AAPG EMD Gas Hydrates Committee Mid-year Report – 2008
By Bob Lankston and Art Johnson

Progress toward commercialization of gas hydrates in North America and Asia continued during 2008, with some notable advancement in both resource assessment and technology.

U.S. exploration Activity
With many challenges and unknowns remaining long-term, economically-viable production of natural gas from hydrates is as yet unproven. Gas hydrate R&D is the type of high cost, high-risk, high-potential endeavor that calls for government economic support.

Progress in the U.S. has been limited by the relatively low budget levels of the Department of Energy (DOE) methane hydrate program, the primary source of funding for U.S. hydrate efforts. While Congress authorized $20 million for fiscal year 2007 under the Energy Policy Act of 2005, the appropriation was for only $12 million. The spikes in energy prices in mid-2008 resulted in consideration by the Bush Administration of an increase in funding for gas hydrate R&D; however, the FY 2008 budget has not been approved. The areas of focus for U.S. hydrate efforts are the North Slope of Alaska and the Deepwater Gulf of Mexico.

The companies that are most involved with gas hydrate programs in the U.S. include BP, Chevron, ConocoPhillips, Schlumberger, and Halliburton. Their in-kind contributions of labor and data are complemented by a substantial match of Federal funds. Several service companies are engaged in a support role as subcontractors.

No additional hydrate drilling activity occurred on the North Slope of Alaska during 2008, but analysis continued on the results of BP's "Mt. Elbert" stratigraphic test in 2007 that included an MDT. The 2007 test confirmed the exploration model for Arctic hydrate and confirmed the producibility of the reservoir. The next step for the North Slope will be a long-term production test that, if successful, will demonstrate the commercial potential of gas hydrate for the first time. An industry-scale test is currently being planned but will require that a gravel pad be used for surface equipment due to the need to operate beyond the winter drilling season. The planned test will be expensive, especially if a new gravel pad will have to be constructed. No date has been released for the test.

In the Gulf of Mexico, the Joint Industry Program (JIP) led by Chevron selected three locations for a series of stratigraphic tests that were scheduled for mid-2008. Due to problems with the rig schedule, the drilling program was deferred until 2009. The locations include Alaminos Canyon 818, Green Canyon 955, and Walker Ridge 313. Current plans call for LWD at several locations in each block. The results from the JIP drilling program will be used to calibrate the exploration model for marine hydrate.

International Exploration Activity
While many countries have expressed interest in the resource potential of gas hydrate, few have been willing to commit the financial resources needed to begin valid assessments that could lead to commercial development. Outside of the U.S., significant programs are currently being carried out in Japan, India, Canada, South Korea, and the Peoples Republic of China.

In Japan, the evaluation of results from the 2004 drilling program in the Nankai Trough led to an announcement by the head of Japan's MH21 program that Japan will begin reservoir testing by 2011. The Japanese estimate of gas in place for the Nankai Trough is 39 TCF.

During the winter of 2007-08, the Japanese/Canadian consortium conducted a 6-day drawdown test on a hydrate-bearing sand at the Mallik site in the Canadian Arctic. The test had a maximum flow rate of 280 MCF per day. Models indicate that much higher rates are possible, and while a commercial rate was not achieved on that test, the test demonstrated that hydrate-bearing sands are capable of sustained flow.

Following the active drilling programs of India in 2006 and China and South Korea in 2007, efforts from those programs in 2008 were primarily focused on analysis of the drilling results and on the shooting of additional seismic data. The most significant result of these programs has been the validation of the "Petroleum Systems Model" for gas hydrate exploration – the recognition that the elements of conventional petroleum exploration (lithology, source, timing, migration, traps, seals, etc.) must be integrated into a hydrate exploration program. A primary reliance on the seismic "Bottom Simulating Reflector" (BSR) was amply demonstrated to mainly yield low-grade deposits containing 3-5% hydrate in a shale matrix.

Resource Estimates

Resource estimates for the Gulf of Mexico and North Slope of Alaska were published in 2008 by federal agencies. The Minerals Management service conducted an evaluation of the petroleum system for the Gulf of Mexico and estimated a total gas hydrate volume of between 11,112 and 34,423 TCF, and a mean estimate of 6,717 TCF in place in sandstone reservoirs. Assessments for the Atlantic and Pacific margins are on-going, and the resource potential of those locations may actually be larger than the Gulf of Mexico estimate. The USGS, in cooperation with the BLM, released an assessment of the undiscovered, technically recoverable gas hydrate resources on the North Slope of Alaska. Using an assessment methodology based on detailed analysis of geological data, the USGS estimated undiscovered, technically recoverable gas resources of 85.4 TCF within gas hydrate.

Other than the Japanese estimate for the Nankai Trough, little reliable data on international basins exist regarding hydrate resource potential where reservoir lithology would permit commercial development.

Critical Technology Needs

Current commercialization efforts are constrained by technology needs in three areas: the lack of thorough and diverse exploration protocol for identifying deposits where hydrate is concentrated and has resource potential, the lack of proven technology for commercial-scale production, and the lack of an environmental impact assessment protocol. All three of these areas are being addressed by the current gas hydrate programs, particularly the U.S. and Japanese programs.

The most important "next step" will be the industry-scale production test planned for Alaska. If commercially viable flow rates are achieved, the reservoir could be quickly developed to supply gas for local use. This result would likely lead to a much greater interest and investment by industry. Current budget constraints could delay the test, however.

Environmental and Geohazard Issues
Potential hazards associated with production of natural gas from hydrate include ground subsidence, methane release, slope instability, and water and sand production. Initial studies have indicated that these issues can be mitigated; however, modeling and field validation of mitigation strategies are needed.

An additional area of interest is the opportunity for sequestering carbon dioxide as a subsurface hydrate. ConocoPhillips is investigating the possibility of using the chemical exchange of carbon dioxide for methane in hydrate-bearing reservoirs. In addition to producing natural gas without dissociating the hydrate, this technology would result in stable, long-term sequestration of carbon dioxide.

EMD Technical Sessions and Publications
The 2008 AAPG annual meeting in San Antonio included an oral session with 10 presentations, a poster session with 4 posters, a short course led by Tim Collett and Art Johnson, and the "Friends of Gas Hydrate" evening meeting. A Gas Hydrate session is planned for the 2009 AAPG annual meeting in Denver.

The publication from the 2004 Hedberg Research Conference is in press and should be available at year end as AAPG Memoir 89, with the title "Natural Gas Hydrates -- Energy Resource Potential and Associated Geologic Hazards". The memoir includes an extensive summary of gas hydrate occurrence, technology, and program results that includes results through mid-2008, written by T. Collett, A. Johnson, R. Boswell, and C. Knapp.

Another conference of interest to EMD members was the 6th International Conference on Gas Hydrates (ICGH) which convened in Vancouver in July, 2008. The conference included over 500 participants from 25 countries with 78 oral and 341 poster presentations. Most of the papers are available through the University of British Columbia website https://circle.ubc.ca/handle/2429/1022.