Appendix 1

Scope of Services for Technical Assistance

A. Cavern Integrity Monitoring

Support services regarding the caverns long term tightness monitoring, as well as related specific studies.

It involves mainly hydrogeology expertise:

- Hydrogeological raw data are continuously to be monitored in order to quickly detect and evaluate any unusual event or trend, and to propose immediately the most appropriate countermeasures.

- The scope includes also the definition and the detailed specification of periodic in-situ tests aimed at evaluating the performance of the water sealing system.

- The relevance of the criteria defined during the construction period is periodically re-evaluated, and revised or new criteria are proposed when deemed necessary.

The raw data (about 600 parameters measured every 30 minutes, for both Namikata and Kurashiki sites) are automatically gathered in the Tepsco (Tokyo Electric power Services Co., Ltd) system. The data are periodically sent to tenderer’s office by Tepsco. The period of transmission is basically every week, but shorter periods may be considered when deemed necessary, for instance during the water curtain system efficiency tests to be performed this fiscal year.

The services shall include the following activities:

1. Acquisition of the related raw data (pore pressure cells; piezometers; water level and supply flow rate in water curtain galleries and boreholes,
shafts, access tunnel; seepage water; cavern process data, such as pressure, temperature, LPG and water level, inlet flow rate etc.; water analysis results; meteorological data), through weekly data files transmission, and continuous update of database

2. Elaboration of calculated data from the raw data
3. Analysis of the data and evaluation of the hydrogeological situation and its trend with respect to the current criteria regarding cavern tightness and stability, with focus to the known weak areas (if any)
4. Identification of abnormal events and potential issues (short term, mid term or long term trends), evaluation and recommendations for countermeasures
5. Update of the models, if necessary
6. The periodic performance tests of the water sealing system will be performed this fiscal year (2017). These tests are aimed at checking the evolution of the water curtain systems efficiency and containment throughout operation.

Tenderer shall assist JOGMEC in the definition of the detailed test programme, will perform the interpretation of the performance tests, and after the comparison with other application results in the different Site(s), will provide recommendations in accordance with the findings. Face to face discussion in Tokyo will be proposed for results and recommendations presentation and discussion (included in item 10 below).

7. Update of the criteria and monitoring plan if deemed necessary
8. Periodic long term reporting (4 quarterly reports per site) including interpretation results, recommendations and conclusions, curves, cross-plots
9. Immediate information and recommendations in case of abnormal situation identification, requiring fast countermeasure implementation
10. Results presentation and discussion meetings with JOGMEC (three meetings for this fiscal year, including two meetings in JOGMEC – Tokyo office and one meeting in tenderer’s office)
11. Technical coordination and interface management with JOGMEC local consultant (Tepsco)
12. On demand technical studies in relation with caverns long term tightness, safety, risk management.
B. Assistance related to the Caverns Operation and Maintenance

2.1 Operation

Tenderer shall support JOGMEC for the operation of the underground facilities.

The support is basically provided from Tenderer’s head office.

The necessary data from the DCS (one minute sampling time) are provided on a weekly basis by Tepsco.

The data transmission becomes faster (typically daily or even every 3 hours) if deemed necessary, for instance during cavern LPG filling operations.

1. Monitoring and analysis of the cavern operating data in order to detect any abnormal event or improper operation with regard to technical performance, cavern integrity, optimum usage of specific equipment (in-shaft equipment, ejectors), safety
2. Real time monitoring of the cavern LPG filling operations, including recommendations for the filling programme, the analysis of the related equipment performance (such as the Flexflo valves and the ejectors)
3. Assistance regarding the specific issues related to the final phase of the caverns full filling (identification of the related issues, recommendations for appropriate procedures and closer real time monitoring)
4. Quick assistance in case of unexpected event
5. Check & review of the operation manuals issued by JX(for Kurashiki Site) and NTC(foe Namikata Site) in case of revision
6. Recommendations for improving the operating procedures
7. On demand on site witness and assistance to JOGMEC for specific operations (normal or unusual operation, periodic LPG loop recirculation for equipment check and operator training, etc.), to be performed by an engineer dispatched from Tenderer.
8. On demand support (for instance on-site technical or safety audit, evaluation of the operator performance, for the implementation of a safety management system, of an operator training simulator etc.)
2.2 Maintenance

This section deals with the support services related to the maintenance of specific cavern equipment (such as in-shaft equipment and ejectors).

It includes a wide range of services, such as preventive equipment remote monitoring, on-site support for equipment pulling out from casings, emergency support, relationships with overseas equipment manufacturers, assistance for inspection, support for completing, improving or supplementing maintenance manuals etc.

These services are performed by appropriate specialists, depending on the nature of the support and JOGMEC request.

2.2.1 Cavern equipment preventive monitoring

The necessary data from the DCS (one minute sampling time) are provided on a weekly basis by Tepsco.

1. Remote monitoring of the main cavern equipment operating performance (LPG and water submerged pumps: flow rate, motor temperature, current, cooling water level, discharge pressure; ultrasonic level measurement; level switches; filling line process data; fail safe valves etc.) and the cavern process data
2. Analysis of the data, check for their consistency, identification and diagnostic of abnormal events, early detection of abnormal trends
3. Information to JOGMEC in case of abnormal situation and recommendations for countermeasures

2.2.2 Specific above ground equipment monitoring

1. Remote monitoring of the ejectors performance
2. Check for the consistency of the data, evaluation of the current performance, identification of abnormal events, early detection of abnormal trends
3. Immediate information to JOGMEC in case of abnormal situation and
recommendations for countermeasures

2.2.3 Support related to overseas equipment

In case of issues or failures related to the overseas equipment (submerged pumps, continuous level measurement, level switches, Flexflow control valve, Whessoe and Halliburton fail safe valves), Tenderer shall provide on demand assistance for:

1. The analysis of the troubles
2. Recommendations
3. Feedback from other sites for similar situations, if any
4. Direct contact with the manufacturers if required by JOGMEC
5. Witness on behalf of JOGMEC of equipment dismantling, inspections, acceptance tests at the original equipment manufacturer’s plant
6. More generally, JOGMEC may request involving direct communication with overseas equipment manufacturers.

2.2.4 Other support related to maintenance

Tenderer shall provide JOGMEC with any other on demand support related to maintenance, such as:

1. Assistance for the execution of the casing inspections with the new AUT inspection tool
   - check of the detailed programme,
   - check of the specific procedures for casings inerting
   - dispatch of an inspection specialist on site (Namikata and/or Kurashiki) for the first casing inspection (partly, tentatively during 2 weeks)
2. Quick response in case of emergency situation
3. Specific support or studies (specialist dispatch for inspections or special issues, audits, CMMS implementation, etc.)
4. Check & review of the maintenance manuals if revised by JX (for Kurashiki Site) and NTC (for Namikata Site)
C. General Assistance

In addition to the above services, Tenderer shall provide JOGMEC with:

1. Periodic technical and progress meetings (2) in Japan between JOGMEC and Tenderer's project manager
2. On demand technical support other than those included in the above sections (including assistance related to the COD issue)
3. Information from other LPG underground operating sites in the world.
4. Access to the sites operated by other owners for JOGMEC studies related to operation and maintenance.
5. Update about the evolution of European regulations and standards related to the LPG underground storage activities.

Also to suggest JOGMEC the necessary modification applicable to plant equipment systems actually installed as well as inspection and operation management for both Namikata and Kurashiki National LPG Stockpiling bases in line with the alteration of SEVESOIII European regulation standard, of which has been introduced in the fiscal year 2016.

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