

Methane Hydrates

You may remember an article which was published in the Province on September 22, 2002, titled "THE FIRE IN THE ICE". In the article it explained the discovery of a deposit of frozen sealed methane by a long time Commercial Fisherman. This was a first for a man that had fished the waters off the BC Coast for over 30 years, and a first for myself to hear about Methane Hydrates after above 30 years in the Natural Gas and Propane Industry.

I was very interested in reading on, not only to read about how ice might be kept frozen in salt water, but what exactly was this "Methane" I had never heard of.

It turns out that Methane Hydrates is a very important find, and has been known about for some time. However, the research and development of a viable energy source has just started to get into high gear in the last couple of years. To accommodate and speed up the research and development of Methane Hydrates, an agency has been set up to help co-ordinate all the research information so all other agencies have ready access to the information, so time is not spent in duplicating the work. The U.S. and Canada are spending large resources of funds to execute the research to see if this product is viable as a commercial energy use.

Over the next few issues we will include some very interesting information about this amazing product, and how it may affect the industry we are in.

What Are Methane Hydrates?

The fossil fuels that have powered the world's economies (first coal, then oil and natural gas) for many centuries have been derived almost exclusively from thermogenic deposits. These deposits form when organic material is pressure-cooked at great depths within the Earth's crust over geologic time. In addition to thermogenic processes, natural gas is continually being produced in vast quantities at and near the Earth's surface through biogenic or microbial processes. Scientists assumed, however, that no natural process exists to collect and concentrate biogenic gas into viable economic deposits.

This view began to change in the 1970s. Tantalizing evidence from Siberia, the Black Sea, and the North Atlantic suggested that under certain conditions typical of deep oceans, water may naturally form hydrate cages that trap and concentrate biogenic methane-virtually as it is being produced. Then in 1982, scientists on board the Glomar Challenger retrieved a 1-m (3.28-ft) thick sample of pure methane hydrates from the deep-water sediments offshore of Guatemala.

This core became the impetus for the first national R&D program dedicated to hydrates. Over the next 10 years, the U.S. Department of Energy (DOE), the U.S. Geological Survey (USGS), Naval Research Laboratory (NRL), and many other organizations demonstrated that methane hydrates occur in staggeringly vast quantities all over the globe. By 1990, it was clear that the volume of energy stored in methane hydrate exceeded that of all the world's coal, oil, and conventional natural gas combined.

Methane hydrates are solid, naturally occurring compounds composed of methane (the main component of natural gas) trapped inside a rigid lattice of water molecules.

Methane hydrates form naturally under conditions of high pressures and relatively low temperatures. Under these conditions, methane molecules are compressed into very tightly packed ice-crystal cages. Therefore, methane hydrates have high energy density at surface pressures. When dissociated at normal surface temperatures and pressures, a 0.028m³ (1 ft³) block of solid methane hydrates could release up to 4.53 m³ (160 ft³) of methane.

Methane hydrates occur naturally in Arctic permafrost regions at depths greater than 200m (656 ft). They also form at ocean depths of 500 m (1,640 ft) or more where temperatures hover near freezing and the weight of the overlying water produces high pressures. The high pressures and relatively low temperatures allow high concentrations of methane to accumulate in the ice.

Methane hydrates can form in rocks or sediments of any type, given suitable pressures, temperatures, and supplies of water and methane. Although methane hydrates commonly occur as disseminated grains, other forms are known. These include massive layers of pure hydrates up to 4-m (13-ft) thick, nodules that grow and displace surrounding sediments, veins filling small fractures, thin layers along bedding planes, and as a cement binding sedimentary grains together.

Methane Hydrate Interagency Coordination Plan.

Methane Hydrate Interagency Co-ordination Plan

Interest in naturally occurring methane hydrates is growing. Many nations, intrigued by the vast volumes of methane contained in hydrates and the promising results of recent well tests in Japan and Canada, are starting to think of hydrates as a future energy source. The widespread occurrence of methane hydrates indicates that the resource could dramatically alter the international balance of power with regard to energy supply as well as provide energy self-sufficiency to many nations now dependent on others.

