Oily Water Treatment

COQG Meeting
September 29, 2005

Anna M. Johnston
Houston Resource Manager
713-898-0378
anna.johnston@cetco.com
Overview

• Who Is CETCO?
• What Services does CETCO Provide?
• Where Is CETCO?
• What Are Some Examples of CETCO’s Services?
CETCO is a subsidiary of AMCOL International. Established in 1927, AMCOL today operates worldwide with over 1,200 employees.

AMCOL is also represented by distributors, agents and is a supplier of specialty minerals, providing products and technologies for a wide range of industrial and consumer-related markets globally.

AMCOL’s various operating units are categorized in four areas: minerals, environmental, nanocomposites and transportation services.

CETCO, AMCOL’s environmental segment consists of:

- Building Materials Group (BMG)
- Lining Technology Group (LTG)
- Waste Water Group (WWG)
- CETCO Oilfield Services Company (OSC)

QUICK FACTS about AMCOL

Net Sales - 2004
$459 Million

Headquarters
Arlington Heights, Illinois, USA
800.426.5564 | 847.394.8730

Locations
53 Facilities Worldwide

Established
1927

Publicly Held
New York Stock Exchange
ACO

President and CEO
Larry Washow
Locations

**CETCO Applications**
- Nova Scotia
- Brazil
- Nigeria
- UK
- Norway
- Kazakhstan
- UAE
- Australia
- USA
- West Indies

**CETCO Offices or Representatives**
- Brazil via Eco Global
- CETCO Oilfield Services Company Nigeria Limited
- CETCO Oilfield Services Company Europe
- Kazakhstan via Gymm
- UAE via Al Mousa
- Australia via Wood Group
- Houston, La - New Orleans and Broussard
- Oman via WJ Towell
- AMGOL International Corporation

**Planned Expansions**
- Angola - 2006
- Equatorial Guinea - 2006
- Malaysia - Late 2006
CETCO Oilfield Services Company has a solid reputation within the oil and gas industry for its dependable service and continuing technological innovations. CETCO, a subsidiary of AMCOL International, provides an array of patented technologies, products and services for the entire life cycle of the oil and gas industry. Our unique fluid separation and treatment services and solutions can be found worldwide in the areas of exploration, development, production, pipeline transportation, storage, and refining. Some examples of the services CETCO provides are as follows:

- Test, unload, and/or clean-up of oil and gas wells
- Produced water treatment
- Pipeline and terminal hydrostatic water treatment
- Gas, oil, water, and solid separation for temporary applications, maintenance and turnarounds in refineries and chemical plants
Sources of Oily Water

• Hydrostatic Test Water (pipeline, tank or other vessels)
• Water from Products (Dewatering of off-spec hydrocarbon based products)
• Contact Water
• Tank Cleaning
Water Handling Options

• Subsurface Disposal
  – Transportation, Disposal fees, Long Term liability

• Local Refinery or Plant
  – Chemicals can interfere with process, plants are at capacity

• Treat On-Site
Pipeline/Onshore Treatment

- Low and High Flow Rates
  -- < 1.0 - 45 BPM

- Level of Contaminants (stringently monitored)
  -- PPM level of additives/inhibitors
  -- solids, construction debris, rust
  -- possible oily interface
  -- possible hydrocarbon
  -- dirt and sand

- Treatment Criteria
  -- ppb removal, BETX
  -- no floating solids, TSS, TDS, no foam
  -- toxicology, COD, BOD
  -- Oil and grease specifications, no sheen, TPH
Common Additives

• Corrosion Inhibitors- filmers & Quat Amines
  – Protect against $\text{H}_2\text{S}$, acid & $\text{CO}_2$. More commonly used in operational PL can depart some biological protection.

• Oxygen Scavengers- catalyzed bisulfite
  – Protect PL against $\text{O}_2$ & biological concerns.

• Biocide-THPS, tetrakis-(hydroxymethyl) phosphonium sulfate or gluteraldehyde
  – Protect against biological concerns.

