

“Study Specifications”

Sand control and perforation design in deep water shallow weak-unconsolidated formations and methane hydrate bearing formations

Japan Oil, Gas and Metals National Corporation

1. Title of Study

The Study of sand control and perforation design in deep water shallow weak-unconsolidated formations and methane hydrate bearing formations. (“Study”)

2. Objective of Study

The objective of the Study is to assess and propose the sand control and perforation design for methane hydrate production test planned in 2012 in Eastern Nankai Trough Area offshore Japan using the commercially available techniques and materials, based on the related data of the area and gas hydrate production wells at Mallik in Canada.

The methane hydrate bearing sediments in Eastern Nankai Trough Area are unconsolidated sand-silt inter-bedding, and exist in 100-300m interval below sea floor under 800-1200m water depth. To produce gas from methane hydrate formation by depressurization method, intensive drawdown (5-8MPa) will be applied into such mechanically weak formations. In such case, formation sand-silt incursion into wellbore through perforation port is one of the possible risks that prevent continuous sand-silt invasion.

Because the methane hydrate reservoirs exist in shallow and unconsolidated sediments that are not targets of conventional oil and production, special attention on the issue of sand control and perforation design must be paid.

3. Scope of work

In order to achieve the objective set out in paragraph 2 above, the contractor shall perform, research, prepare and provide Methane Hydrate Research Project Team in Technology Research Center of Japan Oil, Gas and Metals National Corporation (“JOGMEC-TRC-MH”) with a written report on the subjects described in paragraphs 3.(1) – 3.(5) below.

(1) Investigate example of sand control and perforation systems applied for the similar conditions of the Eastern Nankai Trough area (deep water shallow sediments) and propose the best sand control and perforation system among the examples for methane hydrate production test in Eastern Nankai Trough area. The investigation should include the examples of failure or troubles of sand control and perforation systems/devices and operation with prevention/mitigation methods.

(2) Investigate potential problems and provide mitigation/contingency procedures for sand control and perforation systems and operations in deepwater shallow unconsolidated formation well from the aspect of:

- Mixing and pumping of sand control operation and related down-hole/surface equipments
- Wellbore, screen and gravel sand integrity of unconsolidated intervals and methane hydrate bearing formations
- Dissociation of methane hydrate bearing formation during gravel slurry pumping and perforation.
- Appropriate perforation density, size, penetration length, direction and special pressure conditions (ex. under-balanced perforation) to minimize the sand problems.

(3) Propose the fit for purpose sand control and perforation systems, perform a full characterization of the proposed sand control and perforation designs (advantages and disadvantages), and design the detail sand control and perforation job procedure with a list of necessary equipments to perform the job to achieve the most appropriate sand control using the commercially available techniques and materials for methane hydrate production test in Eastern Nankai Trough area based on:

- The related formation data of Eastern Nankai Trough;
- Cementing data of experiment wells in Eastern Nankai Trough;
- Reports of Mallik gas hydrate production tests of 2002 and 2007–2008
- Experience of sand control and perforation systems in oil & gas field

For those purposes, following study and test would be performed if necessary;

- Sand control and perforation computer simulations with sensitivity analysis using commercially available software;
- Laboratory testing to measure dissolubility of methane hydrate bearing formation due to the disturbance of the gravel slurry, pumping pressure, temperature and salinity;
- Laboratory testing to investigate mechanical properties of the formation material. The materials can become soft and weak, and the relatively stiff gravels may gradually be embedded into the methane hydrate bearing formation, resulting in push gravel slurry against formation.
- Rheological compatibility test between gravel pack fluid and methane hydrate bearing formation;

Applicability, and advantages and disadvantages of those technologies in the methane hydrate reservoirs in Eastern Nankai Trough (deepwater, shallow, cold temperature and unconsolidated) should be stated.

- (4) List the necessary R&D items regarding sand control and perforation design for the methane hydrate production test that will be conducted in 2012 in Eastern Nankai Trough.
- (5) Recommendations from the contractor (if any)

4. Deliverables, Duration of Study

Deliverables shall include and satisfy all of the following items:

- (1) Three copies of final report shall be completed and delivered to JOGMEC-TRC-MH no later than 15th January, 2010.
- (2) Three copies of electronic files (CD or DVD) of the report shall be delivered to JOGMEC-TRC-MH no later than December 28, 2009. All electronic files consisting of the Report shall be prepared with Microsoft Word format, associated with necessary numeric data in Ascii format or spread sheet form, and recorded on the CD/DVDs. Such electronic files shall be editable and citable by JOGMEC-TRC-MH.

5. Methodology

The contractor shall carry out all work related to the Study with such care and skill as could reasonably be expected from a professional providing the same or similar services and in conformance with industry practices and standards. The work should be done under the close cooperation with the MH21 (the Research Consortium for Methane Hydrate Resources in Japan) researchers to exchange knowledge and improve understanding effectively through e-mail communication, workshops or seminars. (An) Interim report(s) shall be issued at appropriate time or upon requests of JOGMEC.

6. Workplace

The workplace shall either be the contractor's workplace or a place designated by JOGMEC.

End of "Study Specification"

*The following data will be provided to the contractor:

Available data

Full dataset of past two drilling campaigns (1999–2000 METI Nankai Trough (NT), 2004 METI Tokai-oki to Kumano-nada (T-K) that includes

- Geotechnical survey data of shallow silty sediments obtained in METI Nankai Trough
- Core derived formation strength data of shallow silty sediments and hydrate bearing sandy formations (METI T-K)
- Log derived formation property data (gas hydrate saturation and permeability) (METI NT, T-K)
- Raw LWD and wireline logging data (RT, GR, DTSM, DTCO, NPHI, FMI/GRV images, METI NT, T-K)
- METI Tokai-oki to Kumano-nada Experimental Wells drilling reports
- Cementing data and cementing evaluation data of METI Tokai-oki to Kumano-nada Experimental Wells

Production history of Mallik 2008

Current plan of marine gas hydrate production test

- Production test plan
- Expected gas and water production rate
- Well construction and completion plans for gas hydrate production in Eastern Nankai Trough using subsea BOPs.