The Dow Chemical Company

Introduction of Next Generation

UCON ADVANTA™

Hydrolube Concentrate

Presented by Pete Pendergast, Global Marketing Manager
UCON™ Fluids and Lubricants
AGENDA

☞ UCON™ Fluids & Lubricants Business Overview

☞ Dow Water Glycol Hydrolube Concentrate Participation

☞ UCON ADVANTA™ Hydrolube Concentrate
  ▪ Product Description
  ▪ Features & Benefits
  ▪ Laboratory and Field Trial Results

☞ Conclusions

☞ Q&A
UCON™ Fluids & Lubricants Business

- Global supplier of synthetic base fluids and fully formulated lubricants
- Primary Chemistry is Polyalkylene Glycol (PAG)
- Leading Global Brands:
  - UCON™
  - SYNALOX™
- Multiple Channels-to-Market
  - Direct to end-users
  - Formulators
  - Chemical Distributors
  - Original Equipment Manufacturers
- Leading Development of Eco-friendly, Specialty Fluids & Lubricants
UCON™ Fluids & Lubricants - Global Capabilities

Midland, MI
Dow World Headquarters

Manufacturing
R&D / TS&D

South Charleston, WV
Freeport, TX
Terneuzen, Netherlands
(Lubricant R&D/TS&D)

Horgen, Switzerland
Lubricant R&D/TS&D

Tarragona, Spain

Guarujá, Brazil
(Lubricant TS&D)

Guangzhou & Shanghai, China
(Lubricant TS&D)

Taipei, Taiwan
(Lubricant TS&D)

OPTIMAL JV, Kertih, Malaysia

Pune, India
(Lubricant TS&D)
# UCON™ Global Product Offering

## Base Fluids

- water soluble and water insoluble polymers
  - Designed for Specialty Lube Formulations
    - Textiles
    - Gear lubes
    - Compressor lubes
    - Hydraulic fluids
    - Metalworking fluids
  - Greases
  - Antifoams

## Formulated Products

- Automotive Refrigeration Lubes
- Compressor Lubes
- Coating Lubricants
- Calendar Lubricants
- Food Grade Lubes
- Gear Lubes
- Heat Transfer Fluids
- Hydraulic Fluids
- Metalworking Fluids
- Quenchants
UCON™ Hydrolube Concentrate Market Position

-leading North American Supplier of Hydrolube Concentrates for Water Glycol Hydraulic Fluids (WGHF)
- Invented in 1950’s by Union Carbide as fire resistant fluids for US Navy Battleships

Integrated Position on Key Raw Materials

Global manufacturing and supply capabilities
- Consistent product quality at each manufacturing plant
- Security of supply
- Support from a global network of subject matter experts

Investing in Next Generation of Technology To Meet the Changing Needs of the Market...
Market Drivers For Developing Next-Generation Water Glycol Hydraulic Fluids

☞ More Severe Operating Environments Requiring More Robust Fluids
  ▪ Smaller hydraulic reservoir sizes
  ▪ Higher pump pressure
  ▪ Higher operating temperatures

☞ Stringent Fire Resistance Testing Protocols
  ▪ North America - Factory Mutual
  ▪ Europe - 7th Luxemburg Report
  ▪ Global - New ISO Standard (ISO-12922) to be Introduced in 2008

☞ Environmental Compliance and Sustainability
  ▪ Bio-degradability
  ▪ No hazard classifications

☞ More Stringent Quality Requirements

☞ Global Product Consistency, Reliability and Dependability
Introducing UCON ADVANTA™ Hydrolube Concentrate
Advanced Fire-Resistant Technology for Severe Hydraulic Service Environments

- Backed by Over 60 Years of DOW/ UCC Experience in Formulating WGHFs
- Patent Pending Formulation
  - Designed around polyalkylene glycol chemistry
  - Target Applications include
    - Steel, Aluminum Metal Processing & Die Casting
    - Mining
- Designed Specifically for Systems Utilizing Piston, Vane & Gear Pumps
- Leveraging Dow Brand & Trademarks
### Typical Physical Properties

**Table 1—Typical Physical and Chemical Properties* of an ISO 46 WGHF Formulated with UCON ADVANTA™ Hydrolube Concentrate**

<table>
<thead>
<tr>
<th>Property</th>
<th>Method</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Visual</td>
<td>Red, Slight Haze</td>
</tr>
<tr>
<td>Viscosity @ 40°C, cSt</td>
<td>ASTM D445</td>
<td>46</td>
</tr>
<tr>
<td>Viscosity Index</td>
<td>ASTM D2270</td>
<td>195</td>
</tr>
<tr>
<td>Reserve Alkalinity</td>
<td>Dow Method</td>
<td>160 – 170</td>
</tr>
<tr>
<td>pH</td>
<td>Dow Method</td>
<td>9.5</td>
</tr>
<tr>
<td>Water, %</td>
<td>ASTM E203</td>
<td>42.5 – 44.5</td>
</tr>
<tr>
<td>Pour Point, °C</td>
<td>ASTM D97</td>
<td>-50</td>
</tr>
<tr>
<td>Foaming Characteristics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sequence I, ml/ml</td>
<td>ASTM D892</td>
<td>10/0</td>
</tr>
<tr>
<td>Sequence II, ml/ml</td>
<td></td>
<td>10/0</td>
</tr>
<tr>
<td>Sequence III, ml/ml</td>
<td></td>
<td>10/0</td>
</tr>
<tr>
<td>Copper Corrosion, 6 hours at 50°C</td>
<td>ISO-2160</td>
<td>1A</td>
</tr>
<tr>
<td>Copper Corrosion 24 hours at 50°C</td>
<td>ISO-2160</td>
<td>1B</td>
</tr>
<tr>
<td>Rust Prevention in Distilled Water</td>
<td>ISO-7120</td>
<td>Pass – No Corrosion</td>
</tr>
<tr>
<td>Biodegradability</td>
<td>OECD 301B</td>
<td>Readily Biodegradable</td>
</tr>
</tbody>
</table>

