Hydrates – Hazards/Safety Issues

Robert P. LaBelle (robert.labelle@mms.gov Tel: 703-787-1656)
US Minerals Management Service
381 Elden Street
Herndon, Virginia 20170

Abstract

The Department of the Interior's Minerals Management Service (MMS) is responsible for ensuring safe, environmentally sound activities associated with offshore oil and gas production. Current MMS research on gas hydrates is focused on seafloor mapping of 3-D seismic data and the use of seismic analysis to differentiate anomalies associated with hydrates, chemosynthetic communities, or carbonate hardgrounds. Core data and submersible observations are then used to verify the success of the mapping program.

Hydrates are most commonly found at the edges of deepwater mini-basins and like chemosynthetic communities, have been avoided during drilling operations. Seafloor stability along proposed pipeline routes, as related to gas hydrate on the continental slope, may become a factor in future deepwater development, however.

MMS regulations cover gas hydrate core test drilling for either exploration or scientific research to ensure general safety and environmental protection.

Gas hydrates occur at or within a few hundred feet below the mudline and generally in deep water. Drilling may be done with or without a riser and may use surface or subsea well control equipment. Hydrate cores must be kept at in-situ temperature and pressure to remain as hydrate. Contact by many chemicals (usually including salt water) can also cause hydrates to release gas. Each of these items raises concerns.

Any disturbance of hydrates at the mudline may cause the hydrates to dissolve and the release of substantial quantities of gas. This could be a foundation problem for jackup rigs and other bottom supported equipment, an anchor problem with floating rigs, and an explosive gas problem for all operations. Buoyancy reduction could also be an issue for floating equipment.

Regulations require conductor casing to be set immediately before drilling into hydrocarbons but with hydrates that may not be possible.

Subsea wellheads and well control equipment are normally set on the conductor casing but this may not provide adequate support if the casing is set in hydrate, which could dissolve.

In some cases free gas occurs just below the hydrate which acts as a seal. It is difficult to impossible to detect this free gas before drilling. Well control must be in place before encountering such free gas accumulations.

Appropriate plugging procedures for hydrate core holes must also be developed. The heat created by cement hydration could dissolve hydrate, free gas, cause channeling of the cement plug, and defeat the original purpose for setting the plug.

Hydrate cores will be brought to the surface, handled, stored, and transported under in-situ pressure and temperature conditions which could create unusual safety hazards both on the rig and during transportation to shore. If the hydrate is not maintained under in-situ conditions, free gas will be released and create associated safety concerns.

The MMS presently funds the Center for Marine Resources and Environmental Technologies (CMRET), which was established to identify, design, and test equipment and techniques to study gas hydrates and marine minerals in the Gulf of Mexico.

MMS also maintains a technology assessment and research program that supports operational safety and pollution prevention research. Several projects related to gas hydrates as geohazards have been funded. The Resource Geoscience Division of the Geochemical and Environmental Research Group (GERG) at Texas A&M University supports hydrates hazard research through this program.

Much applied research has also been done by industry on hydrates as plugs in pipelines and other flow systems, a persistent problem in offshore activities.