EMISSIONS REGULATIONS AND REDUCTIONS TECHNOLOGY IN WESTERN CANADA’S OIL & GAS SECTOR
AIR EMISSIONS – OIL AND GAS

• Process Ecology Introduction
• What Regulations are there?
• What is Canada doing about it?
  • Air Quality Management System (AQMS)
  • Global Commitments
• Oil and Gas – How Big Is the Problem and What can we do about it?
Founded 2003, Calgary, AB

Engineering consulting, process simulation & optimization, software development, air emissions estimation and management

Track record of advanced modelling, simulation and process design, combining and extending simulators and rigorous engineering calculations to handle complex scenarios
AIR EMISSIONS - DEFINITIONS

- Methane – CH4
- Greenhouse Gases – CO2, N2O, HCs
- Risks to Human Health
  - Short Lived Climate Pollutants: Black Carbon, Ozone, Particulate Matter and others
  - Benzene
Methane – CH4

• Alberta – reduce 45% from 2012 by 2025
  • New facility standards Directive (mid 2018?)
  • Measurement Monitoring and Reporting (MMR) (2018?)
  • Leak Detection and Repair (LDAR) (2018?) – already in US
  • Voluntary Joint Initiative – reduction and verification

• BC – reduce 45% by 2025
  • Target fugitive and vented emissions – legacy facilities
  • Offset protocol/clean infrastructure royalty credits – new facilities
  • Mandatory LDAR & others – post 2018
  • Supporting Efficient Engines, supplying clean LNG
Methane

- Saskatchewan
  - No specific provincial regulation
- Federal – reduce 40-45% below 2012 by 2025
  - Regulation Timing – adjusted (was 2020, now 2023)
    - LDAR
    - Compressors – seals and rod packing vents
    - Well Completions – prohibit venting
    - Process Venting – limit totals, dehy capture requirements
    - Pneumatics – low or no emissions
AIR EMISSIONS REGULATIONS BY TYPE

GHG

• Alberta
  • SGRR: >50,000 tonnes/yr CO2e, must report
  • SGER: >100,000 tonnes/yr CO2e:
    • Reduce Emissions Intensity 20% per year by:
      • Improving Operations
      • Purchase Offsets - $30/tonne in 2017
      • Emission Performance Credits from Previous period
    • Replaced by Carbon Competitiveness Regulation by 2018
  • Carbon Tax: $20/tonne CO2e in 2017; $30/tonne in 2018
    • Charged on fuel imported, sold, flared and vented in Alberta
    • Natural Gas produced and consumed ON SITE - exempt
AIR EMISSIONS REGULATIONS BY TYPE

GHG

• BC

  • GHG Industrial Reporting and Control Act – Climate Action Secretariat
    • GHG Emission Reporting Regulation
      • >10,000 tonnes/yr CO2e must report
    • GHG Emission Control Regulation
      • > 25,000 tonnes/yr CO2e must report and verify
    • GHG Emission Penalties and Appeals
    • Use Western Climate Initiative (WCI) rules to calculate
    • Concept of Linear Facilities

  • Carbon Tax
    • Oil and Gas pay on all combustion of fuels
GHG

• Saskatchewan
  • No specific regulation
  • Focus on
    • Carbon Capture and storage
    • Decarbonizing Power System

• Federal
  • Greenhouse Gas Reporting Program (GHGRP) – since 2004
    • >50,000 tonnes/yr CO2e must report – may change to >10,000 tonnes/yr CO2e in 2018 or 2019 – MANY more facilities will report
  • Carbon Tax – minimum $10/tonne CO2e, currently in negotiations with provinces.
Other Air Emissions

• Federal – NPRI (National Pollutant Release Inventory)
  • Air, Water and Ground
  • Full reporting only at > 20,000 man-hours/yr (Under Review)
  • Smaller facility reporting: Part 4 and 5 only
    • Particulate Matter
    • SOx
    • NOx
    • VOCs
    • CO
    • NH3

• Alberta/BC/Saskatchewan – Benzene Reporting
  • Type I Carcinogen
  • From Dehydrators: Alberta Directive 39, BC Oil and Gas Operations
    Manual Appendix J; Saskatchewan Directive S-18
Flaring and Venting (F&V)

- Source of GHG, Methane and Other Gases
- Alberta
  - Directive 60 – rules about F&V, especially conservation of solution gas
  - Also reported in various ways through Petrinex according to rules in Directives 7, 17 and 76
- BC Oil and Gas Commission (OGC)
  - Flaring and Venting reduction guideline – eliminate all routine flaring by 2016 (?)
- Saskatchewan
  - Directives R01, S-10, PNG017 and S-20
AIR QUALITY MGMT SYSTEM (AQMS)

AQMS – Federal Initiative (Except Quebec)

- Canadian Council of Ministers of the Environment – 2012
- Comprehensive approach to reducing air pollution

- Canadian Ambient Air Quality Standards (CAAQS)
  - Canadian Environmental Protection Act (1999)
  - Newly reduced limits on PM2.5 and Ozone
    - Human health impacts – respiratory (Particulates and Smog)
  - Aspirational Targets to Drive Improvements -
    - Benzene Targets
    - SO2 at ground level from flaring of acid gas
AIR QUALITY MGMT SYSTEM (AQMS)

• BLIERs – Base Level Industrial Emission Requirements
  • Major Industrial Emitters
  • Ensure Good Base-Level Environmental Performance
  • Minimum Performance Standards
  • Oil and Gas must follow the MSAPR – Multi-Sector Air Pollutant Regulations
    • Limits on NOx from large combustion sources (Boilers, heaters, stationary engines)
    • Future limits on SO2, VOCs, NH3 and PM likely
AIR QUALITY MGMT SYSTEM (AQMS)

