



## Risk Evaluation Questionnaire

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## Introduction

Dear Sir or Madam,

This Questionnaire has been prepared in the scope of the “Georisk” Project that focuses on identification of the risks and challenges that prevent development of deep geothermal projects and on addressing them. The project aims to gather data in order to develop a customized support scheme for each country taking into account a set of unique characteristics that would facilitate further growth of the geothermal sector.

You have received this paper as one of the key stakeholders that has significant experience and influence on the local geothermal energy market. The Questionnaire contains a list of the risks and challenges that have been collected and structured depending on their origin and cause. Using your experience and awareness about the current situation on the local market you are kindly asked to fill in the risk matrix.

The matrix consists of a risk designation, the project phase it may occur in and a short description of the details. Your task would consist of an evaluation of the risk occurrence frequency/likelihood as well as an assessment of the damage in case the risk takes place. For the purpose of the assessment of the situation in a given local market it is also desirable to note any mitigation system currently available/applied.

The following section gives further explanations and guides you through the evaluation procedure. In case of arising of any question during the course of evaluation, please feel free to contact the Georisk partner responsible for your region.

**Note that the survey results will not be directly published and will remain confidential. The data is to be analysed and used for further improvement of the geothermal field on international scale.**

## The Questionnaire\*

For the ease of utilization and flexibility the questionnaire is represented by an excel file that contains several sheets.

On the first sheet you will find latest version of the Register with all risks that are to be considered during the course of the GeoRisk project. Here, you may familiarize with all set of risks that we have already determined to be a potential hindrance during the project development phase. Unique to this sheet is the column with mitigation measures and comments to each risk that would further clarify what is meant under each entry.

On the second sheet you will find the questionnaire itself. The core structure mirrors one of the Register, however here several adjustments are made to ease the evaluation process.

The entries are divided by topic. This would reduce the number of entries to evaluate allow you to focus on the risks that are relevant only to your particular field. Additionally, the evaluation criteria for each topic could be selected more appropriately rather to having one generalized one. Of course, you are free to fill other topics if you feel inclined to. The division is by no means meant to limit your field of evaluation.

On the top you may see the additional lines, these are meant to specify features of the projects you are about to evaluate as well as your level of expertise in each topic, providing thereby more order to the end results. The right side of the description column provides you options for evaluation of each given entry as well as provides comments.

Since the number of entries is intended to be kept as low as possible, the entries are providing generalized titles of risk branches and focusing on broader coverage of possible risks. Therefore, you may find some of them intertwined with each other and causes intersecting. In your evaluation, please govern with the principle “cover as much as possible”. In case more details on the description are needed, please look at the comments on the first sheet of the Questionnaire, where you will find latest version of the Risk Register.

Note: In the top bar some designation are market with a star (\*) sign. These contain additional hints for easing your understanding. You may see the hints by selecting the corresponding sell. (See Figure 1)

General Information							
Output		Reservoir Type*					
Topic*	Phases			Descr	Reservoir Type If you provide information for various projects within sedimentary formations pick the corresponding depth. If the depth vary from shallow to deep within same environment you may select 0-5000m.	Consequences	
	ident	drilli	explc			Economic/Perform	Health, Safety, Envi
	X	X	X	External natural hazards damaging the infrastructure		X	X
	X	X	X	Anthropogenic hazard damaging the infrastructure		X	X
	X	X	X	Changes in policies, laws, taxes and regulations put developm	Please refrain from mixing various geological environments	X	
	X	X	X	Lack of financing for the next phases		X	

Figure 1: Example of Hints

Finally, on the last sheet you would find a legend. Although most of the evaluation system will be presented here, the legend sheet in excel file is meant to provide you exact criteria for evaluation of each topic groups as well as give overview and several tips.

### Risk Evaluation System\*

Prior to the risk evaluation task, please take a few minutes to familiarize with the presented evaluation system. It is developed for your region/country and serves for correlation of the gathered data.

**You do not need to fill in the entire questionnaire but only focus on the topics of most experience.** For that please provide the assessment of your background knowledge in each of the topic fields.

