



## **Nagra**

**National Cooperative for the  
Disposal of Radioactive Waste**

Hardstrasse 73  
5430 Wettingen

### **Document B**

**Requirement specifications and tender regulations**

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<b>Project:</b>	<b>Deep boreholes (TBO)</b>
<b>Work/ Construction project:</b>	<b>Multi-packer long-term monitoring systems for deep boreholes</b>
<b>Type of performance:</b>	<b>Supply, installation and documentation of multi-packer long-term monitoring systems in deep boreholes</b>

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## Abstract

To investigate the suitability of the subsurface conditions for safely hosting a deep geological repository for radioactive waste in Switzerland, Nagra (National Cooperative for the Disposal of Radioactive Waste, Wetingen, Switzerland) performs geological investigations. As part of such investigations, surface-based characterisation has included the completion of seismic surveys and the drilling, coring and testing of boreholes. Besides shallow boreholes (so-called “Quartärbohrungen”) to investigate the topmost layer of Quaternary sediments, Nagra is investigating, by means of deep boreholes (so-called “Tiefbohrungen”, TBO boreholes), the underlying bedrock formations such as the Mesozoic layers, which include the targeted host rock (Opalinus Clay) for a future repository. All work related to the deep boreholes is done within the framework of the so-called TBO project.

The TBO boreholes focus strongly on obtaining core samples from the relevant geological formations and provide means to conduct in-situ measurements, inter alia, of bedrock lithological, petrophysical, geomechanical and hydrogeological properties. After the drilling and testing work is finished, selected TBO boreholes will be equipped with multi-packer long-term monitoring systems to measure the hydraulic head (groundwater level and groundwater pressure) of designated formations as well as to take groundwater samples from selected aquifers. The supply and installation of these multi-packer long-term monitoring systems including reporting is the subject of this tender. Nagra wishes to award one contract for all work related to this tender.

Current planning foresees the supply and installation of multi-packer systems with a minimum of seven observation intervals in three vertical TBO boreholes with the option for supply and installation of multi-packer systems for additional TBO boreholes. The depth of the observation intervals is expected to range between approx. 100 – 1200 m. The number of intervals and their depth may vary due to technical conditions or modified objectives.

**For this tender, the following work items are requested:**

- **Supply of three multi-packer systems (stand pipe system) including all downhole and surface equipment as well as data acquisition systems.**
- **Installation of all equipment parts in three selected TBO boreholes.**
- **Reporting:**
  - **Planning and mobilisation report documenting all equipment parts including their specifications, calibrations and the performed quality control measures before delivery of the equipment to the site.**
  - **Installation report documenting all on site activities, all performed on-site quality control measures, the specifications of the installed equipment, and manuals for operation and maintenance of the systems.**

The installation work at the drill sites will take place during regular day shifts at all times of the year. Work on Saturdays, Sundays or bank holidays as well as night shifts are not planned.

The drilling and testing work in two TBO boreholes (Bülach and Trüllikon-1) have been completed and drilling and testing work is currently under way at the TBO boreholes Marthalen and Bözberg-1. Current plans foresee the successful execution of at least seven TBO boreholes by the end of 2021. Only selected TBO boreholes will be equipped with a long-term monitoring system.

Information regarding Nagra and the TBO project can be found on Nagra’s website:

<https://www.nagra.ch/en/Up-to-date-information-on-the-deep-boreholes.htm>

## **1. Award procedure**

### **1.1 Legal framework**

- The convention on public procurement of 15<sup>th</sup> April 1994 (SR 0.632.231.422), referred to as GATT/WTO in the following
- Bilateral agreement on public procurement of 21<sup>st</sup> June 1999 between Switzerland and the EU (SR 0.172.052.68)
- Inter-cantonal agreements on public procurement (IVöB) of 15<sup>th</sup> March 2001 (SAR 150.950)
- Bid decree (SubmD) of 26<sup>th</sup> November 1996 (SAR 150.910), canton Aargovia.

### **1.2 Ordering party (Operator)**

#### **Nagra**

National Cooperative for Disposal of Radioactive Waste  
Hardstrasse 73  
Postfach 280  
5430 Wettingen  
Switzerland

### **1.3 Procedure type**

Open procedure.

According to SubmD § 8 par. 3i, the ordering party (Operator) draws attention to the fact that, for a new similar project which relates to the basic assignment of the present project, the award can be done as direct award.

The award procedure is conducted according to GATT/WTO.

### **1.4 Tender documents**

- A. Cover sheet and table of contents
- B. Requirement specifications and tender regulations
- C. Price list
- D. Draft contract
- E. General terms and conditions of Operator
- F. Declaration of data confidentiality
- G. Company Information
- H. Template for Technical Report

Annex 1: Example of geological prognosis profile and casing scheme for the siting region Zürich Nordost

Annex 2: Example of geological prognosis profile and casing scheme for the siting region Nördlich Lägern

Annex 3: Example of geological prognosis profile and casing scheme for the siting region Jura Ost

### **1.5 Schedule of the bidding procedure**

Publication of tender	18.06.2020
Written questions	06.07.2020
Answers to questions	10.07.2020
Deadline for submission of the bid	03.08.2020

Conditional meeting to clarify questions 12.08. – 14.08.2020  
concerning the bid  
Decision on the award, estimated 21.08.2020  
Start of installation work, estimated 01.12.2020

## **1.6 General procedure**

The evaluation of the bids takes place in five steps:

Step 1: Opening of the bid

Step 2: Formal review

Step 3: Evaluation of the suitability criteria

Step 4: Evaluation of the award criteria

Step 5: Clarification of questions concerning the bid, conditional

### **Step 1: Opening of the bid**

Only bids that have been submitted prior to the submission deadline will be evaluated– see section 1.9. Delayed bids will not be considered and will be returned unopened to the bidder.

### **Step 2: Formal review**

Bidders will be excluded if:

- their bid is incomplete or not duly signed;
- they do not meet the conditions described in the present document (e.g. language, period of validity, bidding consortium, legitimacy of the partial bids and / or variants, confidentiality, procedural rules, etc.);
- they give the awarding Operator false information;
- they have not paid their taxes or social security contributions;
- they do not fulfil the obligations described in § 3 of SubmD of the Canton of Aargau;
- they are bankrupt.

### **Step 3: Evaluation of the suitability criteria**

See section 1.7.1.

### **Step 4: Evaluation of the award criteria**

See sections 1.7.2, 1.7.3, and 1.7.4.

### **Step 5: Clarification of questions concerning the bid, conditional**

The Operator reserves the right to invite the bidders who have a chance of being awarded the contract to clarify the plausibility of their bid. The invited bidders will be asked to hold a 10 min presentation about the offered system and personnel.

The appointed days for the bid clarification must be reserved by the bidder (see section 1.5).

The bid clarification and presentation will not be rated; it serves only to substantiate the evaluation of the award criteria and to clarify any open issues. The bid clarification will take place at Nagra's offices, in Wettingen, Switzerland or via videocall.

There is no entitlement to an invitation for a bid clarification.

An invitation for bid clarification will be sent approximately one week before the appointed date. The content and detailed procedure for the bid clarification process will be sent together with the invitation.

## 1.7 Suitability and award criteria

The supporting documents for fulfilling the suitability and award criteria must be provided by the bidder in the technical report as part of the bid documents (bid document H).

### 1.7.1 Suitability criteria (§ 10 par. 1 SubmD)

The bidders submitting a bid must fulfil the suitability criteria listed below. Suitability criteria will be evaluated based on the evidence submitted by the bidders at the bid opening.

