CPANS Edmonton Luncheon

Area Fugitive Greenhouse Gases Emissions Estimation in the Oil Sands

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The oil sands in a carbon constrained world...

**OIL SANDS** = 0.15% of global GHG emissions

Oil sands carbon intensity is decreasing, while the carbon intensity of ‘conventional’ sources is going up

**CANADA** = 2% of global GHG emissions

The challenge: as production increases, so do total emissions
GHG Emissions across Canada

[Bar chart showing emissions across different provinces in Canada for the years 2005, 2010, and 2020. The chart includes data for British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, Nova Scotia, and Newfoundland.]
Reported 2011 Facility GHG Emissions as Portion of Total Provincial/Territorial Emissions

- Alberta: 51%
- Ontario: 40%
- Saskatchewan: 20%
- Quebec: 60%
- British Columbia: 100%
- Nova Scotia: 80%
- New Brunswick: 40%
- New Newfoundland and Labrador: 60%
- Manitoba: 50%
- Northwest Territories: 20%
- Nunavut: 50%
- Prince Edward Island: 20%
- Yukon: 80%

Reported Industrial Emission vs Total Provincial / Territories
Contribution of 2011 Total Reported Greenhouse Gas Emissions by Industrial Sector in Alberta

- **Electric Power Generation**, 44 Mt, 35%
- **Oil Sands Mining and Upgrading**, 29 Mt, 23%
- **Oil Sands In Situ Extraction**, 20 Mt, 16%
- **Conventional Oil and Gas Extraction**, 8 Mt, 7%
- **Chemical Manufacturing**, 7 Mt, 6%
- **Fertilizer Manufacturing**, 4 Mt, 4%
- **Petroleum and Coal Products**, 4 Mt, 3%
- **Pipeline Transportation**, 3 Mt, 2%
- **Mineral Product Manufacturing**, 2 Mt, 2%
- **Other**, 2 Mt, 2%

**Large Emitting Facilities – (>50,000 tonnes CO2e)**

Regulated Emitters = 115 Mt CO₂e >70% of total Industrial Emissions, >50% total Provincial emissions (242 Mt CO₂e)
Specified Gas Emitters Regulation

- Came into force in 2007

- Applies to all facilities in Alberta that produce over 100,000 tonnes of CO₂E
  - About 100 facilities that represent 50% of Alberta’s overall emissions or 70% of industrial emissions

- Requires facilities to establish a historic baseline intensity
  - Based on average emissions intensity from 2003-2005 (emissions/production = baseline intensity)
  - 3rd-5th year average for new facilities

- Intensity limits applied – reductions relative to baseline intensity
  - Existing facilities - required to reduce their intensity by 12% from their baseline
  - New Facilities - phase-in of target for new facilities
Target Example – Existing Facility

Emissions Intensity (tonnes CO2e/unit of production)

Current Emissions Intensity

Baseline Period (3 year Avg. of CO2e per unit of production)

Business As Usual Emissions Intensity

Emissions Intensity Limit = 12% Reduction off baseline intensity
Oil Sands Mining and Upgrading (2011)

2 Mt CO2e, 7%

Stationary Fuel Combustion
Industrial Process
Fugitive/Other
Venting and Flaring
On-Site Transportation
Waste and Wastewater
# 2011 Tailings and fugitive Emissions

<table>
<thead>
<tr>
<th></th>
<th>CH4 Emissions (t CO2e/y)</th>
<th>CO2 Emissions (t CO2e/y)</th>
<th>total GHG (t CO2e)</th>
<th>MMbbl bitumen produced</th>
<th>kg CO2e/bbl bitumen</th>
<th>Diluent loss (m3 ERCB)</th>
<th>kg CO2e/m3 diluent lost</th>
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</thead>
<tbody>
<tr>
<td><strong>Suncor Mines and Upgraders</strong></td>
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<tr>
<td>Total emissions from ponds</td>
<td>122,078</td>
<td>164,948</td>
<td>287,026</td>
<td>105</td>
<td>2.7</td>
<td>64,036</td>
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<td>Total fugitive emissions</td>
<td>142,143</td>
<td>167,810</td>
<td>309,953</td>
<td>105</td>
<td>3.0</td>
<td>64,036</td>
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<td><strong>Syncrude Mildred Lake and Aurora Mines and Upgrader</strong></td>
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<tr>
<td>Total emissions from ponds</td>
<td>562,866</td>
<td>224,500</td>
<td>787,366</td>
<td>127</td>
<td>6.2</td>
<td>74,184</td>
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<td>Total fugitive emissions</td>
<td>886,680</td>
<td>305,573</td>
<td>1,192,254</td>
<td>127</td>
<td>9.4</td>
<td>74,184</td>
<td>16,072</td>
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<td><strong>Shell Muskeg River and JackPine Mine</strong></td>
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<td>Total emissions from ponds</td>
<td>6,754</td>
<td>32,862</td>
<td>39,616</td>
<td>77</td>
<td>0.5</td>
<td>39,793</td>
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<td>Total fugitive emissions</td>
<td>52,205</td>
<td>127,243</td>
<td>179,448</td>
<td>77</td>
<td>2.3</td>
<td>39,793</td>
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<td><strong>All SGER mines</strong></td>
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<tr>
<td>Total emissions from ponds</td>
<td>691,697</td>
<td>422,310</td>
<td>1,114,008</td>
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<td>3.6</td>
<td>178,013</td>
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<td>Total fugitive emissions</td>
<td>1,081,028</td>
<td>600,627</td>
<td>1,681,655</td>
<td>308</td>
<td>5.5</td>
<td>178,013</td>
<td>9,447</td>
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</tbody>
</table>
Quantification Challenges

- Large surface areas (>60 km² ponds, >30 km² mines)
- Surrounded by other sources
- Dangerous (active mine sites, H2S, etc)
- Difficult to sample in some weather conditions
- Temporal and spatial variability
Current Sample Method

- EPA flux Chamber Method
- 1 m²
- Each sample takes ~30 min
- Gas composition obtained from lab
Regulatory Challenges

• Historical baseline
• Incentive to reduce emissions – lag between action and emissions
• Uncertainty on overall inventory and regulatory system (auditor general)
• Limited practitioner expertise and experience
• Variable level of effort to date (frequency and coverage of sampling)
Approach

• Standardized guidance for flux chamber quantification:
  – Frequency/Coverage specified
  – Prioritized sampling by emissions levels and variability
  – Standard assumptions

• Exploration of Other Options
  – Supporting Academic Research – monitoring options and understanding underlying science
  – Industry Options – consultant and facility led
Pond Sample Density

• three locations per zone or one location per 400,000 m² (40 hectares), whichever is greater

• Compute standard error on average fluxes in CO2e for each zone

• Compute expected additional number of samples required based on standard error

• up to maximum total sample requirement of 1 sample location per 4 hectares)
Summary

- Area fugitive emissions represent an area of significant uncertainty in emissions inventories
- All options are under consideration to address the challenge
- The specific regulatory context matters
- Ideally will link to management actions
- First step is to standardize guidance for current method
- Improve data while exploring other alternatives
Questions?

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