Level of Experience*			
Geology	Social/Economical	Drilling	Operation/Develop

Figure 2 : Filling background knowledge

For the simplicity and ability of international correlation of the results, the main quantitative evaluation is chosen to be monetary value of the risk. The qualitative component of the risk is always prone to changes and highly context dependent, therefore the optimal solution is for you to present its equivalent in the form of costs and expenses that should be included into the overall damage estimation.

The description of risks comes together with expected consequences. These imply the presence of one of the named type of damage, in any qualitative form, to be present in case the risk comes to pass. You would only need to assess the gravity of these consequences if in your region.

“What is the cost of the immediate damage from the risk?”

“What is the cost of long time damage?”

“How much will it cost to remediate the impact if it happens?”

*E.g. if the “loss of integrity of surface equipment” occurs, the environmental damage is expected, the gravity of this damage and its consequences however, is for you to define, based on the local thermal water composition, reservoir pressure, process flow equipment, knowledge of circumstances etc.*

For the evaluation you will have to fill in only three fields, they are all coloured in yellow: Damage, Frequency and Relevance (see Figure 3)

Risk Evaluation				
Damage Level*	Frequency	RI*	Relevance*	Comments*

Figure 3 : The main columns to fill in

In order to evaluate the damage scale of the risk following table is presented. Since the exact evaluation of the damage, its immediate and long term consequence are rather challenging, the description provides a subjective evaluation alternative.

Table 1: Risk Evaluation Criteria

Risk Level	Damage Value	Damage description
1	< 10.000 €	Minimal damage
2	> 10.000 € < 100.000 €	Medium damage
3	> 100.000 € < 1.000.000 €	Heavy Damage
4	> 1.000.000 €	Critical Damage

The second factor to be considered for the risk evaluation is the occurrence likelihood or frequency of the each specific risk. Usually, for this field “likelihood” or “probability” is taken as the only criteria, however, since such entry requires a statistical background and some risk occur several times, it was decided to combine it with “frequency of occurrence”, which is also more tangible term and could be given on the bases of even one project.

The frequency of the risks is also classified with four distinguishable levels. However, due to the difference of the background and sort of activity, each topic will have its own, dedicated frequency table with values. Note: that the table is for evaluation of the risks on the project scale. *E.g. If the “blowout” risk has been rated with frequency of 2 (once per 4 months ≤ X < once per month) => it means that in each project within this region, the frequency of this risk occurring is 2. Hereby, it is not meant that within 4 month across all projects in the region, it occurs once or more.*

Risk Level	Frequency/Likelihood description
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1	Minimal frequency/Not occurring – Not likely to occur
2	Low frequency – Mild chances of occurrence
3	Moderate frequency – Moderate chances of occurrence
4	High frequency/Constantly occurring – High Chances of occurrence

In the Questioner you will find more detailed information with evaluation criteria for each thematic section in the Legend sheet.

The evaluation results will be calculated in Risk Index (RI) column that defines the potential importance of the given risk in case. The other value that is required to be filled is Relevance. After the RI of the risk is known, it is crucial also to know how relevant the given risk is for the given region/country. *E.g. “legal framework” has pretty low damage; however, it may considerably prolong realization of the project development if not completely seize it. The relevance field is of particular interest as it highlights the points of the highest challenge in the course of the geothermal project development in the region.*

As you fight your way through all necessary entries. There is will be one last field (See Figure 4) – a place for additional notes. Here you can leave your comments concerning:

- 1) Notable specifications about the Given Project(s)
- 2) Table itself and suggestions for improvements
- 3) On additional information from your side.

Drilling	<input checked="" type="checkbox"/>	Well casing collapse	<input checked="" type="checkbox"/>							
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Blowouts	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>					
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Fluid communication between different formations due to ineffective isolation of the well	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>					
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Induced seismicity (above sensitivity level)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>					
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Surface subsidence or uplift	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>					
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Toxic emissions due to produced in-situ gases and fluids	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>					
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Lack or loss of integrity of the well/subsurface equipment	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>					
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Technical failures/difficulties during drilling (due to any additional causes that were not mentioned)	<input checked="" type="checkbox"/>						
	Additional Notes*									

Figure 4: Additional Notes Field

With this your survey will be complete.

We are grateful for your investment of information, time and effort.