	Criteria	Description
S1	References of key personnel for installation of the multi-packer systems	<p>With the submission of the bid, the bidder confirms that the following minimum requirements are fulfilled by the key personnel (2 people) proposed to perform the installation of the multi-packer systems in all selected boreholes:</p> <ul style="list-style-type: none"><li>- Evidence of minimum 2 comparable projects where multi-packer systems for long-term monitoring were installed in boreholes deeper than 300 m depth.</li><li>- At least 1 person of the key personnel must be fluent in English.</li><li>- At least 1 person of the key personnel must be fluent in German.</li></ul> <p>Proof by listing short descriptions of reference projects and contact details for client references, who can be contacted, in the technical report (bid document H) and submission of CVs.</p>
S2	References of the company for supply and installation of multi-packer systems	<p>With the submission of the bid, the bidder confirms that the following minimum requirements are fulfilled by the company or its sub-contractor: Evidence of minimum 2 comparable projects that included supply and installation of multi-packer systems for long-term monitoring of fluid pressure in boreholes deeper than 300 m.</p> <p>Proof by listing short descriptions of reference projects and contact details for client references, who can be contacted, in the technical report (bid document H)</p>
S3		<p>Fulfilment of minimal technical requirements for equipment in accordance with chapter 3.1 of Doc. B of the tender.</p> <p>Proof by providing the complete documentation and certificates requested in the technical report (bid document H).</p>

The specifications and documentation are to be submitted by the bidder and its subcontractors as the basis for evaluating the suitability criteria. Incomplete or insufficient specifications and documentation will result in bid exclusion (§ 28 Abs. 1 SubmD).

### 1.7.2 Award criteria

Bidders who have delivered a bid satisfying all the suitability criteria will be evaluated based on the award criteria described below.

	Criteria	Mark (M)	Weight (W)	Max points (M*W)
A1	Bid sum in CHF (excluding VAT) according to the price list (bid document C).	0-5	40%	200
A2	Experience and references of the personnel, who will install the systems in the boreholes.  Listing of experience and references of the personnel in the technical report (bid document H) and submission of CVs.	0-5	20%	100
A3	Quality of equipment.  Description in of equipment in technical report (bid document H).	0-5	25%	125
A4	Planned quality control measures before, during and after installation of the multi-packer systems in the boreholes to ensure proper functioning of the system and reliable measurements.  Description of planned quality control measures in the technical report (bid document H).	0-5	10%	25
A5	Time schedule (step by step program) showing, how the bidder ensures that the equipment proposed in the technical report (bid document H) can be completely and fully functionally installed in the first borehole by beginning of December 2020, in the second borehole by March 2021, and in the third borehole by May 2021.	0-5	5%	50

The evaluation is done with a points system. The sum of points of all the award criteria gives the ranking of the bid. A maximum of 500 points can be achieved. The number of points per award criterion results from the multiplication of the mark (M) by the weight (W). The mark scale ranges from 0 (worst mark) to 5 (best mark). **Among the eligible bidders, the one with the highest total score receives the contract.**

### 1.7.3 Evaluation of award criterion A1

To ascertain the price of the work, the document 'price list' (document C) must be completed and enclosed. All equipment listed in chapter 3 must be included in the rates.



The lowest priced bid sum receives the maximum mark of 5. Bid sums with a value of 100% or more over the lowest bid will receive zero points. In between, the interpolation is linear.

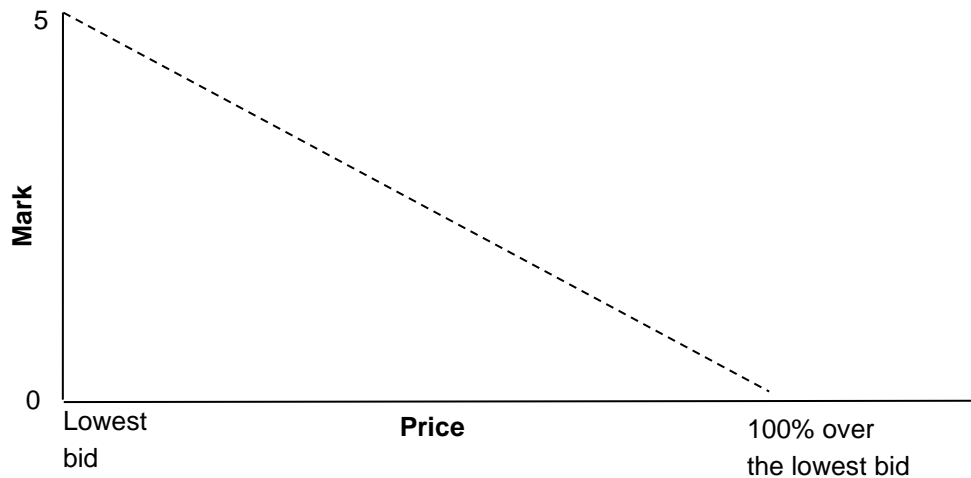


Fig. 1: Evaluation of the bid sum.

#### 1.7.4 Evaluation of award criteria A2, A3, A4 and A5

The qualitative criteria A2, A3, and A4 will be evaluated according to the following scale:

Mark	Based on the fulfilment of the criteria	Based on information and execution
0	Not evaluable, does not fulfil the criteria	No information
1.0	Very poor fulfilment of the criteria	Insufficient or incomplete information
2.0	Poor fulfilment of the criteria	Information without adequate project reference or below the basic requirements.
3.0	Normal, average fulfilment	Reference data corresponds to the bid basic requirements
4.0	Good fulfilment	Good quality, good contribution to the achievement of the objectives
5.0	Very good fulfilment	Qualitatively outstanding, great contribution to the achievement of the objectives

#### A2: Experience and references of the personnel, who will install the systems in the boreholes

To evaluate the work experience in the area of the required services, the bidder must fill in the corresponding lists in the technical report (bid document H) and submit the curriculum vitae (CV) of the foreseen personnel. The CVs of the foreseen personnel (maximum two A4 pages per person) must include qualifications and project references specifying position in the team, exact duties, and duration. The CVs should only state qualifications and project references related to installation of multi-packer systems in deep boreholes (depth > 300 m).

The experience and references of minimum 3 and maximum 5 members of the installation team will be evaluated. For evaluation of award criteria A2, the references of 1 or 2 engineers and 2 or 3 technicians are required. Each team member will be evaluated individually. For the engineers only qualified MSc. hydrogeologists or engineers (or similar), English- or German-speaking (spoken and written), with more than 10 years' experience in installation of multi-packer systems, with experience in multi-packer system installations deeper than 600 m, and with more than 5 reference projects will

be awarded the highest mark as engineer. Only technicians with more than 10 years' experience in installation of multi-packer systems in deep boreholes will be awarded the highest mark. A specialized technician for installation of fiber-optic cables in deep boreholes, will receive additional points.

In justified cases and only with the prior written approval of the Operator, the listed personnel may be replaced by persons with at least equivalent qualifications and experience.

### **A3: Quality of equipment**

The equipment listed in section 3 must be described in detail in the technical report (bid document H). The equipment will be evaluated with respect to quality for the requested services.

The optional fiber-optic cable according to section 3.2 must be described in the technical report. The cable properties and the technical solution of guidance through the packers as well as hydrogen protection and sealing properties will be evaluated with respect to quality for the requested services.

### **A4: Planned quality control measures before, during and after installation of the multi-packer systems in the boreholes to ensure proper functioning of the system and reliable measurements**

The planned quality control measures before, during and after installation of the multi-packer systems in the boreholes must be described in the technical report (bid document H) on a maximum of four A4 pages. The planned quality control measures will be evaluated with respect to convenience for the requested services. Note that the Operator can require additional quality control measures.

### **A5: Time schedule (step by step program) showing, how the bidder ensures that the equipment proposed in the technical report (bid document H) can be completely and fully functionally installed in the first borehole by beginning of December 2020, in the second borehole by March 2021, and in the third borehole by May 2021.**

The planned time schedule will be evaluated with respect to convenience for the requested services.

## **1.8 Questions during the call for bids**

Questions on the submission can be sent in English to the forum of [www.simap.ch](http://www.simap.ch) until 06.07.2020. The answers will be published on [simap.ch](http://simap.ch) by 10.07.2020.

