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# Elemental Analysis of FLO® Drag Reducer Products

Crude Oil Quality Group Meeting  
September 29, 2005

# Additives in Crude

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- **Trace contaminants in the crude feed to refineries can cause many problems**
- **Specific recent focus on calcium and silicon**
- **Additives are a potential source of such contaminants**
  - Corrosion inhibitors, pour point depressants, demulsifiers, paraffin inhibitors, hydrogen sulfide scavengers, etc.

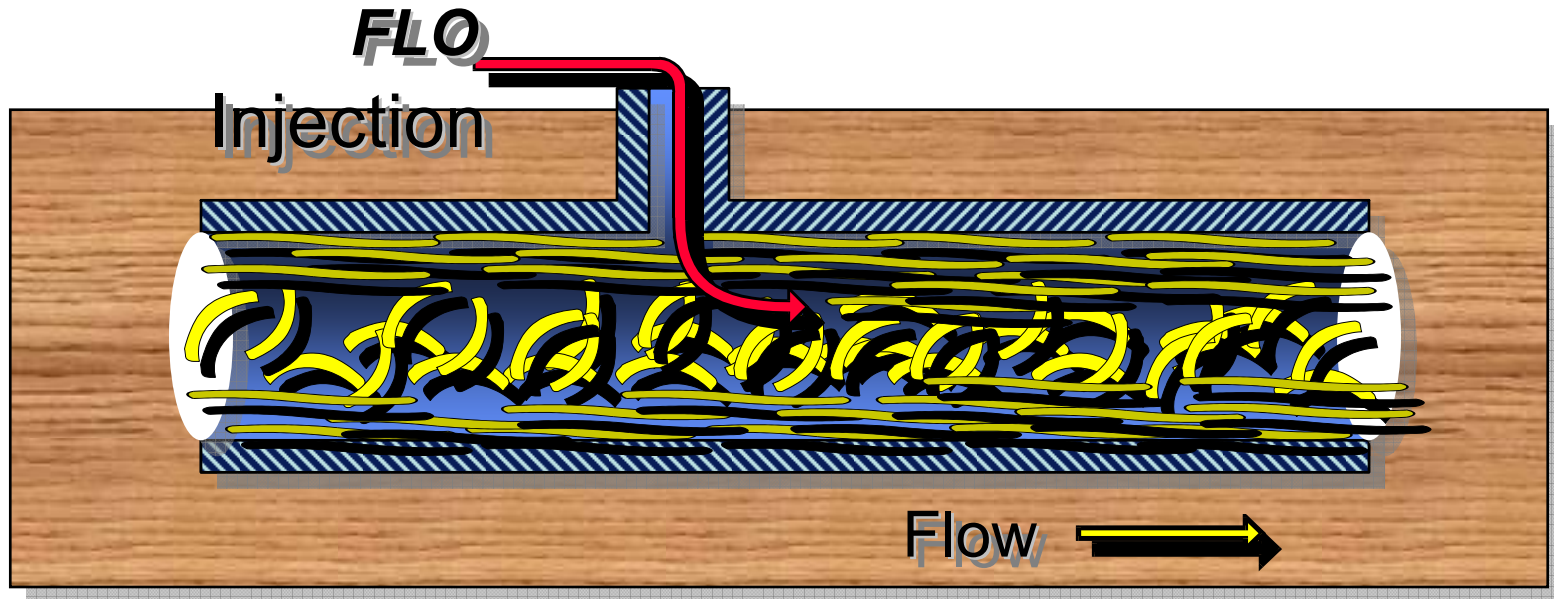
# Preview

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- **Brief drag reduction overview**
- **Composition of drag reducer products**
- **Elemental analysis of FLO® products**
- **Summary**

# Drag Reduction Phenomenon

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DRA's inhibit the formation of turbulent bursts within the pipeline. By helping organize turbulent flow streamlines, DRA's reduce hydraulic friction pressure loss (drag).

# Benefits of *FLO*® Pipeline Booster

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- **Increase profitability via increased throughput, bypassing intermediate pump stations**
- **Eliminate capital spending - removes the need for extra pumps, pump station, and loops**
- **Enhance pipeline operation safety**
- **Allows for improved scheduled maintenance**

# Typical Dosages Used

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- **Assume injection of 100 ppm of any additive into a crude line**
  - If the additive contains a 10 ppm level of X, concentration of X in the crude increases by 1 ppb
- **For crude pipelines, typical DRA dosages are 25-100 ppm/pump station**
  - For most crude lines, DRA is injected at 1-2 pump stations

# Composition of Drag Reducer Products

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- **Commercial drag reducers for crude pipelines contain:**
  - High molecular weight hydrocarbon polymer
    - This is the active ingredient, typically a poly-olefin
  - Carrier solvent(s)
    - Typical examples include simple hydrocarbon solvents, ethers, alcohols, water
  - Stabilizers (anti-agglomeration agents, suspension agents, etc.)
    - These can be organic or inorganic

# FLO® Drag Reducers

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- **FLO® product line consists of 2 product “families”**
  - Gel products
    - FLO® 1010, FLO® 1020, FLO® XS
      - All are >99% organic (C/H/N/O)
  - Slurry products
    - FLO® XL
      - >93% organic
    - FLO® MX
      - >99% organic

# FLO® Product Elemental Analysis

Testing via ICP analysis, all levels in parts per million (ppm).

Product	Cr	Pb	Ni	Sr	Si	S*	V	Sn	Li
FLO® 1020	<0.4	<0.4	<0.4	<0.4	1.1	<0.4	<0.4	<0.4	<0.4
FLO® XS	<0.4	<0.4	<0.4	<0.4	1.6	<0.4	<0.4	<0.4	<0.4
FLO® XL	<0.4	<0.4	<0.4	0.5	56.3	3.6	0.5	<0.4	<0.4
FLO® MX	<0.4	<0.4	<0.4	<0.4	32.2	<0.4	<0.4	<0.4	<0.4

Product	Na	Ca	Mo	Cu	Zn	Ba	Be	Cd
FLO® 1020	2.2	6.8	<0.4	12.1	2.4	0.8	<0.4	<0.4
FLO® XS	2.5	5.8	<0.4	7.2	1.4	0.5	<0.4	<0.4
FLO® XL	6.3	183	<0.4	13.2	1.4	1.3	<0.4	<0.4
FLO® MX	1.0	0.6	<0.4	16.7	0.9	1.2	<0.4	<0.4

\*ASTM D 7039-04 (X-Ray Fluorescence) used for sulfur level determination

# Summary

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- **All FLO® drag reduction products are >93% organic, with most being >99% organic.**
- **Elemental analysis shows many inorganic elements present at <0.4ppm (test detection limit)**
- **All FLO® products: Si: <60 ppm; Ca: <200 ppm; S: <4ppm**
- **Based on these results, and historical experience, FLO® products are expected to have a negligible impact on refinery operations**

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**Thanks!!**  
**Questions??**