the estimated world resource. But because a lot of it is the form of bitumen it's not as easy to extract as the resource in some other countries. The map on the right hand side of the picture shows the location of the major oil sand deposits in Alberta and Saskatchewan. These are shown in purple. There's that big purple blob around Fort McMurray called the Athabasca deposit – this spills over into Saskatchewan, then a smaller area to the west around Peace River, and then a deposit a bit further south on the east side of Alberta, called the Cold Lake Deposit which also overlaps into Saskatchewan.
Slide 7. This map shows the region of northwestern Saskatchewan where oil sands are known to exist in commercially interesting quantities. You'll see the town of La Loche in the lower part of the map. Above La Loche there's a green backwards L that marks the Clearwater River Wilderness area. The area that's been extensively explored for oil sand is inside the bend of the river, around Descharmes Lake.
Slide 8. The Clearwater River is a Canadian Heritage river. It is beautiful and pristine.
Slide 9. So far no commercial extraction of oil sands has taken place in Saskatchewan, but large areas of the countryside have been criss-crossed with seismic exploration lines, trial well operations, worker camps, roads and airstrips. At present commercial development is awaiting financial investment by some major developer.

Slide 10. So let's look at what's involved in getting at the bitumen that's hiding underground. There are two ways of extracting it. If it's not buried too deep, it's mined from the surface; if it's very deep, an alternative process known as 'in situ' extraction is used. Both approaches have been used in Alberta. Let's look first at the mining approach.
Slide 11. This slide really has too much information on it to see very clearly. Basically what it's showing is that you start with the photo in the top left-hand corner where, after clearing off the surface layer of vegetation and soil, huge shovels dig into the ground and remove the oil sand ore and put it into large trucks. The trucks take it to crushers where it's broken down into smaller lumps. These are vigorously stirred up with water - the sand tends to sink and the bitumen to float, so a primary separation is achieved. The dirty water and sand are piped to a tailings pond. The bitumen is mixed with solvent so it will flow, and is pipelined to an upgrader for processing.
Slide 12. This is what the mine site looks like –
Slide 13. And here is a picture of the waste materials being released into the tailings pond. This material is heavily contaminated with oil residues and contains cancer-causing chemicals and tarry material.
Slide 14. All too often birds mistake a tailings pond for a lake, and they land on the filthy water and get coated with guck.
Slide 15. It's not surprising that the birds get confused, because the tailings ponds are large. This shows the tailings area at a Suncor oil sand facility at Fort McMurray.
Slide 16. It's estimated that 1.8 billion litres of tailings are produced every day…
Slide 17. …and that 11 million litres of contaminated water leak out into the environment every day.
Slide 18. This is a really interesting photo. On the right hand side you see a Suncor tailings pond, full of contaminated water. On the left side is the Athabasca River, separated from the tailings pond by a fairly narrow dyke. Concerns about contamination of the river have been raised by people living downstream at Fort Chipewyan, where cancer rates seem to be unusually high.
Slide 19. This google map again shows the proximity of several tailings ponds to the Athabasca River.
Slide 20. So that's what the mining process looks like. The other way of getting at bitumen is the In Situ process. In situ means 'in place' in Latin, and it's a process used when the oil deposit is too deep to mine from the surface. Basically, you dig a well that first goes down vertically into the deposit then turns horizontally through the layer of ore. The horizontal part is perforated with holes. Through that well you pump steam that is released into the surrounding underground region. The heat liquifies the bitumen, which is then collected into another perforated pipe and pumped up to the surface. So you avoid all that surface destruction.
Slide 21. Although we avoid the surface destruction, it's not all good news. This In situ process uses a lot of water – and energy to heat the water to make steam. Some of the water can be recycled and re-used, but some stays down in the ore deposit. Where does the water come from? Whether it's taken from nearby lakes and streams