## **1.9 Deadline, address and form for the submission of bids**

**Bids must be sent to Nagra no later than on the date specified in section 1.5 (postmark is decisive). Late bids will not be evaluated and will be excluded from the process.**

**Due to the current situation (Covid-19 pandemic) the documents must, additionally to the hard copy version, be delivered electronically to the following E-mail address:**

**[george.wewerka@nagra.ch](mailto:george.wewerka@nagra.ch)**

A maximum of 35MB per E-Mail can be received, further restrictions to data volume may apply. A scan of the official shipping confirmation and an overview of the physical documents sent including their number of pages ("table of contents") must be enclosed with the electronic documents.

**The electronic documents must be identical to the hard copy.**

Physical bids must be delivered in a sealed envelope addressed as follows:

**Address:**

Nagra

**A&V – DO NOT OPEN**

**Long-term monitoring systems**

Hardstrasse 73

Postfach 280

5430 Wettingen

Switzerland

**1.10 Language and currency**

The bid and the supporting documentation must be submitted in English. The communication language is English. Subsequent reporting will be in English as well..

At least one person of the foreseen key personnel of the bidder must be German-speaking (spoken and written).

The prices are to be provided in CHF (excluding VAT).

**1.11 Bid opening**

No public opening of the bids will take place.

**1.12 Validity of the bid**

The bid must be valid until 31.12.2020.

**1.13 Bid compensation**

None.

**1.14 Official bid requirements**

**Completeness of the bid**

Based on § 28 SubmD, bids that are submitted late, are not complete or not validly signed will be excluded from the evaluation. The same applies in the case where templates in the bid have been modified, complemented or deleted, or if the procedural principles described in section 1.23 are not met.

**Additional documents**

Any additional documents necessary for evaluating the bid must be submitted within 5 days from the request.

**Restrictions regarding the bid**

Any restrictions must be attached to the bid on a supplementary sheet. Restrictions that contravene the requirements of the acquisition can lead to disqualification.

**Bid; remuneration**

The bidder must submit the completed pricing list (bid document C) in paper form and electronically. In the case of any discrepancies between the two documents, the signed offer on paper shall be valid.

### **Bid; specifications and attachments**

The bid must be submitted in paper form and electronically. In the case of any discrepancies between the two documents, the signed offer made on paper shall be valid.

### **Required documents**

The fully completed and validly signed bid must be submitted in two hard copies (one original and one marked colour copy) together with all the required attachments. In addition, a USB stick containing the complete bid must be submitted. In the case of any discrepancies between the electronic and the hard copy, the signed bid on paper shall be valid.

#### **1.14.1 Table of contents of the bid**

Document identification / caption	Format	File nr.
A. Cover sheet, table of contents	Pa/pdf	1
B. Requirement specifications and tender regulations	Pa/pdf	2
C. Completed price list	Pa/pdf/xls	3
D. Draft contract	Pa/pdf	5
E. General terms and conditions of Operator	Pa/pdf	6
F. Signed declaration of data confidentiality (bidder and subcontractors)	Pa/pdf	7
G. Completed company information	Pa/pdf	8
H. Completed technical report (to be delivered by the bidder)	Pa/pdf	9
USB stick with all electronic data		

### **Legend**

Pa paper

pdf electronic in pdf format

xls electronic in Excel format

Submission of any other documents should be avoided.

#### **1.14.2 Table of contents for the additionally requested documents after awarding of the contract**

The documents listed below are to be submitted unsolicited after awarding of the contract and will become an integral part of the signed contract.

Document identification /plan title	Format
Proof of liability insurance	Pa
VAT no.	Pa
Bank details for payments	Pa

### **Legend**

Pa paper

### **1.15 Liability insurance**

The bidder commits to having a professional liability insurance for the entire duration of the contract, with the following minimum amount insured:

- |  |               |
|--|---------------|
| • Physical injury (per loss event)     | CHF 5 million |
| • Material damage (per loss event)     | CHF 5 million |
| • Pure financial loss (per loss event) | CHF 1 million |
| • Building damage (per loss event)     | CHF 1 million |

Upon request, the bidder has to provide the Operator with valid proof of insurance.

### **1.16 Bidding consortium**

Bidding syndicates are admitted.

If a bidding consortium wins the tender, its members must form a simple society in accordance with Art. 530 of the Swiss Code of Obligations. The lead must be assigned to a company in the bidding consortium. Members of the consortium may not be changed after submission of the bid.

### **1.17 Subcontractors**

Subcontractors are admitted.

Subcontractors must be specified in the bid. If the fulfilment of suitability or award criteria is based on evidence of the subcontractor, the named subcontractor is required to do the respective work.

Subcontractors may be included in several bids of different bidders.

The bidder is obliged to verify the plausibility of the statement of the subcontractor. Responsibility for the fulfilment of delivery of the subcontractor's services and liabilities remains with the Contractor.

### **1.18 Partial bids and alternatives**

Partial bids are not accepted.

Additional bid alternatives are allowed. However, the original bid must be completely submitted. Additional alternatives are to be described clearly and calculated in a similar manner as the original bid. The proof of the equivalency (e.g. fulfil of the minimum requirements of chapter 3.1) between the alternative and the original must be provided by the bidder in written form together with the submission of the original bid.

### **1.19 Option**

The contract can be unilaterally extended for supply and installation of multi-packer systems in additional TBO boreholes, on condition that the same pricing is applied, and the same personnel and same equipment are available. The option will be activated separately for each additional TBO borehole with 4 months advance notice before the start of installation.

### **1.20 Conflict of interest due to access to primary data of the deep borehole project**

Due to a conflict of interest, persons and / or companies including subcontractors, that are directly or indirectly participating in objections against the exploratory borehole applications ("Sondiergesuche" in German) or recourses against DETEC permits in the siting regions Jura Ost, Nördlich Lägern and Zürich Nordost are not entitled to be awarded the present contract. Reciprocally, the successful bidder is prohibited to act against Nagra, for the entire duration of the project.

### **1.21 Procedural principles**

Operator assigns contracts only to a bidder who ensures compliance with § 3 SubmD, canton Aargovia.

### **1.22 Confidentiality**

The data gathered by the Contractor within the framework of the TBO project are the property of the Operator. The bidder awarded a contract agrees to keep these data safe from third parties not explicitly permitted by the Operator to investigate the data. The bidder also agrees not to analyse the data if not explicitly requested by the Operator.

The legally signed form 'Confidentiality agreement and data protection' must be submitted together with the bid.

## **2. Special regulations**

### **2.1 Organisation**

#### **2.1.1 Operator**

Nagra  
National Cooperative for the Disposal of Radioactive Waste  
Hardstrasse 73  
Postfach 280  
5430 Wettingen  
Switzerland

#### **TBO project manager monitoring**

Nagra	Contact person:	Dr. Tobias Vogt
	Email:	tobias.vogt@nagra.ch
	Phone:	+41 56 437 12 84

#### **2.1.2 Contractor**

Company that supplies, installs and documents the multi-packer systems for long-term monitoring = Contractor.

### **2.2 Extent of the required work**

The long-term monitoring in the TBO-boreholes will provide first data in the framework of the baseline monitoring before the construction activities of the repository start. In addition, the results will also provide contributions to the evaluation of the hydraulic test data acquired during the drilling phase and extend the hydrogeological understanding of the investigated sites by providing long-term data of the hydraulic head (fluid levels and fluid pressure) of the deep aquifers and the formations with very low hydraulic conductivity, such as Opalinus Clay and its confining geological formations. For investigations of hydrochemistry, groundwater sampling will be done in selected deep aquifers by means of the multi-packer systems.

One contract will be awarded for the supply and installation of three multi-packer systems for long-term monitoring in the TBO-boreholes between 2020 – 2022 including a documentation in form of reports. The contract has the option for extension of supply and installation of multi-packer systems in additional TBO boreholes. The TBO boreholes, which will be equipped with the multi-packer systems, are vertical boreholes. The selection of the boreholes is not defined yet.

