Alberta’s Chemistry Sector: Adding Value to Resources

CIAC PRESENTATION TO
ALBERTA WATER COUNCIL
OCTOBER 29, 2015
the voice for 75% of the Canadian industrial chemistry industry

more than 40 member-companies & partners

81,000 direct jobs

$53B industry

2nd-largest exporter
Responsible Care® is the chemistry industry's commitment to sustainability. Its ethic and principles compel companies to innovate for safer and more environmentally-friendly products and processes, and to work to eliminate harm throughout the entire life cycle and value chain of their products.
Responsible Care® companies have reduced:

- **by 98%** – discharges to water
- **by 89%** – emissions of toxins targeted by the *Canadian Environmental Protection Act*
- **by 72%** – emissions of air pollutants, such as sulphur dioxide
- **by 70% plus** – number of injuries and illnesses in the workplace

...*since 1992*
CIAC Members In Alberta

DOW

NOVA Chemicals

INEOS

Evonik Industries

Shell Chemicals

Chemtrade

BASF

ERCO Worldwide

A division of Superior Plus LP

NALCO

An Ecolab Company

MEGlobal

National Silicates

an affiliate of PQ Corporation

Methanex
CIAC Alberta Quick Facts

#1 manufacturing exporter in Alberta at $8.7B

$14B in shipments

7,850 direct jobs

80% of product moved by rail

40,000 indirect jobs

key markets USA / China / Mexico

$97K average annual salary

#1 in resource-upgrading value-add manufacturing in Alberta

converts over 1/5 of Alberta gas consumption
Feedstocks to

Large consumption in Alberta

<table>
<thead>
<tr>
<th>Feedstocks and example petrochemical products</th>
</tr>
</thead>
<tbody>
<tr>
<td>methane</td>
</tr>
<tr>
<td>hydrogen</td>
</tr>
<tr>
<td>ammonia</td>
</tr>
<tr>
<td>methanol</td>
</tr>
<tr>
<td>methyl chloride</td>
</tr>
<tr>
<td>carbon black</td>
</tr>
<tr>
<td>acetylene</td>
</tr>
<tr>
<td>formaldehyde</td>
</tr>
</tbody>
</table>
Value-Add – O&G to Ethylene

Produced by cracking any of the optional feeds
Produced only by cracking any of the liquid feeds
Value-Add – NG to Methanol

Steam

Hydrogenator
Sulphur Saturator
Pre-reformer
Steam Reformer

Natural Gas

Product Methanol

Light Ends to Fuel

Water

Oxygen

Steam

Secondary Reformer

Methanol Reactor

Makeup Compressor

Condensate

Raw Methanol Storage

Raw Methanol

Responsible Care®

Gestion responsable™

Chemistry Industry
Association of Canada

Association Canadienne de
l'industrie de la chimie

Our commitment to sustainability.

More engagement means to development decades.
Value-Add – Ethylene End-Products

Ethylene Chain

- Natural Gas
- Ethylene
  - Low Density Polyethylene and Linear Low Density Polyethylene
  - High Density Polyethylene
  - Ethylene Dichloride
  - Ethylene Oxide
  - Ethylbenzene
  - Linear Alcohols
  - Vinyl Acetate
  - Food Packaging, Toys, Housewares
  - Crates, Drums, Plastic Bottles, Construction materials
  - Vinyl Siding, Window Frames, Swimming Pools, Pipes
  - Automotive Chemicals
  - Carpets, Clothing, Nylon
  - Styrene
    - Insulation, Styrofoam products
    - Instrument Lenses, Housewares
    - Tires, Automotive parts
    - Paper products, Coatings

- Packaging, Film
- Insulation, Styrofoam products
- Instrument Lenses, Housewares
- Tires, Automotive parts
- Paper products, Coatings
• Importance of water quantity **AND** quality
• "Conserve and efficiently use valuable resources” is a core requirement of RC
• RC commits member companies to continuous improvement and sustainability
• Let’s focus on WATER!
CIAC Water Use In General

• Critical to operations – raw material, steam, cooling
• Intake quantity, effluent volume and quality are regulated and monitored
• Intake water is treated (cleaned) for use
• Often, effluent quality is better than intake
• Cooling tower evaporative losses are included as consumption
CIAC Water Use In General

• Assumption – small user is <10,000 m3/yr
• Discount small use and municipal water use
• Chemistry sector water use is relatively small
• 12 companies, 21 individual facilities
  – 2 co-gen facilities included in other site data
• Some company facilities share sites with others
# CIAC Water Use Profile

<table>
<thead>
<tr>
<th>VOL. (m³/yr) USED</th>
<th># OF FACILITIES</th>
<th>COMPANIES</th>
<th>WATER SOURCE/S</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–10k</td>
<td>5</td>
<td>Dow Ag Sciences, BASF (2), Nalco, CCC Group</td>
<td>either zero usage OR all sourced from municipal services</td>
</tr>
<tr>
<td>10–25k</td>
<td>2</td>
<td>National Silicates, Chemtrade</td>
<td>municipal services</td>
</tr>
<tr>
<td>25–100k</td>
<td>3</td>
<td>NOVA Calgary, Chemtrade (2)</td>
<td>NOVA (municipal) Chemtrade (1 municipal, 1 river)</td>
</tr>
<tr>
<td>100–999k</td>
<td>3</td>
<td>ERCO, INEOS, Evonik</td>
<td>surface</td>
</tr>
<tr>
<td>&gt;1MM</td>
<td>7</td>
<td>NOVA, Dow (2), Shell, Methanex, MEGlobal (2)</td>
<td>NOVA, Dow, MEGlobal, Shell – surface Methanex – municipal aquifer/groundwater</td>
</tr>
</tbody>
</table>
Alberta’s Chemistry Hubs

Main watersheds involved
- Peace/Slave
- North Saskatchewan
- South Saskatchewan
  - Red Deer River sub-basin
CEP Tactics – Existing Facilities

- **C&E** → Manage cooling water cycles, minimize make up
- **C&E** → Consolidate wastewater streams, treat and re-use when technically possible
- **C** → By-product or wastewater synergy – one company can recycle or use at another facility
- **E** → Discharge sanitary wastewater to municipal facilities
- **C&E** → Capture and recycle stormwater
- **C** → Recycle boiler blowdown
- **E** → Optimize boiler feed water treatment to minimize wastewater
- **C&P** → De-bottleneck – increase production without increasing water use
CEP Tactics – New Facilities

• Choose the most efficient equipment possible – BATEA
• Implement metering and monitoring devices at appropriate locations
• Design water/steam balance with re-use and recycling opportunities in mind
• Share utilities with other facilities where possible
‘Annual Water Use’ reporting began in 2012

<table>
<thead>
<tr>
<th>FACILITY</th>
<th>CITY</th>
<th>Facility Output (in current year)</th>
<th>Facility Collects Water Use Data (Y/N)</th>
<th>Water Consumption (m³/yr)</th>
<th>Surface Source Amount (m³/yr)</th>
<th>Source: Surface</th>
<th>Source: Municipal (m³/yr)</th>
<th>Source: Ground Water (m³/yr)</th>
<th>Facility Collects Stormwater (Y/N)</th>
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<tbody>
<tr>
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