  – Biological concern-e.g. formation of slime, deposits, biomass, the generation of acid and of hydrogen sulfide.
In our lab, CETCO can flow contaminated fluid through our media (in blue container). We then can test for the additive or its attributes such as toxicology testing.
East Houston – Terminal Location

- Three tanks with total of 150,000 barrels of contact water
- All three product tanks out of commission
- Industrial area near residential homes
- Discharge to local stream
East Houston Terminal Results

- Treated all 150,000 barrels of fluid
- Oil and Grease in the 50-100 ppm, effluent ND
- BTEX ranges of 600 ppb, discharges as ND
- All toxicity tests past
Koch Pipeline
Cottage Grove, Minnesota
Large Volume

• Treated 320,000 barrels of Pipeline Hydro Test water
• Fluids discharged into nearby field
• Average flow rate were 10 to 15 BPM
• Rates as high as 20 BPM were achieved
Koch Pipeline
Cottage Grove, Minnesota

- Discharge Criteria:
  - Benzene 10 ppb
  - Ethyl Benzene 70 ppb
  - Toluene 1,000 ppb
  - Xylene 1,000 ppb
  - Oil and Grease *
  - *no criteria specified
Koch Pipeline  
Cottage Grove, Minnesota

• **Results:**

<table>
<thead>
<tr>
<th></th>
<th>Influent</th>
<th>Effluent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzene</td>
<td>3,630 ppb</td>
<td>&lt; 5 ppb</td>
</tr>
<tr>
<td>Ethyl Benzene</td>
<td>210 ppb</td>
<td>&lt; 5 ppb</td>
</tr>
<tr>
<td>Toluene</td>
<td>3,180 ppb</td>
<td>&lt; 5 ppb</td>
</tr>
<tr>
<td>Xylene</td>
<td>940 ppb</td>
<td>&lt; 10 ppb</td>
</tr>
<tr>
<td>Oil and Grease</td>
<td>18 ppm</td>
<td>&lt; 5 ppm</td>
</tr>
</tbody>
</table>
Williams Pipeline
Coatsville, Iowa

• Treated 39,000 barrels of Pipeline Hydro Test water

• Fluids discharged into nearby stream in accordance with permit requirements

• Permit specified 14 days to complete project
Williams Pipeline
Coatsville, Iowa

- **Permit Requirements** (daily maximum)
  - COD: 100 ppm
  - Oil and Grease: 15 ppm
  - Benzene: 5 ppb
  - BETX: 100 ppb
  - pH: 6 to 9
Williams Pipeline  
Coatsville, Iowa

<table>
<thead>
<tr>
<th>Results</th>
<th>Influent</th>
<th>Effluent</th>
</tr>
</thead>
<tbody>
<tr>
<td>COD</td>
<td>87 ppm</td>
<td>&lt; 15 ppm</td>
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<tr>
<td>Oil/Grease</td>
<td>22 ppm</td>
<td>&lt; 1 ppm</td>
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<tr>
<td>Benzene</td>
<td>321 ppb</td>
<td>&lt; 2 ppb</td>
</tr>
<tr>
<td>Ethyl Benzene</td>
<td>&lt; 5 ppb</td>
<td>&lt; 2 ppb</td>
</tr>
<tr>
<td>Toluene</td>
<td>358 ppb</td>
<td>&lt; 2 ppb</td>
</tr>
<tr>
<td>Total BETX</td>
<td>990 ppb</td>
<td>&lt; 7 ppb</td>
</tr>
<tr>
<td>pH</td>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>

- Completed project in 7 days
- average Flow rate 4 bpm
Weir Box

Allows for chemical treatment and addition residence time.

1) Bulk oil is separated & sent to a designated location
2) Additives that may be present get broken down to be safely discharged.
3) Oxygen scavengers can be deactivated through sparging.
Bulk Filtration Vessels

Largest offshore spec fleet
Conventional Offshore Pipeline dewatering application for removal of solids, corrosion inhibitor, oxygen scavenger, dye and oil & grease.