The maintenance and operation of the systems after installation is not included in this tender, because a separate tender will be published in summer 2020 and a separate contract will be awarded for the maintenance and operation work of the next years. All bidders but also the Contractor of this tender can submit a bid for the separate tender about maintenance and operation work. At the end of the installation work of a system, the Contractor is obliged to train the company, who will do the maintenance and operation services, on proper maintenance and operation of the system including the data acquisition system. The training is expected to last half a day or a full day per system and can be remunerated by pos. 3.2 and 3.3 of the price list.

When the multi-packer systems will be installed, the selected TBO boreholes will be fully cased without open borehole sections. The casing outer diameter will be 7 5/8", 9 5/8" or 13 3/8". The boreholes will have a constant casing diameter or up to three different casing diameters (with smaller

diameters in the deeper parts) in case liner hangers are used. See Annex 1 – 3 as examples of potential casing schemes. Before the installation of the multi-packer systems, the observation zones will be perforated to create a hydraulic connection to the formations. After perforation, a casing scraper will be used to even the inner surface in the perforation areas and to remove unwanted material from the inside wall of the casing. The borehole will be filled with fresh water or if needed with an artificial porewater to avoid swelling in the areas where the perforations are located in clay formations. The electrical conductivity of the artificial pore water will be adapted to the groundwater composition and can reach a maximum of 50 mS/cm. A fluorescent dye (uranin) will be added to the water in low concentration (1 – 10 ppm).

For each borehole, the Operator will define before the definitive planning of the system and the mobilisation of the equipment the number of packers respectively the observation intervals, the depth of the packer seats and the depth of the observation interval ports/filters. The existing knowledge from hydraulic packer testing during drilling operations about hydraulic head (artesian or subartesian conditions) of the observation intervals will be communicated to the Contractor before the definitive planning of the system. The planning of the system for each borehole will be an iterative process together with the Operator. The definitive planning will be documented in the planning and mobilisation report.

The multi-packer systems must consist of the following main components:

- central tubing string;
- hydraulically inflatable packers;
- observation lines with ports/filters to measure the hydraulic head in the observation intervals;
- sliding sleeves to guarantee individual additional access to aquifers for groundwater sampling;
- pressure sensors for pressure measurements in the observation intervals and of the packer pressures;
- data acquisition system.

The Contractor is fully responsible for the correct screwing of the central tubing string.

Each packer must have a hydraulic line to be individually hydraulically inflatable when at the required depth and to pressure test monitoring lines while running in the borehole for quality control. The packer is set by pressuring the respective line with water and added antifreeze to avoid damage on the surface due to low temperatures in the bore cellar. The pressure is kept constant on the packers to ensure integrity by using a pressure maintenance on the surface in the bore cellar, which consists for each packer of a pressure sensor, a manometer and pressure vessel, which is connected to a single nitrogen gas bottle. The water for packer inflation must contain a tracer (e.g. eosin or sodium naphthionat) in low concentration (1- 10 ppm), which is different from the tracer added to the borehole fluid.

The multi-packer systems must feature a minimum of 7 observation intervals for measurements of hydraulic heads. Each interval must be hydraulically isolated and must have an individual monitoring line. The depth of the observation intervals is expected to range between 100 – 1200 m. The number, length and depth of the intervals may vary for each borehole due to technical and geological conditions or modified objectives. Depending on the hydrogeological situation of the borehole, the maximum number of observation intervals may vary between 7 to 9. In case the hydraulic head lies below ground level, the fluid level in the lines is monitored by submersible water level probes (downhole pressure probes), which will be installed in the observation lines below the expected hydraulic head (fluid level). The fluid level in the observation lines can lie between 0 – 100 m below ground level. In case a pumping test with groundwater sampling is performed in an aquifer, the probe



depth must be easily adjustable. If an observation interval shows artesian conditions, the hydraulic head is measured at the wellhead level at the end of the observation with a pressure transmitter and with a manometer. In case of sensor failure, both, the submersible water level probes and the pressure transmitters have to be easily replaceable. In addition, the Contractor must equip each bore cellar with a barometric (atmospheric pressure and temperature) sensor.

All data must be recorded continuously by means of a data-acquisition system. The entire data acquisition system must be installed in boxes and must have an uninterruptible power supply. The licenses of the software to operate the data acquisition system must be transferable from the Operator to a third party, who will be in charge of the operation and maintenance of the systems over the next years. The data transfer to an off-site server is not included in this tender.

The bore cellars will be prepared in a way that they can host the data acquisition and packer-pressure maintenance systems. The Operator will equip them with a heating and dehumidification system to ensure acceptable operation boundary conditions for the surface equipment. However, protection against temperatures below 0°C, high humidity, and splashing water is nevertheless required (e.g. by protection boxes).

In the observation intervals of the aquifers, a sliding sleeve must be installed, which allows selective pumping from the individual aquifers. Each sliding sleeve must be opened with wireline by jarring down and closed by pulling the wireline in tension.

Besides the monitoring of hydraulic head, the bidders are asked to offer as an option also a fiber-optic cable that runs from the ground level to the top packer of the deepest observation zone of the multi-packer system. The fiber-optic cable must be suitable for long-term measurements of Raman backscatter distributed temperature sensing and must not compromise the long-term hydraulic measurements. Based on the technical concept and price of the provided solution for integration of a fiber-optic cable into the system, the Operator will decide if and in how many boreholes a fiber-optic cable will be installed. The technical concept of the integration and installation of the fiber-optic cable has to be described in the technical report of the bidder (bid document H). During and after the installation the Contractor must prove with measurements of temperature and optical loss that the fiber-optic cable is intact and providing high quality data with very low optical loss. The Contractor must provide a light reading unit only for the quality control during and after installation. In this tender no purchase or rental of a light-reading unit (interrogator) is included. Potential long-term measurements will be included in the separate tender for maintenance and operation of the systems.

The minimum equipment requirements are described in chapter 3.1.

In addition to the equipment of the multi-packer systems, the Contractor must provide all tools and infrastructure on the drill site that are needed for installation. For installation, a crane or drill rig including personnel operation the rig or crane will be provided by the Operator (see chapter 3.2).

Quality control measures before, during and after installation of the multi-packer systems are a crucial part of the work of the Contractor. The bidder has to describe the planned quality control measures in the technical report of the bidder (bid document H). The requested information is stated in chapter 3.5.3. If additional equipment (e.g. fill-up valves), which is not included in the minimum requirements of chapter 3.1, needs to be included in the systems for the planned quality control of the Contractor, this equipment has to be described in the technical report of the bidder (bid document H).

After the installation work is successfully finished, the Contractor hands over the system to the Operator together with the documentation of the performed quality control measures, the detailed logbook, the detailed tally list, the first data after packer inflation in numerical format (txt, csv, or xlsx) and visualized in form of plots, and the draft version of the manuals for operation and maintenance of

the system. The Operator will examine closely the documents. When the documents are complete and the system is providing reliable data (no hydraulic connections between observation intervals, no indications for leakage, stable packer pressures, very low optical loss and no step losses of the fiber-optic cable), the Operator will approve the installation work.

Reporting is an important task of this tender. The following reports are planned and must be prepared for every borehole:

- Planning and mobilisation report documenting the definitive system layout of the system as well as all equipment parts including their specifications, calibrations and the performed quality control measures before delivery of the equipment to the site.
- Installation report documenting all on site activities, the specifications of the installed equipment and all performed on-site quality control measures. The final version of the manuals for operation and maintenance of the system by a third party must be included.

The installation work at the drill sites will take place during regular day shifts at all times of the year. Work on Saturdays, Sundays or bank holidays as well as night shifts are not planned. The installation team consists of a leading engineer and two technicians. To cover illness and holiday time, the Contractor must provide a back-up engineer and a back-up technician.

### **2.3 Location of the boreholes**

Details on the already executed and foreseen boreholes can be found on Nagra's website:

<https://www.nagra.ch/en/Up-to-date-information-on-the-deep-boreholes.htm>

Note: Nagra has submitted more drilling permit applications ("Sondiergesuche") than boreholes are planned.

