Water
A Construct for Sustainable Drilling
All Water Is Local.
Water as Asset
What is the value?
thirst
Scalable
Wyoming Oil & Gas Conservation Commission

2211 King Boulevard, Casper, WY 82601
P.O. Box 2640, Casper, WY 82601

Governor Dave Freudenthal, Chairman
Dan Litvack, Chairman

September 29, 2008

Department, Safety & Regulatory Affairs

In order to continue fulfilling the mission of the State of Colorado to protect its natural resources and its environment, the regulations in Title 6, Chapter 24, Section 1 (z), for use of Process Water, have been established. These regulations require that water quality standards are met, including but not limited to:

a. Water quality
b. Water quantity
c. At the same time

d. Depending

Submit this statement:

The report for chronic biomonitoring of the North Platte River by the Denver Water Corporation on effluent from the Ceraidaphnia dubia on the C. dubia was 100%. Sub-lethal IC50's for reproduction of samples collected on 02/23/09, 02/25/09, 03/24/09, 03/26/09 (Whole Effluent Toxicity) testing.

Unfeasible

#5793288
Regulations
Regulations
Regulations
Regulations
Treehugger
O&G Water Source Transition

Produced Water (Decades)

Frac Water (Years)
### Transportation Cost

<table>
<thead>
<tr>
<th>Description</th>
<th>Traditional</th>
<th>Centralized</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cost (before risk factors)</td>
<td>$8.40</td>
<td>$4.67</td>
</tr>
<tr>
<td>Net Additional Costs</td>
<td>$-</td>
<td>$4.26</td>
</tr>
<tr>
<td>+ 10# Brine</td>
<td>$-</td>
<td>$-</td>
</tr>
<tr>
<td>+ Gel Cost Savings</td>
<td>$-</td>
<td>$-</td>
</tr>
<tr>
<td>+ Hot Water Savings</td>
<td>$-</td>
<td>$-</td>
</tr>
<tr>
<td>+ Methanol Recovery</td>
<td>$-</td>
<td>$(0.55)</td>
</tr>
<tr>
<td>+ Natural Gas Condensate Recovery</td>
<td>$-</td>
<td>$(0.60)</td>
</tr>
<tr>
<td>+ Gas or Electric Costs</td>
<td>$-</td>
<td>$1.00</td>
</tr>
<tr>
<td>Cost of 212 Resource</td>
<td>$8.85</td>
<td>$8.85</td>
</tr>
<tr>
<td>Percent Injected</td>
<td>100%</td>
<td>8%</td>
</tr>
<tr>
<td>Effective Injection Costs</td>
<td>$8.40</td>
<td>$8.40</td>
</tr>
</tbody>
</table>

#### Water Treatment Net Cost Calculator

**Financial**

- **No-Reuse**
- **212 Resources**

**Environmental**

- **Drilling Site**
- **Water**
- **Water Statistics**
- **Flowback Disposal**
- **Resources Created**
- **Water**
- **Truck Movements**
- **Emissions**
- **Reduced Truck Movements & Hours**
- **Reduced Emissions (lbs.)**
- **Water**
- **Truck Movements**
- **Emissions**
- **Traditional**
- **Centralized**
The Water Management Decision Continuum

- Dump to Evap Pit
- Clean a little and Reuse
- Maximize Water Value and Minimize Disposal
- Obtain Max Results + PR with BAT
- Recharge Aquifer

Study Dentistry

Turn Dirty Water into Fresh Water

impact $$$$ impact $$$$ impact $$$$ impact $$$$ impact $$$$ impact $$$$
200,000,000 Gallons Clean
The Real Deal
Zero-Discharge for 15 Years

IP Processes
- High-Rate Turbulent Flow
- Vapor Recompression
- Submerged Boiling
- Flash Evaporation

Process Benefits
- Max Concentration
- Any TDS Feedstock
- No Fouling
- No Scaling

Toyota, Caterpillar, AisenWarner, YKK, International Paper, MARTA, and more...
Proven Science in Action

Optional (if existing steam source)

Thermal Compression

Mechanical Compression (Remove if use Thermal COMPRE)

Brine Concentrate or Recovered Oil

Oil-Water Separator

Recovered Alcohol

Recovered Oil

Oil-Water Separator

Optional

Continuous Concentrating

Flash

Back Pressure

Heat Exchanger

40-Effect Distillation

Feed

Brine Concentrate or Recovered Oil

Feed

Clean Water
Western Flowback

70%

15,000 to 40,000 mg/L TDS
Eastern Flowback

20%

50,000 to 120,000 mg/L TDS
Water for Reuse or Discharge

Produced Water
Concentrated Brine
Pre-Strip Water
Distilled Water
Permits for Unique Water Use or Discharge

BEFORE THE OIL AND GAS CONSERVATION COMMISSION

Surface Hole Drilling
First in the Nation
Substitute for “Fresh” Water

Variance to Chapter 4, Section 1 (z), for use of Process Water for Surface Drilling, 212 Resources
Integrated Distillation

Hydrocarbon & Alcohol Recovery

NPDES Water Quality

Landfill or Value Residue

3,000 bbl/day

Transportable System
Heat Exchanger
Steam Disengagement Vessel
Distillation Column
Mechanical Steam Compressor
Effluent Polishing and Discharge
POD

Large or Little
Mobile or Modular
Plug ‘n Play
On the Anticline in Wyoming
Evaporation Skid
Pump and Blower Skid
POD
Two Evaporators and One Distillation Column
Flexible Site Configurations
Advanced Control and Automation
Foundation Field Bus and DeviceNet
The Piceance in Colorado

Vega Field
Site Overview (across from Compressor Station)
Set for Ten Year Operation
Pitless Site Infrastructure
Site Planned for Five PODs
REALLY CLEAN = REALLY FLEXIBLE
The Clear Difference

Clean

Dirty
What will you choose to do?
FAQs

• How much does it cost?
  :: It depends.

• How much water do you recover?
  :: It depends.

• How much energy do you require?
  :: It depends.

• How much time does it take to build a POD?
  :: It depends.

• How much money and hassle can you save me?
  :: Sometimes a lot.