Samples on left are from New PL displacement.
Major Oil Company
New Pipeline - Dewatering GOM

General Permit prohibits discharge of floating solids and foam

Fluid In CETCO Weir box, Prior to Treatment
Major Oil Company
New Pipeline - Dewatering GOM

Solids Collected in Sock Filters
Major Oil Company
New Pipeline - Dewatering GOM

Before CETCO

After CETCO
Major Oil Company
New Pipeline - Dewatering GOM

CETCO Equipment
10 bpm with 5 Operational Personnel
Williston Basin Interstate Pipeline – Recluse Wyoming
Pond Water Fill/Discharge - Water Re-USE

• New/Existing Pipeline Commissioning - 15,500 bbls
• Average Rate  = 12 bpm
• Biocide Neutralization & Hydrocarbon Reduction
## Williston Basin Interstate Pipeline – Recluse Wyoming
### Pond Water Fill/Discharge - Water Re-USE

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Free Oil Sheen</th>
<th>Floating Solids</th>
<th>Max BBL Per Min</th>
<th>THPS Results in PPM</th>
<th>Protocol Sample Taken</th>
<th>Pass/Fail</th>
<th>Static Sheen Test</th>
<th>Static Sheen Test Fail</th>
<th>Discharge Rate</th>
<th>Discharge Y/N</th>
<th>Observations</th>
<th>Date</th>
<th>Time</th>
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<tbody>
<tr>
<td>11/24/03</td>
<td>2:30 PM</td>
<td>N</td>
<td>N</td>
<td>NA</td>
<td>50</td>
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<td>N</td>
<td>Y</td>
<td>N</td>
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<td>Y</td>
<td>11/24/03</td>
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<td>50</td>
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<td>N</td>
<td>N</td>
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<td>0.02</td>
<td>N</td>
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<td>NA</td>
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<td>N</td>
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<td>N</td>
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<tr>
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<td>N</td>
<td>15,306</td>
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<td>N/A</td>
<td>N</td>
<td>11/26/03</td>
<td>7:00 AM</td>
</tr>
</tbody>
</table>
# Williston Basin Interstate Pipeline – Recluse Wyoming

## Pond Water Fill/Discharge - Water Re-USE

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Permit Limits (mg/L)</th>
<th>Water Quality before and after CETCO Treatment Process (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Influent</td>
</tr>
<tr>
<td>Oil &amp; Grease</td>
<td><strong>Visual</strong></td>
<td>N/A</td>
</tr>
<tr>
<td>TPH</td>
<td>10</td>
<td>230</td>
</tr>
<tr>
<td>TSS</td>
<td>30</td>
<td>180</td>
</tr>
<tr>
<td>TDS</td>
<td>5000</td>
<td>1320</td>
</tr>
<tr>
<td>Benzene</td>
<td>0.005</td>
<td>0.071</td>
</tr>
<tr>
<td>BTEX</td>
<td>0.100</td>
<td>0.284</td>
</tr>
<tr>
<td>TRC</td>
<td>1.0</td>
<td>ND</td>
</tr>
<tr>
<td>pH*</td>
<td>6.5 – 9.0</td>
<td>Pond water – 9.72</td>
</tr>
</tbody>
</table>
Shell Pipeline - Patoka Illinois

- New Pipeline Commissioning - 25,000 bbls
- 10 bpm
- Project Completion - 4 days (even with delays)
## Shell Pipeline - Patoka Illinois

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Influent</th>
<th>Effluent</th>
<th>Daily Limit</th>
<th>30 day</th>
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</thead>
<tbody>
<tr>
<td>TSS</td>
<td>825 ppm</td>
<td>6 ppm</td>
<td>15 ppm</td>
<td>30 ppm</td>
</tr>
<tr>
<td>O&amp;G</td>
<td>&lt; 6 ppm</td>
<td>ND</td>
<td>15 ppm</td>
<td>30 ppm</td>
</tr>
<tr>
<td>Total Iron</td>
<td>709 ppm</td>
<td>0.132 ppm</td>
<td>2 ppm</td>
<td>4 ppm</td>
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<tr>
<td>Chlorine</td>
<td>&lt;1.25 ppm</td>
<td>&lt;0.05</td>
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</tr>
<tr>
<td>pH</td>
<td>8.17</td>
<td>8.35-7.33</td>
<td>6-9</td>
<td>6-9</td>
</tr>
</tbody>
</table>