### **2.4 Schedule for installation and mobilisation**

The personnel and equipment must be ready for mobilisation to the first borehole with subsequent installation on 01.12.2020, to the second borehole per March 2021 and to the third borehole per May 2021. However, the mobilisation dates might take place later due to technical or other constraints. The effective mobilisation date will be announced at least 4 weeks in advance. However, the delivery of the equipment to the site is allowed only one week before the announced date and not earlier.

See chapter 3.4 for delivery dates of the different reports.

### **2.5 Preparation workshop**

In November 2020, a one-day workshop will be held at Nagra's office in Wettingen, Switzerland, in preparation for the installation work. Participation is compulsory for four persons of the Contractor, who will perform the installation work on-site, including the key-personnel. Technical aspects will be discussed together with the rig or crane operator but also aspects of HSE. In addition, a visit to one of the drill sites is planned.

The costs for the participation in this workshop will be compensated by positions 1.1 of the price list (bid document C).

If the preparation workshop must be done by means of video conference due to travel restrictions (e.g. because of Covid-19), then the compensation will be done by positions 1.2 of the price list (bid document C).

## 2.6 Project organisation

The following functions and personnel will form the key interfaces of the project organisation:

- TBO project manager monitoring
- Personnel of the Contractor
- Personnel for crane or drill rig operation during installation of the multi-packer systems

The responsibilities of the TBO project manager monitoring are:

- Overall coordination of the work off site and on the drill site.
- Acting as contact person for all the companies and persons working at the drill site.
- Coordination and organisation of the operations in the boreholes.
- Technical supervision of installation work.
- Assuring safety on the drill site.
- The TBO project manager might hire a technical supervisor who will supervise the installation and the planned quality control measures during installation together with the TBO project manager.

The responsibilities of the Contractor are described in chapters 2.1.2, 2.2 and 3.

The responsibilities of the personnel of the crane or rig operator are:

- Operation of the crane or rig during installation.

## 2.7 Drill sites

The actual sequence of the TBO boreholes until the end of the campaign is not yet settled. The potential drill sites are documented in the applications for drilling permits ("Sondiergesuche") and an overview can be found on Nagra's website:

<https://www.nagra.ch/en/boreholes.htm>

The bid must be valid for any drill sites of the investigated siting regions (<https://www.nagra.ch/en/sitingregions.htm>).

The following rules apply on entering the drill sites:

- Personal protective equipment (PPE) is obligatory on the drill site: helmet, safety shoes (protection class S3), high visibility working garments with protection against bad weather and against heat and flames, noise protection, protection goggles, protection gloves.
- Alcohol consumption during working hours and generally on the drill site is forbidden.
- Smoking on the drill site is forbidden. Smoking is allowed only in designated areas outside the drill site.
- During installation work the established HSE rules on drill sites of deep boreholes have to be respected.
- It is expected that the bore cellars will have a horizontal concrete roof with entrance and stairs as well as a big enough opening above the borehole. During installation work in the bore cellar the Contractor has to provide a system for circulation of fresh air.

## 2.8 Personnel

- The installation team consists as a minimum of a leading engineer and two technicians. To cover illness and holiday time, the Contractor must provide at least one back-up engineer and one back-up technician. If required for installation for the optional fiber-optic cable, one additional technician, who is specialized in fiber-optic cable installation and splicing, can support the on-site team.

- The execution of the installation work must be performed only by personnel that is listed in the bid. If the Contractor wants to exchange or add personnel to the installation team, the Contractor must send the CV of the new person to the Operator by email and the Operator must approved by email the new person before he starts the on-site work.
- The installation work at the drill sites will take place during regular day shift on weekdays at all times of the year. Work on Saturdays, Sundays or bank holidays as well as night shifts are not planned. The personnel of the Contractor must respect the Swiss regulations regarding maximum working time per week.
- In the price list (document C), designated positions are foreseen for the expenses, like food and accommodation, and mobilisation and demobilisation of equipment and personnel to the drill site.

## **2.9 Time during interruptions**

If the installation team is mobilised and interruptions occur that are caused by technical problems of the crane or the rig, another service company, or the Operator, the stand-by rates (Positions 3.5 and 3.6 of the price list in document C) will be paid for a maximum of 3 working days without activity related to preparation or installation. If the interruption will be going on for more than 3 working days, the installation team can be demobilised and called back (re-mobilised) to the site, when the installation work can proceed. In this case the position 3.1 of the price list can be charged for demobilisation and re-mobilisation.

## **2.10 Import/export of equipment and material**

The Contractor is responsible for the import and export of equipment and materials. Note that Switzerland is not part of the EU; with the acceptance of the present contract, the Contractor takes full responsibility for the equipment and material import and export, including transportation to the drill site. All valid customs regulations and formalities must be fulfilled, and the necessary permits must be approved.

## **2.11 Bank guarantee and advance payment**

The norm SIA 118 will be part of the contract. According to Art. 149, Abs. 3 of the norm SIA 118 an unconditioned bank guarantee of a reputable bank or insurance company must be provided. The bank guarantee covers 20% of the actual total contract amount.

An advance payment is possible. If an advance payment is desired, the bidder has to indicate the amount in the price list (bid document C). If the advance payment is higher than the 20% of the actual total contract amount that is covered by the obligatory bank guarantee, then the amount of the bank guarantee must be increased to cover 100 % of the advance payment amount.

After both parties have signed the contract, the Contractor must provide the Operator with the bank guarantee. Upon receipt of this bank guarantee, the Operator will do the advance payment. When the Contractor successfully finished the installation of the first multi-packer system, the bond amount of the bank guarantee is reduced to 66%. When the Contractor successfully finished the installation of the multi-packer system in the second borehole, the bond amount of the bank guarantee is reduced to 33%. The bond expires, when the Contractor successfully finished the installation in third borehole.

After the system installation in a borehole is accepted by the Operator and the final invoice per borehole is paid, the Contractor must provide the Operator the surety bond (see chapter 4.4 'Warranty, defects notification period, limitation period and bank guarantee').

## **2.12 Further aspects**

It should also be noted that the Operator will occasionally hire photographers and camera teams to document the work, due to its duty to inform the authorities and the public.

### 3. Performance specifications

#### 3.1 Minimum requirements for the test equipment

The minimum requirements for the test equipment are listed below. All these minimum requirements must be fulfilled to qualify for participation in the bidding process. Non-fulfilment of one requirement leads to exclusion of the bid. The specifications of the test equipment must be stated in the technical report as part of the bid documents (bid document H) and will be used for evaluation of suitability criterion S3.

General minimum requirements for downhole equipment:

- Temperature resistance up to 70°C
- Suitable for installations in boreholes with a casing diameter of 7 5/8", 9 5/8" and/or 13 3/8" API-Casing
- Suitable for groundwater sampling in different aquifers
- Distance between packers must be adjustable between approx. 4 – 100 m
- Free positioning of filter/port in the observation interval between the packers
- All couplings as part of the central string (incl. the packers) must be gas and watertight (API standard)
- The auxiliary parts (e.g. observations or packer inflation lines etc.) must be manufactured in stainless steel as well as all couplings (Swagelok or comparable quality with NPT thread)
- Minimum applicable tensile force on the entire system = total weight of the entire system for the maximum system length plus additional loads caused by friction plus sufficient reserves for additional tensile forces. The maximum applicable tensile force for the entire system must be specified in the technical report (bid document H)

Packers:

- Minimum length of packer sleeve = 1.00 m
- Rubber type = proven long-term stability (installed for > 10 years) in similar pressure and temperature conditions.
- Integrated steel reinforcement in sleeves
- Minimum packer diameter for 7 5/8" casing API = 5.5"
- Minimum packer diameter for 9 5/8" casing API = 7"
- Minimum packer diameter for 13 3/8" casing API = 10"
- Fixed end packers (the packer diameter must be optimized according to the planned casing diameter)
- Minimum inflation pressure (delta to installation depth) = 10'000 kPa
- Packers must be able to hold a differential pressure (pressure difference across a packer element) of 6'000 kPa for the above defined casing diameters
- Individual hydraulic inflation line for each packer with fluid (minimum OD ¼")
- The pressure of each packer must be kept stable with a pressure maintenance system in the bore cellar
- Minimum inner diameter of packer inflation lines ≈ 0.004 m (≈ 4 mm)
- Material of packer inflation lines = stainless steel

Packer pressure maintenance system

- The pressure of each packer must be kept constant with a pressure vessel, which is connected to a single 20 litre nitrogen gas bottle with high precision reducing valve. The vessel is filled up to 2/3 with water and 1/3 with gas. It must be possible to check visually the water level in the vessel (side glass). The nitrogen gas bottle must contain a small amount of a non-toxic tracer gas with a strong smell, so that tiny leakages in the packer pressure maintenance system can be detected easily when entering the bore cellar.