The growing recognition that methane hydrates exist on a massive scale in nature presents public interest issues that require immediate and focused investigation:

- We need to find ways to mitigate the potential hazards that hydrates pose to ongoing deep-water oil and gas drilling and production, and
- We must better understand the role methane hydrates play in the natural environment.

Vast methane hydrate accumulations are continually absorbing and releasing methane gas as they equilibrate in response to natural changes in pressure, temperature, and geochemical regimes. This vast and dynamic, and previously unnoticed methane storehouse raises questions about our current understanding of the global carbon cycle, long-term climate, sea-floor stability, and other natural phenomena. A successful National Methane Hydrate R & D Program will answer many of these questions and will have enormous long-term public interest benefits.

National Methane Hydrate R&D Program Goals

Primary Goals

- Provide the knowledge and technology to ensure the safety of deep-water oil and gas operations.
- Fully realize the potential of methane hydrates to support our Nation's continued economic growth, energy security, and environmental protection.

Near-Term (by 2005):

- Conduct laboratory and field studies on methane hydrates to compile more complete data on the physical and chemical properties of hydrates and hydrate-bearing sediments.
- Provide databases on methane hydrate topics on a global website for use by the entire methane hydrate R&D community.
- Conduct initial investigations into the relationships among naturally occurring methane hydrates, the global carbon cycle, and climate; and report results to Congress.
- Provide improved assessments of the distribution and volume of methane hydrates.
- Provide practical means to avoid or mitigate the potential hazards of overlying hydrate deposits on conventional oil and gas production in the GOM.
- Develop improved seismic and other geophysical tools for hydrate identification and characterization.
- Develop pressure/temperature-controlled devices to collect and preserve samples in low-temperature, high-pressure environments.

Mid-Term (by2010):

- Refine analytical tools to identify and characterize naturally occurring methane hydrates.
- Produce estimates of the recovery potential from methane hydrates.
- Develop and test engineering concepts for producing methane from hydrate deposits.

Long-Term (by2015):

- Commercially produce methane from hydrates, providing a secure, long-term supply of domestic natural gas.
- Allow the continued safe production of oil and gas from deep-water deposits overlain by hydrates.
- Provide a comprehensive knowledge base and suite of analytical tools to support ongoing research into methane hydrates and their role in the global environment.
- Secure the United States as a global leader in the science of natural gas hydrates and the technology of hydrate production.

Federal Advisory Committee

Effective collaboration and coordination among agencies require that these agencies also work in partnership with industry and academia. The Methane Hydrate R&D Act of 2000 established the Federal Advisory Committee. This committee consists of experts outside the government, including industrial enterprises and institutions of high learning. The Committee advises the Secretary of Energy through the Assistant Secretary for FE, and is charged with recommending research priorities for the program and for reporting to Congress on the impact that hydrates have on global climate change. In addition, this committee coordinates with member agencies by inviting ICC members to attend meetings. The first meeting of the Federal Advisory Committee occurred in May 2001.

Interagency Coordination Committee

Congress passed and the President signed the Methane Hydrate R&D Act of 2000. In response, the agencies named in the legislation formalized their collaboration on hydrates research with the creation of the ICC. The member agencies are (1) DOE through FE and NETL's SCNG, (2) DOC represented by NOAA, (3) DoD represented by NRL, (4 and 5) DOI represented by MMS and USGS, and (6) NSF.

The purpose of the ICC is to increase communication and sharing of information and resources among member agencies. The Committee responds to the Act and answers a need of the National Methane Research Program. DOE is responsible for coordinating ICC activities. The ICC is required by law to meet every 120 days to review progress of the program and make recommendations on future activities. The overall purpose of these meetings is to avoid duplication of effort and to collaborate on hydrates R&D. Committee meetings encourage sharing of information on past, present, and future work by each agency.

Bringing together national groups with significant experience in hydrate R&D should stimulate the creation of new ideas as well as new ways to solve problems. Each agency has unique abilities, experiences, and resources that will be valuable in R&D coordination. This collaboration facilitates the sharing of resources, and thus, increases the efficiency and scope of the individual agency programs.

The ICC met for the first time in January 2001. The agencies exchanged information about ongoing hydrate R&D activities at that first meeting and determined that an interagency Technical Coordination Team would be beneficial to ensure the free flow of information among agencies.