Canada's Oil Sands

Image from: http://nobleinvestments.co.uk/canada%20oil.jpg

Outline

- Introduction to the Tar Sands
- Environmental Consequences
- Social and Economic Consequences
- International Reactions and Environmental Organizations
- What is being done…

Oil sands or tar sands?

http://www.freedomsphoenix.com/Uploads/Graphics/000-0730102557-tar-sands-in-hands1.jpg

- ***Oil sands*** is the term used by the oil industry and the Government of Canada

- ***Tar sands*** is the term often used by environmental organizations against development in the oil/tar sands

Tar Sands = Oil Sands

Alberta's Oil Sands

- **Deposits cover ~140,200 km^2 of land**
  - **world's second largest hydrocarbon reserve**
    - **potential to recover an estimated 175 billion bbls of oil (Tenenbaum, 2009)**
  - **91 active oil sands projects in Alberta**
    - 1990 to 2003 : **210%** increase in production

(Timilsina et al., 2005).

What is bitumen?

Bitumen is composed of:

-polycyclic aromatic hydrocarbons (PAH),

-sulfur, lead, mercury, arsenic, nickel, vanadium, chromium, and selenium (Tenenbaum, 2009).

-more carbon and far less hydrogen than conventional oil;

- ***Unconventional Oil***
  - **More energy and fresh water intensive**

Surface Mining

- **20% of total oil sands deposits are accessible through mining**
  - **61% of current daily production is from surface mining**
  - 1 barrel (bbl) of oil from surface mining requires:
    - the removal of **2000kg** of over burden material & **4 bbl water**

- **Environmental Concerns**
  - **Habitat loss & Deforestation**
  - **Saline soils**
  - **Emissions**
    - **Volatile Organic Compounds (VOCs)**
    - **Greenhouse Gases (GHGs)**
    - **Sulfur and nitrogen oxides (SO_X& NO_X)**

Tailings Ponds

- Store toxic waste produced from oil refinement
  - Cover an area of ~**150 km²**
    - » equivalent in size to Vancouver

- **Source of toxic seepage into the soil and groundwater systems**
  - Estimated at 11 million L/day (Price, 2008)

- **Toxins Include:**
  - **Bitumen**
  - **Phenols**
  - **Polycyclic Aromatic Hydrocarbons**
    - **(PAHs)**
  - **Cyanide & Arsenic**
  - **Napthenic acids (NA)**

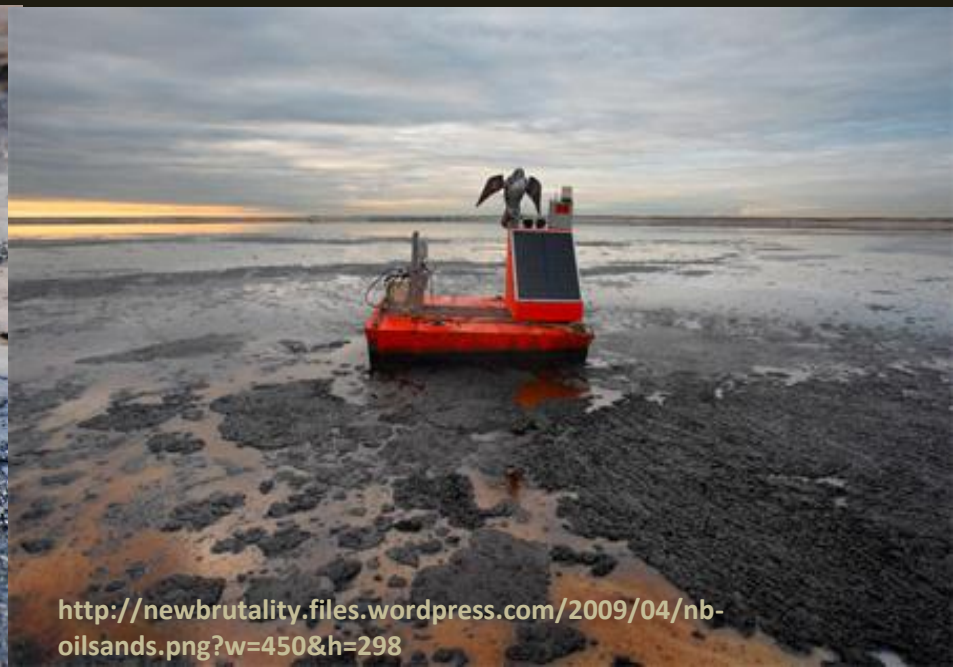
http://tippingpointblog.files.wordpress.com/2008/12/tar-sands-more-tailing-ponds.jpg