- The vessel must be pressure tested up to 100 bar before installation
- The packer pressure resp. the pressure in the vessel must be monitored by a manometer (range 0 – 10'000 kPa with a diameter of 160 mm and liquid filling; CrNi-steel)
- In addition, the packer pressure resp. the pressure in the vessel must be monitored by a pressure sensor (range 0 – 10'000 kPa, see below)

#### Sliding sleeve and operation tool

- To be able to take water samples from selected aquifers it is foreseen to install up to three sliding sleeves into the central tubing string (Comment: The final decision on number and depth of the sliding sleeves will be made based on the hydraulic packer test results.). By opening the sliding sleeve the access to the observation interval is established and the water can be pumped to the surface by installing a 2"-pump or something similar (e.g. piston pump) into the central tubing string.
- The sliding sleeve must have a proven ability to operate numerous times over a long period of time (several years); any damage of the sealing pack resp. the seal itself should be prevented even if fluid with a sediment content ("sand") is pumped.
- The sliding sleeve must have an opening and closing mechanism which is activated by a wireline operation tool. The operation tool must be compatible with a standard wireline winch.
- The material should be stainless steel.
- A detailed manual about the use of the operating tool and the sliding sleeves must be delivered with the installation report.

#### Wellhead flange / Landing spool

- The wellhead flange is a standard 13 5/8" API flange (5'000 psi) with a soft iron ring as seal. Due to technical reasons the wellhead flange might have a smaller diameter for one borehole.
- The wellhead flange must have 2 7/8" EU connections, and screw-in connections (NPT) for the packer and observation lines (through-hole tube fitting for the 3/4" observation lines) and/or stuffing boxes for an optional sensor cables or fiber-optic cable etc.

#### Hanger sub

- Optional a hanger sub can be integrated into the tubing string beneath the wellhead flange, if needed for a smoother installation procedure.

#### Centralizer

- For the centralization of the whole downhole assembly in the borehole centralizer should be installed wherever it is appropriate to guarantee in critical sections a smooth installation (e.g. in the area of the liner hangers).

#### Sensors

- Pressure sensors:
  - o Submersible water level probes, that will be installed in the observation lines, if fluid level is below well-head level
    - maximum outer diameter = 10 - 12 mm
    - Range = 0 – 500 kPa
    - Accuracy  $\leq 0.5$  % full scale (FS)
    - Resolution  $\leq 0.05$  % FS
    - Housing made of stainless steel
    - Sensor cable with a tensile force reinforcement according to the expected water level resp. drawdown during pumping in the observation line with about 20 m extra cable

- Pressure transmitter, if an observation interval shows artesian conditions (observation lines with fluid level below well-head level)
  - Range = 0 – 1'000 kPa (assumed; the range will be adapted according to the hydraulic packer tests results)
  - Accuracy  $\leq 0.5$  % full scale (FS)
  - Resolution  $\leq 0.05$  % FS
- Manometer, if an observation interval shows artesian conditions (observation lines with fluid level below well-head level)
  - Range = 0 – 1'000 kPa (assumed; the range will be adapted according to the hydraulic packer tests results)
  - Manometer diameter = 160 mm
  - Material = CrNi-steel
- Packer pressure transmitter
  - Range = 0 – 10'0000 kPa
- Packer pressure manometer
  - Range = 0 – 10'0000 kPa
  - Manometer diameter = 160 mm
  - Material = CrNi-steel
- Atmospheric (air) pressure sensor including air temperature
- All pressure sensors must be absolute pressure sensors (not relative pressure) and must have an integrated temperature compensation.
- Optional: fiber-optic cable for distributed temperature sensing (DTS)
  - Robust design of the cable to be protected against damage during installation
  - 1 multimode fiber for Raman DTS,
  - Preferred design: fiber placed loose in metal tube
  - Resistant against hydrogen intrusion
  - Hermetically sealed to avoid any water flow inside the cable
  - Splice locations must be reduced to a minimum. If splicing is necessary, the splice location must be hermetically sealed for long-term sealing of up to 12'000 kPa
  - E2000 connector incl. dust proof protection box
  - 50 m of extra cable length to be stored in the bore cellar for calibration purpose

#### Observation intervals

- Interval Filter/Port
  - Length port = 0.5 – 1.0 m
  - Material = Stainless steel
  - Slot opening = 0.75 – 1.0 mm
  - Ability to retain fine particles in formation/borehole fluid
  - Free positioning in test interval between the packers
- Monitoring lines
  - Individual monitoring lines for each monitoring zone
  - Minimum inner diameter of the monitoring lines from observation interval until 100 m below ground level  $\approx 0.006$  m ( $\approx 6$  mm)
  - Minimum inner diameter in the top 100 m of the system  $\approx 0.016$  m (16 mm),  $\frac{3}{4}$ " OD
  - For artesian conditions, the monitoring lines must have a valve at the end so that the pressure transmitter and manometer can be removed without outflow or pressure decrease in the observation line

#### Central tubing with protector couplings and banding straps

- The tubing must be new. Used or second-hand tubing is not accepted
- Water and gas tight couplings: API standard
- Outer diameter = 2 7/8" EU



- Inner diameter of the central tubing > 59 mm to be able to install a 2" pump inside the tubing string for water sampling
- Length of single test tubing  $\approx$  9 m (range 2)
- Material = steel (steel grade = L/N8)
- Pup joints: Different lengths to adjust the test string to a stickup  $\leq$  1m above reference level (platform) for any test depth
- The central tubing string will be installed using so-called protector couplings which protects and guide the packer and observations lines; the steel quality should be comparable with the central tubing string
- For the banding straps Monel 400 is the required material

#### Data acquisition system

- The data acquisition system must record the data of the following measuring devices:
  - Observation interval pressure sensors
  - Packer pressure sensors
  - Atmospheric pressure and temperature sensor at surface
- The recording rate must be adjustable at any time
- Minimum recording 1 Hz
- The data acquisition system must allow different recoding modes (e.g. recording of actual measurement value or averaged value of e.g. 10 measurements).
- All sensors connected to the data acquisition system must run on exactly the same time (winter time, CET)
- Uninterruptible power supply for the data acquisition system. At least 15 minutes of power failure must be covered.
- All data acquisition system components must be installed in boxes in the bore cellar (fixed to side walls). The boxes must be dust protected and protected against splashing of water (minimum degree of protection equal to IP code 54). The boxes must be of the bore cellar.
- The license of the software to operate the data acquisition system must be transferable from the Operator to a third party, who will be in charge of the operation and maintenance of the systems over the next years.
- The data files of the pressure measurements must include the time series of each sensor containing measurement time, measured raw value (e.g. mA) and calculated pressure (kPa or bar as well as meter above sea level for the observation intervals). The data files must contain a unique header for every time series component. It must be possible to generate daily data files, monthly data files or one continuous data file. The data files must have txt, csv or xlsx file format. The conversion equations from raw values to calculated units must be documented in the installation report.
- The data transfer to an off-site server is not included in this tender. However, the data acquisition system must allow installation of data transfer by internet or mobile phone connection.
- The PC of the data acquisition system must have several USB ports and an ethernet port.
- During and directly after the installation, on-line measurements including visualisation of all measured data is required.

### 3.2 Equipment and infrastructure provided by the Operator

The Operator provides a crane or a rig for installation of the multi-packer systems including qualified staff operating these machines during installation. No pulleys are allowed at the crane or rig. In addition, the following infrastructure will be provided by the Operator:

- Electricity and water supply.

