

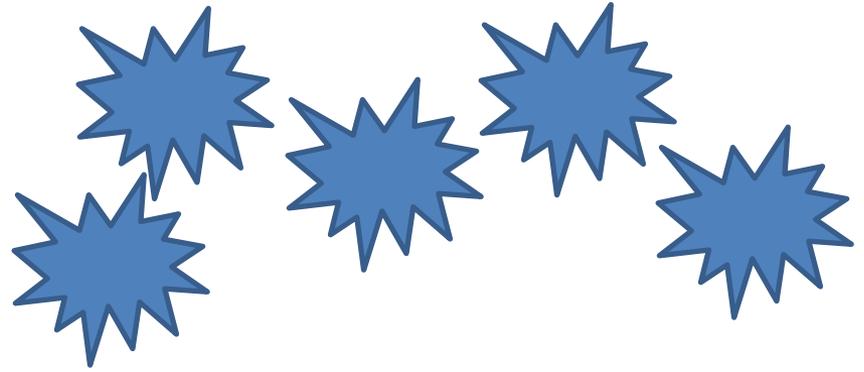
**Arkansas' Brine Production
Business--How You Make
Something From Less Than Nothing**

By Thomas A. Daily

The History of Arkansas Brine Development

- Arkansas' brine business was born from its oil industry
 - The Smackover Limestone Formation
 - Gushed Oil during early ArkLaTex boom
 - Mostly self-destructed from over-production
 - Poster-child of why fugacious mineral production must be regulated.
 - The Serendipity
 - Somebody thought to analyze the saltwater

BROMINE



- South Arkansas Smackover brine is the most prolific source of bromine in the Western Hemisphere
- Rare chemical element
- Lots of uses, e.g.:
 - Gasoline additives
 - Flame retardants
 - Water purifying chemicals
 - Pain pills

Brine Production Process

- You drill large-bore wells, completed in the water-filled Reynolds Aquifer of the Smackover Limestone
- You install big downhole centrifugal pumps
- You get up to 20,000 barrels of brine, per well, per day

Bromine Extraction Process

- You pipe the produced brine to nearby bromine plants
- You drip the brine down ceramic honey-combed towers
- You simultaneously infuse the towers with chlorine
- The chlorine displaces the bromine from bromide salts within the brine, leaving about the same volume of “tail brine,” now with chloride salts

Tail Brine Disposal Process

- You pipe the tail brine back to the field
- You re-inject the tail brine back into the same Reynolds Aquifer of the Smackover Formation from whence it came

The Result: A Water-Flood

- The reinjected tail brine maintains formation pressure as it moves from higher pressure around injection wells toward lower pressure around production wells
- This causes high-bromine brine on tracts in between to gradually be replaced with “worthless” tail brine
- Eventually the bromine concentrations within produced brine decline as they are being diluted by tail brine.

Now The Legal Stuff—Whose Brine Is It, Anyway?

- The *Strohacker* Doctrine complicates things
 - Only mineral severances occurring after 1955 are recognized as severing brine
- Trespass vs. the Rule of Capture
 - *Budd v. Ethyl Corp.*
 - *Young v. Ethyl Corp.*
 - *Jameson v. Ethyl Corp.*

How To Avoid Trespass Liability

- We get leases from all brine owners lying between injection and production wells
 - **BUT WAIT!!!!**
 - What if some owners won't lease?
 - **Quick**—We need to get some unitization legislation passed

Arkansas' Brine Conservation Act

- The Act arose out of the “emergency” caused by *Young and Jameson*
- The Act gives jurisdiction to the Oil and Gas Commission
- The Act permits unit formation and integration of non-consenting owners' interests
- The Act establishes a minimum royalty for brine which has become the royalty for brine

Brine Royalty

- More like a rental, actually
- \$____, per acre, per year.
- Totally unrelated to production volumes
- Totally unrelated to production value
- Simple and easy to calculate
 - Hard to place a value on brine
- **Ticking-time bomb?**

The Ticking Time-Bomb Problem

- Bromine concentrations will inevitably decline making produced brine less valuable
- Bromine itself may become less valuable
- Meanwhile, royalty, indexed to inflation, increases, increasing fixed costs for producers
- Complicating factor is that acreage once in a unit is always in the unit
- The inevitable result: Premature abandonment of less profitable operations

The “Other Substances Rule.”

- In addition to any other amounts due and owing by the producer or producers of any unit to the owners therein, the producer or producers shall account separately and on a fair and equitable basis to each owner in the unit for all substances which are found by the commission to be profitably extracted from brine by a producer and which were not extracted by a producer on January 1, 1979.

The “Other Substances Rule.”

- The act appoints the Oil and Gas Commission as arbiter of the “fair and equitable” accounting for other substances.
- This occurred once, on a minor scale, with a plant (now closed) which extracted commercial salts from tail brine before reinjection.

We Got



Lithium

The Lithium Era is Dawning

- Lithium is the flavor of the week; just watch the news
- Renewable energy sources generally produce only when the sun shines, the wind blows or the rivers run
- What we need are batteries to store all this renewable energy
- Moreover, batteries are portable, a requirement for many applications (i.e. cars)
- Lithium makes the best batteries, at least until someone comes up with something better

The Lithium Era is Dawning

- Most of today's lithium comes from South America and Australia, with only a small portion currently being produced within the United States. While some concentrations of lithium are present in most brines, including sea water, the traditional process of pumping the brine into shallow ponds which are then evaporated by the heat of the a hot sun requires much higher concentrations than are generally common, as well as a hot arid climate. Even then, it is painfully slow and, thus, expensive.

The Lithium Era is Dawning

- A Canadian company, Standard Lithium, Ltd. recently announced that it has developed a process for extracting a highly concentrated lithium chloride solution from brine which is much faster and more efficient than pond evaporation, and then immediately converting that lithium chloride solution into battery grade lithium carbonate.

The Lithium Era is Dawning

- Arkansas Smackover brine's lithium concentrations of lithium are high enough to permit commercial application of its new processes in South Arkansas.
- The pilot plant is in the final testing stage. The word is that it will work. They can economically produce battery-grade lithium carbonate from Arkansas Smackover brine.

The “Other Substances Rule.”

- The act appoints the Oil and Gas Commission as arbiter of the “fair and equitable” accounting for other substances.
- The next step is for the Commission to establish this “fair and equitable” accounting for lithium recovered from the brine.

Lithium Royalty

- More properly, additional brine royalty due to recovered lithium
- Will it be per-acre “rental” again or real royalty based upon real economic factors?
- Well...You know what I think.

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