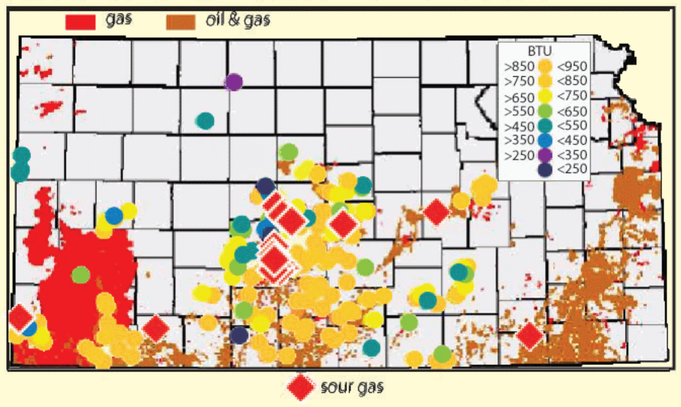
CONCLUSIONS

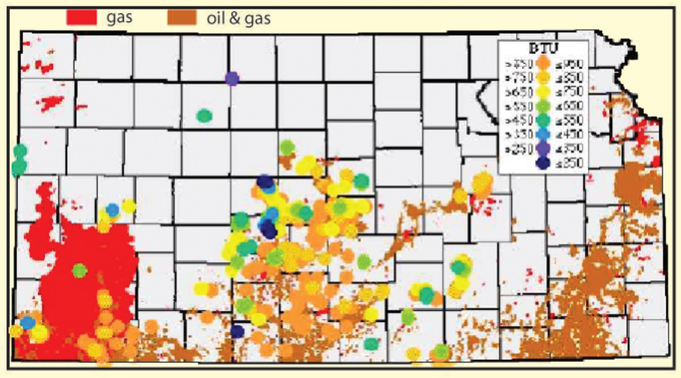
OPPORTUNITIES FOR REDUCING RISK

There are several types of opportunities for reducing risk by understanding the chemistry of natural gases. Simply recognizing where sour gas is produced is a substantial step toward risk reduction.

Location of Sour Gas superimposed on Known Low-BTU Gases



Location of Known Low-BTU Gases



Knowing where low-BTU gases can be found is essential if new and cost-efficient technologies are to be applied to upgrade the quality of these gases. Conversely, avoiding low-BTU gas is necessary if conventional exploration strategies are being pursued.

CHARACTERISTICS OF NATURAL GASES IN KANSAS AND THE SOUTHERN MIDCONTINENT

Analysis of a large data set of gas compositions reveals several temporal and spatial trends:

1. Natural gas fields in upper Pennsylvanian strata (i.e., Virgilian- and Missourian-age) and Permian strata in Kansas (exclusive of the Hugoton Gas Field) are mostly composed of low-BTU gases.

2. Gas quality, principally expressed as heating value (i.e., BTU content) is better in lower Pennsylvanian (Desmoinesian) and older strata.

3. BTU content and other descriptors of gas chemistry, such as % noncombustible gas, N_2:He ratio, and hydrocarbon wetness, tend to plot as slightly skewed normal distributions. Low-BTU gas does not represent a separate distribution, but rather a statistical flank to a larger distribution.

4. Heavier-molecular-weight hydrocarbon gases (i.e., wetter gases) are more prevalent in Pennsylvanian and older strata, whereas the hydrocarbon component in Permian gases is mostly methane.

5. Nitrogen is the main noncombustible component gas that lessens BTU content in Midcontinent gases. Noncombustible gases average greater than 20% for natural gas fields in upper Pennsylvanian and Permian strata (exclusive of the Hugoton Gas Field). Older strata generally contain 15% or less noncombustible gas.

6. N_2:He ratios for natural gases in Kansas generally decrease with increasing age of the strata.

7. The N_2:He ratio for pay zones along the basal Pennyslvanian unconformity averages 15:1, but this ratio decreases updip and on-structure to approximately 5:1 on the Central Kansas uplift.

8. Low-BTU gas is more common northward in Kansas, essentially in shallower and younger strata higher on the flanks of the Anadarko basin. Several stratigraphic units hold low-BTU gas on the Central Kansas uplift.

9. Low-BTU gas is present along the perimeter of the giant Hugoton Gas Field. This low-BTU rim broadens on the northeastern margin of the field. Low-BTU gas constitutes approximately 15% of the total gas in the Hugoton Gas Field (Permian Chase Group main pay) and 7% of the underlying Panoma Gas Field (Permian Council Grove Group main pay).

10. Several low-BTU gas plays can be defined for future exploration and development:
    a) Permian strata (mostly Chase Group) west of the Central Kansas uplift and east of the Hugoton Gas Field.
    b) Mississippian reservoirs on the west flank of the Pratt anticline.
    c) Permian (Red Cave Sandstone) and Pennsylvanian (Virgilian Shawnee Group) in the Greenwood Gas Area in extreme southwestern Kansas.
    d) Pennsylvanian (Virgilian Douglas Group, Missourian Lansing-Kansas City Group) on the Central Kansas uplift.
    e) Cambrian-Ordovician Arbuckle Group and Pennsylvanian (Virgilian Douglas Group, Missourian Lansing-Kansas City Group) on the western margin of the Central Kansas uplift.
    f) Permian, Pennsylvanian, and Mississippian strata in scattered localities in the Sedgwick and Cherokee basins.

AND FROM HERE...

Understanding the distribution of gas quality in Kansas can lead to a better estimate of the volumetric importance of low-BTU gas in the Midcontinent. Statistical inferences, possibly based on Monte Carlo methods, may be useful for estimating size distributions of gas fields in specific low-BTU gas plays.

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