- Internet connection cannot be guaranteed for the time of installation.
- Parking spaces for 2 cars and 1 van.
- Areas to store the equipment. The storage areas will be uncovered and not guarded. Storage is at risk of Contractor. Equipment is allowed on the site only one week before the announced mobilisation date and not earlier.
- One office container. This container will have one working space (desk) for the Contractor and space for the Contractor's personnel to sit during breaks.
- Toilet.
- Light.

The Operator provides the Contractor with no further equipment, no installation tools (e.g. tubing spider, tongs, pulleys), no vehicles (e.g. fork lift), no scaffolding, no high pressure cleaner, and no storage containers.

The Operator provides the well-head. However, the landing spool with feed-through for the tubing and the observation lines must be provided by the Contractor.

### **3.3 Calibration of sensors and quality control of equipment before delivery to the site**

Before delivery to the site all sensors must be calibrated. The official calibration certificates (manufacturer or other accredited company) must be attached to the mobilisation report and calibration results need to be approved by the Operator.

All packers must be visually inspected and checked for leaks before the delivery to the site. For leak detection the packers must be pressurized for 24 hours in a steel tube and the packer pressure must be recorded. Documentation of these checks must be provided in the mobilisation report.

### **3.4 Planned reporting structure**

The planning of the system for each borehole will be an iterative process between the Contractor and the Operator. The final system design (number and depth of packers and observation intervals, decision on fiber-optic cable) will be determined latest two months before the planned mobilisation date. Before the mobilisation of the equipment, the Contractor must submit a detailed planning and mobilisation report documenting all equipment parts including their specifications, calibrations, and the performed quality control measures before delivery of the equipment to the site. The mobilisation report for each borehole must be submitted latest two weeks before the announced mobilisation date. Only if the mobilisation report is accepted by the Operator the equipment may be mobilised to a drill site. The mobilisation report must contain the following information:

- Detailed tally list of the system showing the planned depths, length, diameter and weight of all system components in the borehole
- Detailed sketch of the system showing the planned depths, length, diameter, tensile strength, and weight of all system components in the borehole. In addition the perforated section of the borehole have to be shown (information will be provided by the Operator).
- Specifications of all system components incl. serial numbers
- Specification sheets of all sensors, packers, sliding sleeves, tubing
- Calibration certificates of the sensors
- Maps of each boxes showing included components of the data acquisition systems
- Maps of the interfaces of the data acquisition system showing which sensor is connected to which port
- Sketch of the pressure maintenance system explaining each component

For every multi-packer system a separate installation report must be prepared. By submission of the installation report all data in conjunction with the installation must be transferred to the Operator. The installation report must be completed and sent to the Operator 3 months after the end of the installation. The installation report must contain the following information:

- Description of the system and the installation process
- Description and documentation of the performed on-site quality control measures
- Detailed logbook of all activities during installation
- Photo documentation of the installation work
- Detailed tally list of the system showing the as-built depths, length, diameter and weight of all system components in the borehole
- Detailed sketch of the system showing the as-built depths, length, diameter, tensile strength, and weight of all system components in the borehole. In addition, the perforated sections of the borehole have to be shown (information will be provided by the Operator)
- Specifications of all system components incl. serial numbers
- Specification sheets of all sensors, packers, sliding sleeves, tubing
- Calibration certificates of the sensors
- Maps of each boxes showing included components of the data acquisition systems
- Maps of the interfaces of the data acquisition system showing which sensor is connected to which port
- Sketch of the pressure maintenance system explaining each component
- Manuals for operation and maintenance of the system by a third party. The manuals must allow a third party to operate and maintain the system components. This includes exchange of defective pressure sensor and manometer, removal and adjustment of the depth of the submersible water level probes, operation and maintenance of the packer pressure maintenance system, operation of the data acquisition system and its software, modification of the conversion equations from raw values (e.g. mA) to calculated units (kPa or bar as well as meter above sea level), access to the stored data, replacement of the battery of the uninterruptible power supply, etc..

### **3.5 Technical report**

#### **3.5.1 Information about company and personnel**

The information about the personnel must be given in the technical report as part of the bid documents (bid document H) and will be used for evaluation of award criterion A2. The list below shows the required information for the technical report:

- Experiences and references of the foreseen personnel
  - Fill in required information in the tables
  - CVs of the foreseen personnel (maximum two A4 pages per person), including qualifications and project references specifying function in the team, exact duties, and duration. The CVs should only state qualifications and project references related to multi-packer system installation

Moreover, the bidder can list project references of the company and the subcontractor(s) in the appendix of the technical report to describe the reference projects of the personnel in more detail.

### 3.5.2 Equipment

The specifications of the equipment must be stated in the technical report (bid document H) and will be used for evaluation of suitability criteria S3 and award criteria A3. The list below shows the required equipment information for the technical report.

- Multi-packer system (overview)
  - System layout: Drawing of system
    - inner and outer diameter (for each system component)
    - Length (for each system component)
    - Maximum applicable tensile force for the entire system without damaging the system
  - Maximum fluid pressure, maximum differential pressure, maximum downhole temperature
  - Range of possible length (in metres) of the observation intervals (minimum and maximum distance between the two packers)
  - Handling of lines and the optional fiber-optic cable during installation (number of winches, fixation to test tubing)
  - Summary list of entire downhole equipment with most important specifications and maximum applicable tensile force for relevant items that are most affected by the tensile forces.
  - Example of installation protocol(s) and tally list(s)
- Packers
  - Manufacturer (packer sleeve and parts)
  - Type/model and specification of packer type (fixed end, sliding end, material of sleeve, information about reinforcement type)
  - Length of sleeve in metres
  - Specification of packer diameters for the different casing diameters
  - Specification in table format of outer diameter, overall length, rubber sleeve length, thread connections, maximum inflation diameter, maximum inflation differential pressure at maximum diameter, material and temperature range
  - Diagram of working pressure (maximum differential pressure or maximum inflation pressure vs. borehole diameter)
  - Material (specify exact steel type) and diameter (inner and outer) inflation lines.
  - Max. temperature for a period of several years
- Packer pressure maintenance system
  - Description of packer pressure monitoring and data recording
  - Description of system to keep packer pressures constant.
  - Measures to compensate for pressure changes due to outside temperature variations.
  - Manometer specifications / description
- Sliding sleeve and operating tool
  - Specification with sealing pack and the seal
  - Schematic drawing with the explanation of the operating mode
  - Material (specify exact stainless-steel type)
  - Description of operation tool and compatibility with wireline winches
- Wellhead flange / Landing spool
  - Technical drawing
  - Material (specify exact steel type)
  - Description of connections for tubing and lines as well as for the optional fiber-optic cable
- Hanger sub
  - Technical drawing

- Material (specify exact steel type)
- Protector couplings
  - Technical drawings and photo
  - Material (specify exact steel type)
- Centralizers
  - Technical drawings and photo
  - Material (specify exact steel type)
- Sensors
  - Pressure sensors
    - Type/model, range, accuracy, resolution, measuring frequency, year of commissioning
    - Specification sheets
  - Manometers
    - Type/model, range, accuracy, year of commissioning
    - Specification sheets
  - Optional: Fiber-optic cable
    - The specifications of the optional fiber-optic cable must be stated in the technical report as part of the bid documents (bid document H) and will be used for evaluation of award criterion A3
    - Type/model
    - Outer Diameter
    - Materials of coating and cladding
    - Cross-section of cable
    - Description of design, e.g. fiber placed loose in metal tube
    - Description of protection against hydrogen intrusion into the fiber
    - Description of how hermetical sealing is achieved
    - Description of how splice locations are protected
    - Description of how the cable is guided through the packers and protected at the tubing threads
    - Specification sheet
- Filter port / screen
  - Type/model and manufacturer
  - Photo or sketch
- Monitoring lines / Observation lines
  - Inner and outer diameter
  - Material (specify exact stainless steel type)
- Packer lines
  - Inner and outer diameter
  - Material (specify exact stainless steel type)
- Test tubing
  - Type/model and manufacturer
  - Type of coupling / thread
  - Tubing: inner-/ outer diameter, coupling: outer diameter
  - Material of tubing (specify exact steel type)
  - Length of a single tube
  - List of available pup joints
  - Maximum applicable tensile force in tons
- Data acquisition system
  - Description of hardware, software and features
  - Examples of visualisation of on-line measurements that is needed during and directly after installation
  - Examples of data file and of access to the stored data files.
  - Specification of measurement frequencies (choices, range)