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Shell Henrietta, Texas

- Houston to Henrietta, Texas
- Diesel Line – 170 miles
- Hydro test
- Desired Rate 40 bpm
- NASTY FLUID – diesel and dye
## Discharge Permit Sampling

The following sampling frequency will be followed:

<table>
<thead>
<tr>
<th>EVENT</th>
<th>FREQUENCY</th>
<th>CONTAMINANT</th>
<th>LIMIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Discharge</td>
<td>Once</td>
<td>List Below</td>
<td>List Below</td>
</tr>
<tr>
<td>First Hour¹</td>
<td>Once</td>
<td>List Below</td>
<td>List Below</td>
</tr>
<tr>
<td>Last Hour¹</td>
<td>Once</td>
<td>List Below</td>
<td>List Below</td>
</tr>
<tr>
<td>Visual, Olfactory²</td>
<td>Every 2 hours</td>
<td>Oil &amp; Grease, Odor</td>
<td>Any</td>
</tr>
<tr>
<td>pH³</td>
<td>Once per day</td>
<td>PH</td>
<td>Between 6.0 &amp; 9.0</td>
</tr>
</tbody>
</table>

### List of Contaminants

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>MAXIMUM</th>
<th>SAMPLE TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Petroleum Hydrocarbons⁴</td>
<td>15 mg/l</td>
<td>Grab</td>
</tr>
<tr>
<td>Benzene</td>
<td>0.005 mg/l</td>
<td>Grab</td>
</tr>
<tr>
<td>Total BTEX</td>
<td>0.10 mg/l</td>
<td>Grab</td>
</tr>
<tr>
<td>Total Lead</td>
<td>0.10 mg/l</td>
<td>Grab</td>
</tr>
<tr>
<td>PH</td>
<td>Between 6.0 &amp; 9.0</td>
<td>Grab</td>
</tr>
<tr>
<td>Chemical Oxygen Demand</td>
<td>250 mg/l</td>
<td>Grab</td>
</tr>
</tbody>
</table>
Henrietta Texas
On-Line Separation Applications

- Pigging Operations
- Hydrostatic Testing
- Cleaning Operations
  - Gel cleaning
  - Chemical cleaning
On-Line Separation Capabilities

- Three/four phase separators
  - Gas
  - Liquids
    - Hydrocarbons
    - Water
  - Solids
On-Line Separation

• Current Capabilities
  – 18” – 20” Lines < 125 MMSCF/day

• Ultra High Flow Rate Vessels
  – 250 – 400 MMSCF/day
Why Are We Different

• Multiple Vessels - multiple jobs – multiple crews
• Varying sizes and descriptions – + 20 separators
  – Customized site specific applications
  – Small Footprint if needed
  – Gas measurements at low and high rates
• Multiple Crews
  – Professional seasoned, tested, pressure vessel/system trained crews
• All Related Equipment – totally control all fluids at all times
  – Choke manifolds
  – Second phase separation – to eliminate breakout gasses in liquids
  – The only 2000 lb working separator(s) available in US
Why Treat On-site?

- CETCO systems are temporary and require no capital expense
- All fluids discharged within requirements on location
- Treatment time is 50 to 200% faster than conventional methods.
- Converts a liability back to a revenue stream in short time
- Mobilize quickly
- Large volumes handled more economically.
Why Use CETCO?

Project Experience:

- Large hydro tests offshore,
- Pipeline abandonment's,
- New pipeline construction/dewatering,
- Pipeline re-commissioning or change of service,
- Platform abandonment's,
- Large hydro tests onshore (COD, O&G, BETX)
- Terminal/Tank Farm Applications
- Pipeline/Terminal Commissioning