- **Air emissions:**
  - Evaporated **VOC's from tailings ponds → increased 119%** since 2005 (Timoney and Lee, 2009)
  - **GHG's – CO_2, methane (CH_4), NO_X**

April 28, 2008: Syncrude Duck Incident

- 1,606 ducks were killed after landing on a tailings pond
  - Initially Syncrude did not report the event
  - First reports estimated the deaths of 500 ducks…

http://www.theepochtimes.com/n2/images/stories/large/2010/03/03/ducks2.jpg



http://newbrutality.files.wordpress.com/2009/04/nb-oilsands.png?w=450&h=298

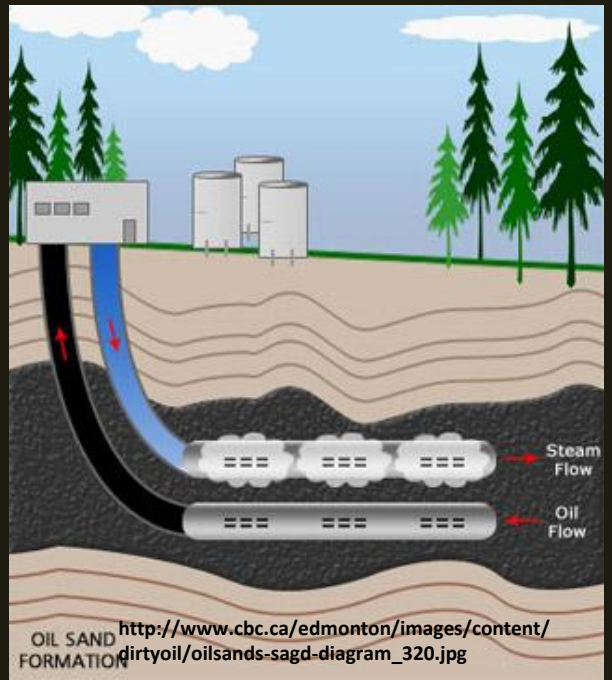
In-situ Extraction

- Involves injecting steam into underground bitumen deposits
  - **decreasing the viscosity of the material**
  - **Natural gas is generally used to heat the steam**

- **Deposits available to in situ extraction cover 135,250 km^2**

- used to extract deeper bitumen deposits
  - **>100m below the surface**

- **Major Environmental Concerns:**
  - **More emissions released than mining**
  - **Water withdrawl**
  - **Habitat Fragmentation**



http://www.cbc.ca/edmonton/images/content/dirtyoil/oilsands-sagd-diagram_320.jpg

Upgrading Heavy Oil & Overall Air Emissions

- Within **50** km of oil sands upgrading facilities:
  - 11,400 tons of airborne particles were deposited on the snowpack
    - **391 kg** of polycyclic aromatic compounds (**PAC**s) (Kelly et al., 2009)

Overall Emissions

- **Volatile Organic Compounds (VOCs)**
  - interact with NO_x to generate tropospheric ozone
  - Can affect human health

Overall Emissions:

- **Sulfur and Nitrogen Oxides** (NO_X & SO_x)
  - Acid Rain
  - deposition accelerates acidification of soil

  – **Recent Trends:**
    - **$SO_{2(g)}$**: Peak increase of **38%** since 2005
    - **NO_x**: Peak increase of **78%** since 2005 (Timoney and Lee, 2009)