- Description of data recording and storage as well as interfaces
- Description of protection boxes hosting the data acquisition system
- List of ports
- Description of uninterruptible power supply for the data acquisition system

The following units must be used in the technical report

- Metres (m) for length
- Millimetres (mm) for all system diameters; inches can be used in addition.
- Kilopascal (kPa) for pressure
- Degrees Celsius (°C) for temperature

### **3.5.3 Planned Quality control measures**

The description of the planned quality control measures before, during and after installation of the multi-packer systems in the TBO boreholes must be stated in the technical report (bid document H). The description may not exceed four A4 pages including text, sketches and tables. The list below shows the required information for the technical report.

- Concept and organisation of the quality control (QC) measures.
- Quality control measures of system components (e.g. packers, sensors) before mobilization to the drill site.
- Quality control measures (e.g. for depth control for multi-packer system components and the optional fiber-optic cable, tightness or leaks of tubing as well as packer and observation lines) during system installation to ensure system components are correctly installed and not damaged.
- Quality control measures after system installation to ensure proper functioning of all installed system components and the system is providing reliable data.
- Description of additional equipment or tools (e.g. packer fill-up valve) needed for performance of the on-site quality control measures and for a smooth installation

Note that the Operator can require additional quality control measures.

### **3.5.4 Time schedule**

The description of the time schedule must be stated in the technical report (bid document H). The bidder has to show how he ensures that the equipment proposed in the technical report (bid document H) can be completely and fully functionally installed in the first borehole by beginning of December 2020, in the second borehole by March 2021, and in the third borehole by May 2021.

### **3.5.5 Safety management system**

The description of the safety and quality management system must be stated in the technical report (bid document H). The list below shows the required information for the technical report.

- Description of the safety management system of the bidder
- Description of the quality management system of the bidder
- Certificates

### **3.5.6 Project organisation**

The project organisation must be described (maximum two A4 pages) in the technical report (bid document H). The list below shows the required information for the technical report:

- Team roles and responsibilities for testing, analysis and documentation
- Redundancy regarding personnel and equipment

## **4. Contract and remuneration**

### **4.1 General conditions**

The general terms and conditions of the Operator apply.

The Operator reserves the right to terminate the contract at any time, with a period of notice of three months. Already produced or procured equipment parts before the termination notice will be fully paid.

The Operator has the right to delay the planned installation dates (see chapter 3.5.4) due to technical or other reasons without additional costs.

By submission of a bid, the bidder accepts the content of document E (draft contract).

### **4.2 Remuneration**

All cost items must be defined in the price list in document C (yellow cells in the different sheets) and are to be filled in and signed by the bidder. With his signature, the bidder obliges himself to maintain these prices until the end of the contract.

The prices related to equipment must include all consumables, all spare parts and all tools for installation and quality control as well as all costs for repair of the tools resulting from normal wear and tear during installation.

The prices related to drill site infrastructure needed by the Contractor must include all required items (e.g. scaffolding, pulleys, forklift) that are needed during installation and are not provided by the Operator.

Insurance costs must be included in the offered prices.

As all TBO boreholes will be fully cased and no open borehole sections will exist when the multi-packer systems will be installed, the Operator will not compensate any downhole equipment that becomes damaged or fully unusable during installation. In addition, costs related to normal wear and tear of the multi-packer systems during installation will not be compensated. Excluded from this regulation is equipment damage that is caused by faulty handling of the equipment by the drill rig or crane operator.

To avoid leaks and malfunctioning equipment parts, an intensive quality control procedure is requested before mobilisation and during installation. Costs related to the off-site quality control measures must be included in the equipment costs. On-site quality control measures during installation will be remunerated by the hourly rates of the installation team. However, in the case that the multi-packer system is not functioning properly (packers not holding pressure, sensors not working, etc.), neither personnel nor equipment costs will be remunerated to repair or replace system parts. In such a case the Operator will provide the rig without charging these costs to the Contractor.

### **4.3 Additional services**

Additional services or equipment that are not covered by the contract will be compensated only if explicitly ordered by the Operator on the basis of an offer.

#### **4.4 Warranty, defects notification period, limitation period and surety bond**

The Contractor issues a warranty for all downhole and surface equipment for a period of 2 years starting after installation is fully completed and accepted by the Operator. Malfunction of the equipment caused by the following reasons shall be exempted from this warranty:

- Faulty use or handling by the Operator or a third party contracted by the Operator
- Repairing the equipment without written agreement from the Contractor, or substitution of a genuine part by another one from another manufacturer
- Carelessness or lack of maintenance by the Operator or a third party contracted by the Operator.
- Use of the products outside the limit of their working range
- Act of God
- Replacing parts of the products done by Contractor do not extend the warranty.

The norm SIA 118 will be part of the contract. The defects notification period according to Art. 172 Abs. 1 of the SIA 118 and the limitation period according to Art. 180 of the SIA 118 remain unchanged. According to SIA 118, Art 181, the joint security should be provided for the period of 2 years allowed for examination and sending notice of a defect or deficiency. The joint security is provided by a surety bond that is issued by a reputable bank or insurance company. The guarantee is to be payable on the first request. The amount of the surety bond is 5% of the effective value of the total contract amount per borehole.

#### **4.5 Remuneration of additional costs**

##### **4.5.1 General additional costs**

All additional costs such as mobile phones, customs fees, insurances or costs for on-site working space must be included in the offered prices in the price list (document C). Office work, which is not part of the supply, installation and documentation of the multi-packer systems, such as compilation of the bid documents and invoicing will not be compensated.

##### **4.5.2 Costs for board and lodging**

To be defined in the price list (document C).

##### **4.5.3 Travel costs**

To be defined in the price list (document C).

##### **4.5.4 Documentation costs**

The reports must be provided as word- and pdf-document. Documentation costs, paper copies and printouts will not be compensated separately. The costs must be included in the positions in the price list (bid document C).

#### **4.6 Price changes**

In general, the offered prices stated in the price list (bid document C) are fixed for the entire duration of the contract and cannot be changed. Only positions 1.4, 3.2, 3.3, 3.5, 3.6, and 4.2 of the price list (bid document C) can be subject to price changes that will be determined according to SIA norm 126 "Preisänderung infolge Teuerung bei Planerleistungen", taking into account the published KBOB price change factors ([www.kbob.ch](http://www.kbob.ch)). Only price changes exceeding 1% will be approved.



#### **4.7 Controlling, invoicing**

- Invoicing is done according to the agreed rates or lump sums. Invoices require the acceptance of the work by the Operator. The Contractor must send with the invoice a detailed record of the working hours that are not billed by lump sums.
- The invoices must be comprehensible and verifiable based on the work performed as well as the terms and prices of the contract. Invoices that do not comply with these requirements will be rejected and returned to the Contractor for corrections and, if necessary, amendment. Modifications require a new invoice with adjusted invoice and due date.
- Invoicing and payments are made in Swiss Francs CHF.
- VAT must be indicated separately on the invoices.
- The terms of payment are: the Operator shall pay invoices net within 30 days or within 15 days with a 2% deduction.
- After acceptance of the mobilisation report by the Operator, the mobilisation report and 50% of the related equipment costs can be invoiced.
- The remaining 50% of the equipment costs can be invoiced after successful installation of the system in a borehole and approval by the Operator.
- After successful installation the manpower costs for the installation work must be invoiced.
- After acceptance of the installation report, the respective costs must be invoiced.