• **Provincial and Regional**
  
  • Directives as indicated above
  
  • Special Air quality management areas – e.g. Peace River
    
    • AER Directive 84 – HC Emission Controls and Gas Conservation Peace River Area – effective April 1, 2017
  
  • Provincial Guidelines:
    
    • Alberta
      
      • Substance Release and reporting Regulations under EPEA (Environmental Protection and Enhancement Act)
      
      • Alberta Ambient Air Quality Objectives (AAAQO)
    
    • BC
      
      • Oil and Gas Waste Regulation
      
      • Air Quality Objectives (BC AQO):
        
        • PM10, PM2.5, Ozone, SO2, NO2, Formaldehyde, TSP (total Suspended particulate)
    
    • Saskatchewan
      
      • Environmental Management and Protection Act and Regulations
      
      • Focus on SO2, NO2, PM2.5, PM10, CO and VOCs
• **AIR doesn't respect BORDERS**
  
  • Conference of the Parties - recently COP21 (Paris, 2015) and COP22 (Marrakech, 2016)
    
    • Reduce HFCs
    
    • Reduce Aviation Emissions
    
    • Ratification of Paris agreement – limiting global warming
    
    • Carbon Tax Commitment
  
  • United Nations Environment Programme:
    
    • Canada a founder of CCAC – Climate and Clean Air Coalition
    
    • Focus on Short Lived Climate Pollutants (SLCPs):
      
      • Black carbon, ozone, methane, HFCs
      
      • Targeting Transportation, Electric generation, Oil & Gas Methane, HFCs, AQMS
Global Methane Initiative (GMI)
- Voluntary, Canada co-chairs Oil and Gas Subcommittee
- Canada focusing on:
  - Oil & Gas
  - Landfills
  - Agriculture
  - Global alliance for Clean Cookstoves

Global Gas Flaring Reduction Partnership (World Bank) (Alberta)
- Public/Private
- Research, Best practices, Regulatory work

United Nations Economic Commission for Europe
- Best practices on reducing emissions

Arctic Council
AIR EMISSIONS – OIL AND GAS NUMBERS

• Federal Estimates
  • 2015 (most Recent): 189 Mt CO2e - 26% of national emissions (NIR to UNFCCC)
  • GHGRP – reports only 81 Mt CO2e (only facilities that are large)

• Alberta:
  • Methane: 31.4 Mt CO2e as Methane, 70% of provincial CH4 emissions

• REFERENCE:
  • 722 Mt CO2e – Canada’s Total GHG Emissions in 2015
  • ~50,000 Mt CO2e – Worldwide Total
### Clearstone Report – (2011 data) and Current Alberta Government:

<table>
<thead>
<tr>
<th>GHG Source</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel Combustion</td>
<td>59.8%</td>
</tr>
<tr>
<td>Fugitive Equipment Leaks</td>
<td>11.9%</td>
</tr>
<tr>
<td>Reported Venting</td>
<td>10.4%</td>
</tr>
<tr>
<td>Unreported Venting</td>
<td>9.2%</td>
</tr>
<tr>
<td>Releases of Formation CO2</td>
<td>4.8%</td>
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<tr>
<td>Flaring</td>
<td>3.9%</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Methane Source</th>
<th>% of Total (Clearstone)</th>
<th>% of Total (AB Govt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reported Venting</td>
<td>31.7%</td>
<td>48%</td>
</tr>
<tr>
<td>Unreported Venting</td>
<td>28.2%</td>
<td></td>
</tr>
<tr>
<td>Fugitive Equipment Leaks</td>
<td>36.1%</td>
<td>46%</td>
</tr>
<tr>
<td>Other (Flaring, Tanks, etc.)</td>
<td>4.1%</td>
<td>6%</td>
</tr>
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</table>
**New Data (2017):**

- St. F.X – BC Montney Shale – 111,800 tonnes CH4 annually
- Environmental Defence / Greenpath – Alberta Methane emissions from oil and gas could be 60% higher than originally thought (significantly more leaking equipment – unreported venting)
- Purdue University – refineries and Gas power plants – methane leaks 2-120 times higher than EPA estimates
- Environmental Sci & Tech (2015) – Natural Gas Processing and Gas Gathering – Actual Methane emissions substantially higher than current EPA estimates
- Many others – generally measurements are higher than estimates have been

**Baseline**

- Hard to capture
- Factored estimates increasingly inaccurate
- Can’t measure it all – 100,000+ sources in Alberta alone
- NEED BETTER MODELS!
AIR EMISSIONS – OIL AND GAS REDUCTIONS

• First Targets?
  • Fugitives
  • Venting
  • Combustion

• Protocols
  • Existing
    • Pneumatics
    • Solution Gas Conservation
  • Upcoming
    • LDAR (Leak Detection and Repair) ?

• Best Practices
  • CAPP Documents
  • CSA Z620.1
  • API Compendium
  • EPA’s AP-42
• WHAT are the Regulations?
  - It’s convulted!
• WHAT are we DOING about it?
  - Federal initiatives
• WHAT is our place in the Global Picture?
  - World leader
• HOW Big is the Problem?
  - Numbers vary, hard to estimate
• WHERE to reduce?
  - Fugitives and Venting
THANK YOU

• QUESTIONS?
• CONTACT:

Laura Chutny
laura@processecology.com
403-478-4758