

Risk Register and Risk Assessment Tools

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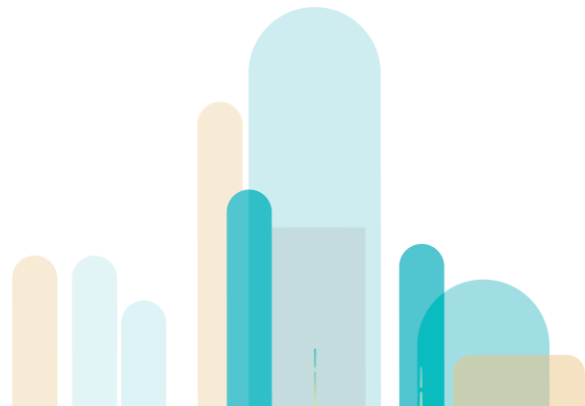
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Introduction

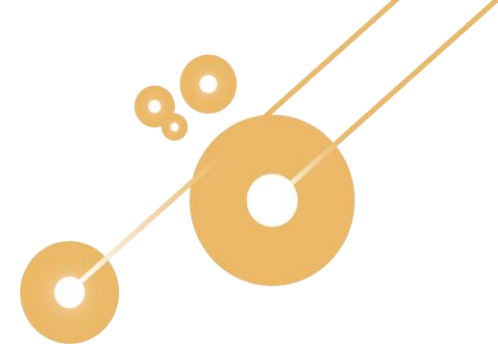
GEORISK is about Risk

Risk in GEORISK = possibility of (mainly financial) loss for developers of geothermal projects



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Introduction

Purpose of risk assessment

We need a good understanding of the risks before we can mitigate them

Understanding risk (« risk assessment ») means:

1. What can go wrong ? (« risk identification » – produces a risk register)
2. How likely is it? (« risk analysis »)
3. What are the associated consequences ? (« risk analysis »)

Only then can we ask:

4. What can we do about it ? (« risk mitigation »)

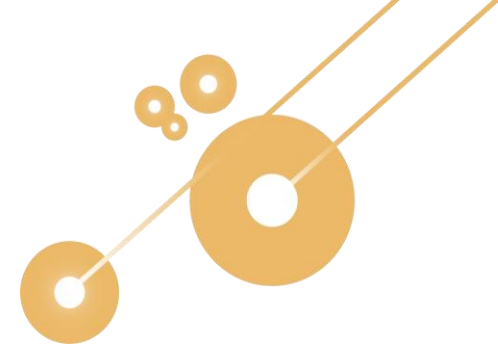
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Introduction

Work in progress

Today : overview of tools developed during first phase

Update of the tools during second phase (this year)