- **Particulate Matter ($PM_{2.5}$ & PM_{10})**
  – Smog & Haze Formation
  – Human Health
    - Cardiac and respiratory systems

- ~65-70% of the emissions → Saskatchewan
  (Prebble et al., 2009)

Water Impacts: Athabasca River water quality

- **Seepage from tailings ponds, atmospheric deposition, & natural seepage**

Downstream of oil sands facilities:

- **26 species of PAHs increased** in concentration
  (Kelly et al., 2009)
- **Mercury** content in walleye fish near Ft. Chipewyan **~0.45 mg/kg**
  - (Aquatic life guideline (ALG) = 0.17mg/kg)

  (Timoney, 2007)
- **$[Arsenic]_{sediment}$ = 9.2 mg/kg** (ALG= **5.9 mg/kg**)
  (Timoney, 2007)
- **[Se], [Al], [Ag] and [V]** exceeded fish protected threshold limits
  - reproductive failure, deformities and death among aquatic organisms and waterfowl

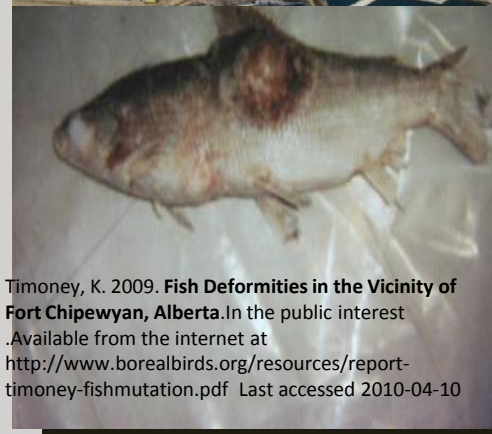


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Image available from http://www.cbc.ca/gfx/images/news/photos/2008/08/18/north-chip-fish080815.jpg

Reclamation

- A **tailings pond** has **never** been successfully reclaimed in the oil sands
  - Mature Fine Tailings, End Pit Lakes

- **Reclamation of Wetlands**
  - Net loss of wetlands with reclamation
  - Wetland withdrawl policy is limiting

- **Salinity of Soils**
  - Poses a challenge for reinstating native vegetation
- **Habitat Loss and Fragmentation**

- **0.2%** of the disturbed land has received a **certificate of reclamation** (Government of Alberta, 2008b; Grant et al., 2008)

http://www.oilsandsreview.com/common/media/OSR_PHOTO/img11.jpeg

Problems with Policy


http://news.auroraphotos.com/wp-content/uploads/canada_oil_river.jpg

- **Precautionary principle:** Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

- Potential Issues in the Tar Sands:
  - Limited Publically Available Data
  - Lack of Transparency
  - Rate of reclamation greatly lagging behind the rate of development
  - AB Security Fund (**Polluter pays:** The polluter should, in principle, bear the cost of pollution).
  - Ineffective policy that lacks in regulatory enforcement

Problems with Policy Cont'd.

- ***Regional Aquatics Monitoring Program (RAMP)***
  - Industry funded initiative for the monitoring
  - In 2007 accused of using inappropriate scientific methods and inadequate sampling by an independent report that found RAMPs programs to be ineffective (Burton Ayles et al., 2004)

http://www.onearth.org/files/onearth/article_images/07fall_alberta41_slideshow.jpg

- ***Cumulative Environmental Management Association (CEMA)***
  - a multi-stakeholder committee, which incorporates participation from first nation groups, industry, environmental organizations and government
  - Established in 1999

Economic and Social Perspectives

- *"At this time of global economic turmoil, the one shining economic light in this country is the oil sands."- Ron Stevens, the Alberta Deputy Premiere (CAPP, 2009).*

- In AB, 1 in 13 jobs is related to Energy (Government of AB, 2010)
  - Oil Sands → over 240, 000 jobs across Canada
- For every 1$ invested → ~9$ return value (Government of AB, 2010)

Campaigns against the Tar Sands

-NGOs such as Climate Action Network, Greenpeace, World Wildlife Foundation and many more

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