Line 5 Discussion
U.P. Energy Task Force

Finlandia University, Hancock Michigan
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Introduction

Peter Holran
Director, U.S. Government Affairs
Enbridge Pipelines
System Map
Major Canadian and U.S. Crude Oil Pipelines and Refineries
Fueling people’s quality of life
A Leading North American Energy Delivery Company

Global scale
- 12,700 employees
- Operations in 41 states, 8 provinces, 2 territories
- Headquartered in Calgary
- Hubs in Houston, Toronto, Superior/Duluth

Diversified energy assets:
- Liquids Pipelines 28% of NA crude oil (16,500 miles)
- Gas Transportation and Midstream: 20% of natural gas consumed in NA (34,500 miles)
- Gas Distribution: 3.7 million customers in 500+ communities
- Power & Transmission: Interests in nearly 1,700 MW renewable generation (net) @ 30 facilities
System Overview

Marlon Samuel
Director, Customer Service
Enbridge Pipelines
Enbridge System Overview - NGL

NGL Delivery (Sarnia)

NGL Injection (Edmonton/Kerrobert/Cromer)

NGL Delivery: De-propanized and re-injected (Rapid River)

NGL Delivery: De-propanized and re-injected (Superior)

US Produced Crude Oil Injection (Lewiston)

Crude Delivery to US Refineries (Marysville)

Line 1 and Line 5 designed specifically for transportation of NGL:

NGL received at:
- Edmonton
- Kerrobert
- Cromer

NGL delivered to:
- Superior
- Rapid River
- Sarnia

NGL: Natural Gas Liquids that contain the following:
- Propane
- Natural gasoline (pentanes)
- Butane
- Ethane
**Line 5 Operation Overview**

### Superior: NGL/Crude injected in batches specific to quality and delivery needs

- **Crude**
- **Crude**
- **NGL**
- **Crude**
- **Crude**
- **NGL**

### Rapid River: NGL sidestream delivered to Rapid River:
- Safely delivers product at a reduced rate of Line 5 flowrate
- Allows for timing of Propane to be stripped out and remaining product re-injected
- 70% of product delivered to Rapid River remains as propane, 30% re-injected into Line 5
- Crude allows for staging of NGL to allow re-injection

![Diagram showing NGL and Crude delivery and processing through Superior and Rapid River]

### Sarnia: Remaining NGL delivered to NGL Facilities – Crude delivered to Crude facilities

- **Crude**
- **Crude**
- **NGL**
- **Crude**
- **Crude**
- **Crude**
- **Crude**
- **Crude**

![Diagram showing NGL and Crude delivery and processing through Sarnia]

**Gogebic**

**Ino Saxon**

**US Produced Crude Oil Injection (Lewiston)**

**Crude Delivery to US Refineries (Marysville)**

**NGL Delivery and Processing (Sarnia)**

**NGL Delivery: De-propanized and re-injected (Superior)**

**Residual re-injected**

**Propane Extracted**

**NGL sidestream delivered**

**Sarnia**

**Crude Refineries Pipelines**

**NGL Spheres and Processing Facility**
Superior to Sarnia Summary:

North Route: Line 5
- Transports NGL and Light crude
- **Specifically designed for NGL/Light crude mix**

South Routes: Lines 6/14/61/78
- Lines 6/14/61 inject from Superior, WI with full breakout locations at Griffith, IN and Flanagan, IL
- Line 78 injects at Flanagan, IL and Griffith, IL with full breakout locations at Stockbridge and Sarnia
- **No NGL storage or transport ability on any south routes**
Pipeline Demand vs. Capacity

- Current approximate demand on Line 5 and Line 78 totals approximately 970 Kbdp (including NGL).
- Current approximate capacity of Line 78 is respectively, 570 Kbdp and 500 Kbdp.
- The demand currently being filled via Line 5 will shift and compete for space on Line 78.
- If Line 5 were shut down, assuming current demand and line capacities, the demand for Line 78 would exceed capacity by 19,656,000 US gallons per day to refineries in Michigan, Ohio, Pennsylvania, Ontario and Quebec.
- Based on 2017 EIA data, Michigan consumption of petroleum products (excluding gas liquids and olefins) is 435.5 Kbdp, Michigan refining capacity as of January 1st 2019, is 140 Kbdp. This highlights Michigan’s reliance on interstate supply of refined products to meet demand.
- Under the federally regulated rules and regulations, all shippers will be treated equally.

### Demand on Enbridge pipelines (approximate)

<table>
<thead>
<tr>
<th>Line</th>
<th>Kbdp</th>
<th>US gallons per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line 5 (Including NGL)</td>
<td>500</td>
<td>21,000,000</td>
</tr>
<tr>
<td>Line 78</td>
<td>470</td>
<td>19,740,000</td>
</tr>
<tr>
<td>Total</td>
<td>970</td>
<td>40,740,000</td>
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</tbody>
</table>

### Capacity of Enbridge pipelines

<table>
<thead>
<tr>
<th>Line</th>
<th>Kbdp</th>
<th>US gallons per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line 5</td>
<td>540</td>
<td>22,680,000</td>
</tr>
<tr>
<td>Line 78</td>
<td>570</td>
<td>23,940,000</td>
</tr>
<tr>
<td>Line 78 (ex-Stockbridge)</td>
<td>500</td>
<td>21,084,000</td>
</tr>
</tbody>
</table>
Line 5 System Design and Operations

Mike Moeller
Director, Great Lake Region
Enbridge Pipelines
Line 5 Pipeline Design Considerations

Operational Requirements

• Station placement based on hydraulics
• Pumps specified to safely operate on their curve
• Software (gaskets/seals) on valves and equipment based on product served
• Full rate vs side stream deliveries; facility modifications required to facilitate

Hydraulic modeling and design of Line 5 is specific to NGL and crude mix:

• Safe operating limits of Line 5 require both products in specific quantities and line-ups
• Traps placed to allow ILI runs of various technologies
Pipelines that transport NGL require terminal specific equipment:

- Facilities specific to safely contain NGL located in terminals at Superior, Rapid River and Sarnia

Stations that operate with NGL require:

- Three-sided shelters
- Tandem pump seals
- Flare pits
- Seals on equipment are sensitive to product shipped
Could Line 5 operate with only NGL?
• No, Line 5 is currently designed for a mix of crude and NGL

Line 5 is a “Steady State Operation” pipeline
• It is designed, operated and maintained to minimize frequency of start/stops and flow rate changes in order to maximize reliability

Why steady state matters
• Utility power supply and infrastructure designed to match steady state operation
  • Steady State avoids excessive fatigue of pipeline steel
  • Frequent starts and stops wears motors, pumps, seals and other equipment
  • Dead headed line = Storage tank; 1.2 MMBBLs
Line 5’s operation and maintenance program was designed considering both NGL and crude properties:

The importance of a crude and NGL lineup on Line 5:

- Minimum flow requirements of pumps avoid vibration and other abnormal operating conditions
- Maintenance more difficult with start/stop operation or without crude
  - ILI tool runs would require numerous traps to be added due to battery life constraints. Tool runs ensure safety of pipeline and closely monitor pipeline for:
    - Defamations
    - Cracks
    - Corrosion
- Very large purges for maintenance on pipe
  - Flare NGL or require storage
  - Welding/Tapping on empty pipe or when NGL in pipe is not preferred