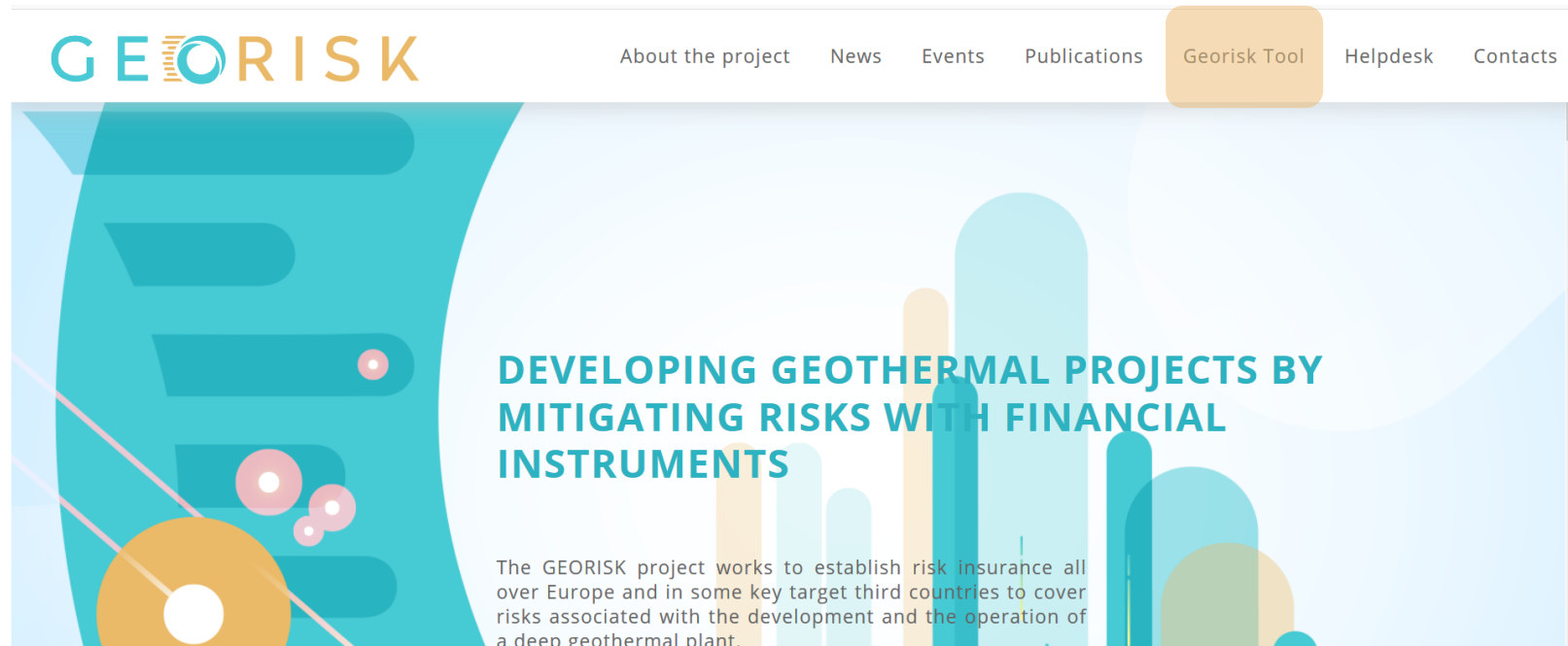


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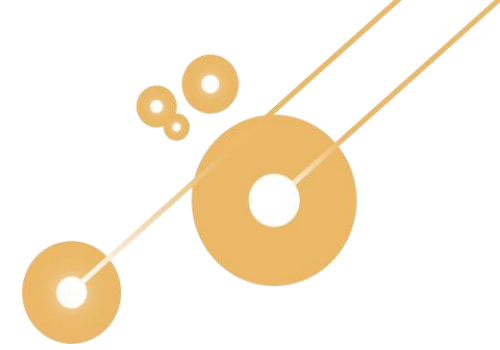
Risk register

What can go wrong?

www.georisk-project.eu :



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Risk register

What can go wrong?

GEORISK

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Category	Id	Phases				Description
		IE	DT	ED	PC	
Risks due to subsurface uncertainties	D-2			✓		Flow rate degrades over time
	D-4			✓		Temperature degrades too quickly
	D-6			✓		Pressure is changing during the operation in an unexpected way
	D-7	✓	✓	✓		Fluid chemistry/ gas content / physical properties are different from expected
	D-8			✓		Fluid chemistry/ gas content / physical properties change
	D-12	✓	✓	✓		Excessive scaling in the geothermal loop
	D-13	✓	✓	✓		Excessive corrosion in the geothermal loop
	D-14			✓		Particle production ("sanding")
	D-15			✓		Hydraulic connectivity between wells is insufficient for commercial use
	D-16	✓	✓			Re-injection of the fluid is more difficult than expected
D-17			✓		Degradation of the reservoir (structure, properties, deteriorating whole-scale further commercial utilization)	

FILTERS

Categories

- External hazards
- Risks due to uncertainties in the external context
- Risks due to internal deficiencies
- Risks due to subsurface uncertainties
- Technical issues
- Environment risks

