

Specification for “Trend Survey of Well Test” (Draft)

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1. Survey background

In general, well test means test using well for evaluating rock characteristic and fluid properties. When a variety of well tests are divided according to production status, there are wireline formation test (WFT), drillstem test (DST) and extended production test during exploration period, and additionally there are some monitoring techniques using downhole gauge like pressure, temperature and flow during production period.

DST is the most representative technique of well test since commercializing in 1920's, and is mainly conducted at exploration and appraisal well. As exploration activity moves into more harsh environments, innovative technologies about DST are being developed.

On the other hand, WFT has attracted attention because this operation is safer, less costly and environmental friendly, especially in the offshore fields. While service companies have developed new generation tools to obtain representative pressure and fluid data under a variety of situations, some oil companies are now utilizing WFT as an acceptable replacement to conventional DST.

One of main objectives of extended production test for appraisal phase is to evaluate the connected reservoir volume into the testing well. There are main two progressive technologies which are permanent downhole gauge and deconvolution method.

2. Survey objective

The objective of this survey is to investigate the latest techniques, interpretations and planning of well test that oil companies over the world have conducted. These survey results will be disclosed to JOGMEC and Japanese oil companies.

Most of the techniques about monitoring were already investigated last year. Consequently, survey about monitoring keeps to a minimum.

3. Work scope

In the contents of this survey, the following items will be included as much as possible, and JOGMEC requests the proposal of any additional items for well test techniques based on your experience and ability.

- ① Executive summary of well test
- ② Techniques and interpretation of well test (By literature research and interview)

- ✧ Wireline formation test (WFT)
 - Tools and reliability of downhole fluid analyzer (e.g. reliability and limitation of HPHT, accuracy and limitation against each fluid)
 - Tools and techniques of taking representative pressure and sample (e.g. reliability and limitation of HPHT, improvement and limitation of probe, pump, sampler and dual packer, techniques against each reservoir and fluid)
 - Interpretation methods of permeability and PVT model (e.g. evaluation of permeability and limitation, oil based mud contamination)
 - Case history of wireline formation test (e.g. a variety of alternate utilizations for conventional DST)
- ✧ Drillstem test (DST)
 - DST in HPHT (e.g. reliability and limitation of each tool, solution method and case history)
 - DST in offshore (e.g. operation equipment, solution way for regulation of oil or gas flare and case history)
 - DST in deep water (e.g. operation equipment, solution way for hydrate or solid deposition and case history)
 - Methods of taking representative sample (e.g. CGR in gas condensate reservoir, concentration of H₂S and CO₂, clouding point of oil)
 - The other latest equipment (e.g. multiphase flow meter and accuracy of Onsite PVT)
- ✧ Extended production test
 - Tools and reliability of permanent pressure gauge including connection and line (e.g. durability, accuracy and limitation of each temperature range)
 - Pre-processing like wavelet filtration on the occasion of using deconvolution
 - Algorithm, caveats and limitation of deconvolution
 - Case history (e.g. deconvolution of single well)
- ✧ Case history of Well test during production (e.g. fluid type detection using DTS)
- ✧ The other case history of well test (e.g. FTWD, slug test, interference test)
- ✧ The other case history of interpretation of well test (e.g. removal of tidal effect, fracture reservoir, horizontal well)
- ③ Approach to well test (interview for the most part)
 - ✧ Term and cost of testing design, contract with service companies, equipment supply and operation
 - Drillstem test like deeper reservoir and deep water
 - Wireline formation test
 - Permanent pressure gauge
 - ✧ Current status of oil companies

- Philosophy about DST, WFT and extended production test (e.g. WFT utilizations as an alternative for DST, data quality of a variety of well test, reliability of downhole gauge, feature characteristic against each area)
 - Recent advances, technical problem and challenge, and future trend
- ④ Opinion on the well test
- ✧ Feature characteristic of well test against each area, each reservoir or each fluid type and against each phase like exploration, development and production
 - ✧ Mature techniques, emerging techniques, future trend and recommendation
 - In the case that other critical issues arise during the survey, they will be investigated and reported on.

4. Deliverables and Presentations

- Final Report

Hard copy: 3 copies

Digital files: 10 copies like CD-R media

* The digital files which are including final report and final presentation should be able to be edited by JOGMEC and to be transferred to another storage device. This report shall be disclosed to Japanese Exploration and Production companies.

- Final presentation in Japan

The consultant shall make a presentation on the results of the technical survey around mid-February, 2010 for JOGMEC and Japanese oil companies.

Final Presentation shall consist of an executive summary presentation for 0.5 - 1 day, a detailed seminar for 2 - 3 days aimed at intermediate reservoir engineer and drilling engineer, and some consultations for Japanese oil companies for 1 day.

* Presentation materials of executive summary and seminar will be distributed to presentation attendees.

5. Time schedule of survey

- ① Biweekly Progress Report: Progress will be reported every two weeks and discussed with JOGMEC person in charge frequently.
- ② Interim Review (50% Review) Document: The consultant shall submit an interim review (50% Review) document two month after the start of contract.
- ③ Draft of Final Report: The consultant shall submit a draft of final report 1 month before the end of contract.
- ④ Final Report: The consultant shall submit the final report no later than the end of contract. Final report should be finalized after JOGMEC review.

6. Budget

Lump-sum budget for the work is about US\$309,000 (JPY30,000,000, at US\$1=JPY97)
(The cost performance is examination item.)

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