*Example properties, not to be construed as specifications

*ml of 0.1N HCl to pH= 5.5
UCON ADVANTA™ Hydrolube Concentrate - Features & Benefits

Reduced Pump Wear

Ring and vane configuration in pump evaluation

Table 2—Comparative Hydraulic Performance Data for an ISO 46 Grade WGHF Formulated with UCON ADVANTA™ Hydrolube Concentrate vs. Conventional WGHF

<table>
<thead>
<tr>
<th>Test</th>
<th>Method</th>
<th>WGHF Formulated with UCON ADVANTA™ Hydrolube Concentrate</th>
<th>Conventional WGHF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vickers Vane V-104C*</td>
<td>ASTM D7043</td>
<td>10 – 15</td>
<td>20 – 50</td>
</tr>
</tbody>
</table>

* Test run at 2000 psi, 1200 rpm, and a fluid temperature of 65°C for 100 hours. Typical results based on multiple pump test runs.
UCON ADVANTA™ Hydrolube Concentrate - Features & Benefits

High Shear Stability
- Extend Equipment Service Life
- Reduced Maintenance Costs and Equipment Reliability
- Reduced Fluid Condition Monitoring
- Reduced Fluid Reconditioning

Figure 1 – Extended Hydraulic Pump Performance, ISO 46 WGHF formulated with UCON ADVANTA™ Hydrolube vs. Conventional WGHF (Extended ASTM D7043 Hydraulic Pump Test)
UCON ADVANTA™ Hydrolube Concentrate - Features & Benefits

Reduced Pump Wear - Field Trial Results

Six month trial of UCON ADVANTA™ Hydrolube Concentrate in continuous use under severe operating conditions (3100 psi at 113°F/45°C) in a Buhler SE Die casting machine operating at Maddison-Kipp Corporation.

Trial confirmed a > 20% increase in piston pump life compared to a conventional WGHF used in the system previously.
UCON ADVANTA™ Hydrolube Concentrate - Features & Benefits

- High Shear Stability
  - Reduced Fluid Maintenance
  - Reduced Fluid Reconditioning
  - Minimum Additive Depletion

Validated via 6 month trial with large Aluminum Die Caster operating in equipment with two Parker piston pumps at 1200 psi with bulk reservoir temperature of 115-130°F (46-54°C)
UCON ADVANTA™ Hydrolube Concentrate - Features & Benefits

✦ Excellent Fire Resistance
  - FM Approved
  - Higher Water Content than Conventional WGHFs
UCON ADVANTA™ Hydrolube Concentrate - Features & Benefits

☞ Fluid Compatibility
  - Compatible with conventional WGHFs
    - Efficient fluid conversion proven via field trials
    - No loss of performance or service life
  - Compatible with common metal alloys used in hydraulic circuits
  - Compatible with common elastomers and hoses

☞ Environmental, Health and Safety
  - Readily Biodegradable
  - Safer to use
    - Does not contain secondary amines (e.g., morpholine)
    - Meets European formulation requirements
UCON ADVANTA™ Hydrolube Concentrate - Features & Benefits

🔝 Excellent Multi-Metal Corrosion Resistance

Figure 3 – Corrosion Performance of UCON ADVANTA™ Hydrolube Concentrate; (ASTM G31 Corrosion Testing)

Steel    Iron    Aluminum    Brass    Copper    Iron    Steel

Solution Phase  Vapor Phase

Note: Also compatible with Zinc
UCON ADVANTA™ Hydrolube Concentrate - Features & Benefits

心得 / 长 lasting
- No deposit, sludge or varnish formation

心得 All-Season Service
- Low Pour Point
- High VI
Extensive Field Trial Summary

❖ Test in variety of pumps...
  ▪ Piston & Vane
  ▪ Multiple Manufacturers

❖ ... in a Variety of conditions
  ▪ Low-High Pressure (1000-3500 psi)
  ▪ Low-High Temperatures (80°F-140°F)
  ▪ Large and small equipment (100-1000 gallons reservoir size)
  ▪ Trials also conducted where a fluid “top-off” on to a conventional WGHF has been assessed with success
Conclusions

Dow is a historical leader in the development of WGHFs

Trends in equipment design and requirements to meet global fire resistant testing requirements have created opportunities for engineering new fluids

Dow is investing in the UCON™ Fluids & Lubricants business and is setting the competitive standard for the next generation of WGHFs

UCON ADVANTA™ Hydrolube Concentrate commercially available

- Extensive Laboratory Testing Complete
- Six months of field trials in severe operating environments has demonstrated excellent performance
- UCON ADVANTA™ Hydrolube Concentrate is Available Today in North America!
  - Expected to be available globally in Q1 09
Thank you!

Questions?

www.ucon.com