or from aquifers underground, we need to be concerned about the impact on local water systems. It's worrying that the aquifers in the area of Saskatchewan that is being explored for oil sand development have not been mapped.
Slide 22. Also, you shouldn't get the impression that there's no surface impact from In situ facilities. The complex of wells, pipelines, storage and treatment facilities takes up a lot of space.
Slide 23. This is an In situ site at Long Lake, Alberta, probably similar to what would be developed in Saskatchewan. It includes a 99 hectare central facility, 234 exploration wells, 288 production wells, and power lines to each well pad.
Slide 24. The oil from oil sands is sometimes described as 'dirty oil'. Let's think about whether that label is justified. What are environmental impacts that we should be concerned about?
Slide 25. Let's think first about the impact on wildlife when you convert a landscape that looks like this into something that looks like-
Slide 26. this –
Slide 27. - or even like this.
Slide 28. On this picture you can make out the criss-cross lines through the forest where clearing of vegetation has taken place for seismic exploration. This Opti-Nexen site consists of a 10,600 hectare land parcel in which 80% of the land is less than 250 metres away from industrial infrastructure. The fragmentation of physical habitat results in the natural range of wildlife being diminished and split up.
Slide 29. Some of the declining species in northeastern Alberta that are affected by this habitat damage are listed here – lynx, caribou, wolverine, marten, fisher and several bird species.
Slide 30. The woodland caribou is a species of particular concern. These animals are migratory, and they are being confronted not only with habitat fragmentation -,
Slide 31. - but also with great expanses of above-ground pipelines that restrict their movement.
Slide 32. Lynx is another iconic species that is in decline as a result of industrial intrusion into its habitat.
Slide 33. Birds are not immune from harm. Although they can fly over the disturbed areas, their nesting sites are destroyed. This common nighthawk and –
Slide 34. – Lesser Scaup are both facing decline in northern Alberta.
Slide 35. Here's another impact of industrialization. Road building, heavy vehicle traffic and stream crossings stir up a lot of dirt, causing soil erosion and depositing of sediment in surface waters.
Slide 36. So let's summarize the potential impacts of in situ oil sand operations on water:

- Steam injection requires a lot of water. Extraction of groundwater can lower aquifer levels in the vicinity of the well from which the water is taken, in turn creating a reduction in the water levels of nearby lakes, ponds and wetlands.

- Aquifer or surface water quality can be damaged by well blow outs, when there is an uncontrolled release of oil.
- Thermal plumes created during bitumen extraction can mobilize arsenic. This means that the elevated underground temperature resulting from steam injection can make arsenic or other contaminants that were previously fixed in the rock become mobile so they can move around and potentially end up as a hazard to living things.
- Bitumen under pressure may leak into permeable aquifers and contaminate water supplies.

Slide 37. But it's not only the water we worry about. The primary processing of the bitumen results in emission of air pollutants, including sulfur dioxides, nitrogen oxides, volatile organic compounds, particulates and carbon dioxide. This is true regardless of what method is used to extract the bitumen from underground.
Slide 38. This is an up-grader in Alberta where the primary processing takes place. This is the source of much of the air pollution associated with the oil sands industry.
Slide 39. Greenhouse gas emissions from the oil sands are estimated to be about triple those from conventional oil production. For many in situ oil sands plants, greenhouse gas emissions can be even higher.
Slide 40. This graph shows that oil sands production is a lot worse than conventional oil production as far as greenhouse gas emissions are concerned. You'll notice that Canadian conventional oil production results in a bit more greenhouse gas emission than American production does. This is presumably due to the fact that more of our oil tends to be heavy and is more energy-demanding to remove.
Slide 41. As well as greenhouse gases, the air pollutants include acid gases such as sulfur dioxide. These gases are carried by the wind for hundreds of kilometers before they get washed down in the rain as acid rain. Because the prevailing winds are from the northwest, much of the acid precipitation from Alberta's up-graders comes to earth in northern Saskatchewan. Acidification of lakes, streams and soils has a variety of damaging effects.
Slide 42. Here are some of the impacts on water bodies and the creatures that live in them. Insects, frogs and other little creatures are vulnerable to acid damage. As they often form the food supply for fish, the fish may go hungry. Also, as the water becomes more acidic, fish may be poisoned by chemicals that are released from the lake bottom . Not all species of fish are equally affected.
Slide 43. Trees are also vulnerable to acid damage. This illustrates how acid rain can directly damage leaves, resulting in a reduced level of photosynthesis. The tree becomes more susceptible to stresses such as drought, extreme cold, insect damage and disease. At the same time, acid rain falling on the soil can lead to release of toxic metals from the soil into solution, causing root damage and reduced ability of the tree to take up water and nutrients.

Slide 44. So here's our list of the major environmental problems associated with oil sands production:

- Forest fragmentation and loss of boreal forest habitat even when there are many species in decline,
- Loss of lands that deserve protection or have high alternative economic values,
- Risk of aquifer contamination and decline in surface water quality,
- Sulphur and nitrous oxide emissions result in acid rain and damage to northern lakes,
- Unusually high greenhouse gas emissions compared to conventional oil production.

Slide 45. So here's the question for you – Is it worth it?
Would it make more sense to concentrate on cleaner ways of meeting our energy needs? Can you imagine eventually living without oil? How would we manage it?