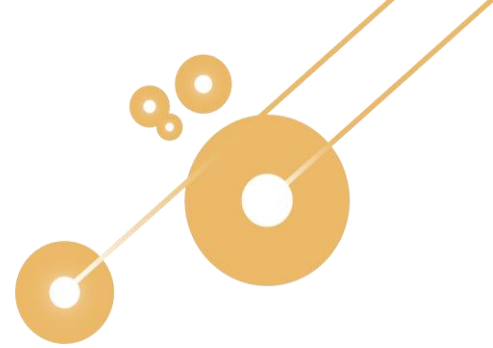
Phases

- Identification / Exploration
- Drilling / Testing
- Exploitation / Development
- Post-closure

For more details, click [here](#)

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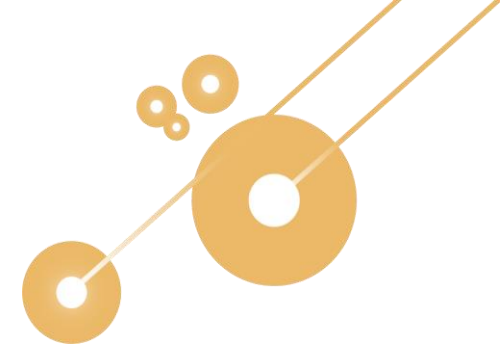


Risk analysis

How likely is it and what are the associated consequences ?

Country level => results from survey accessible on the website

Project level => Spreadsheet available as guidance



Country risk analysis

How likely is it and what are the associated consequences ?

Results from all GEORISK countries

More than 60 answers

2 questions for each risk :

- How likely is it (on a scale from 1 to 4)?
- How damaging is it (on a scale from 1 to 4)?

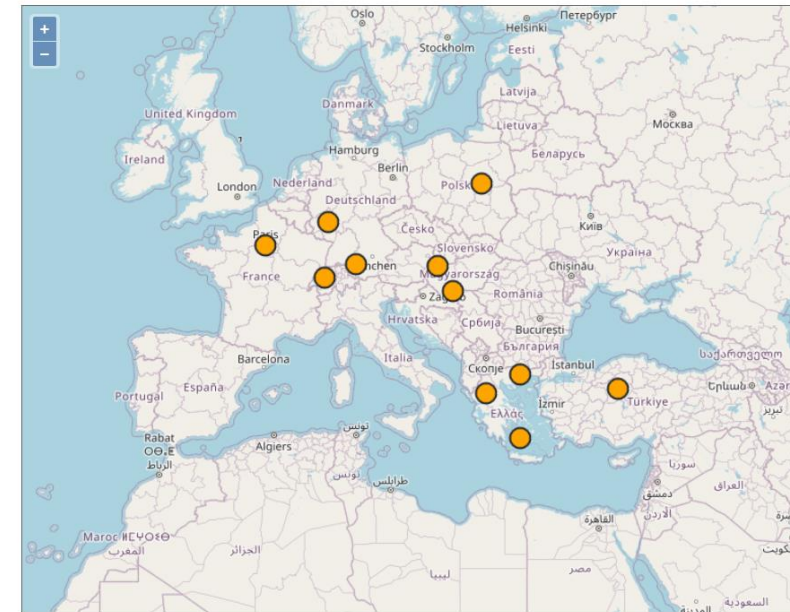
Summing both scores gives Risk Index

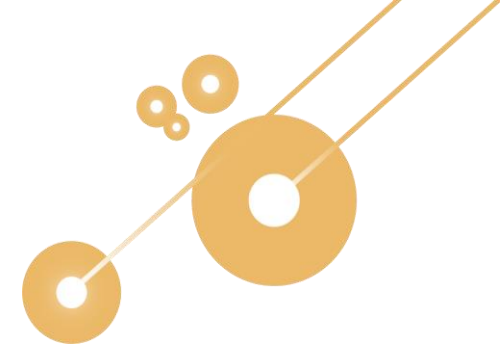
Additional question:

- How relevant is this risk to you (on a scale from 1 to 4)?

RESULTS FROM GEORISK

Click on the region you are interested in or get more info [here](#)





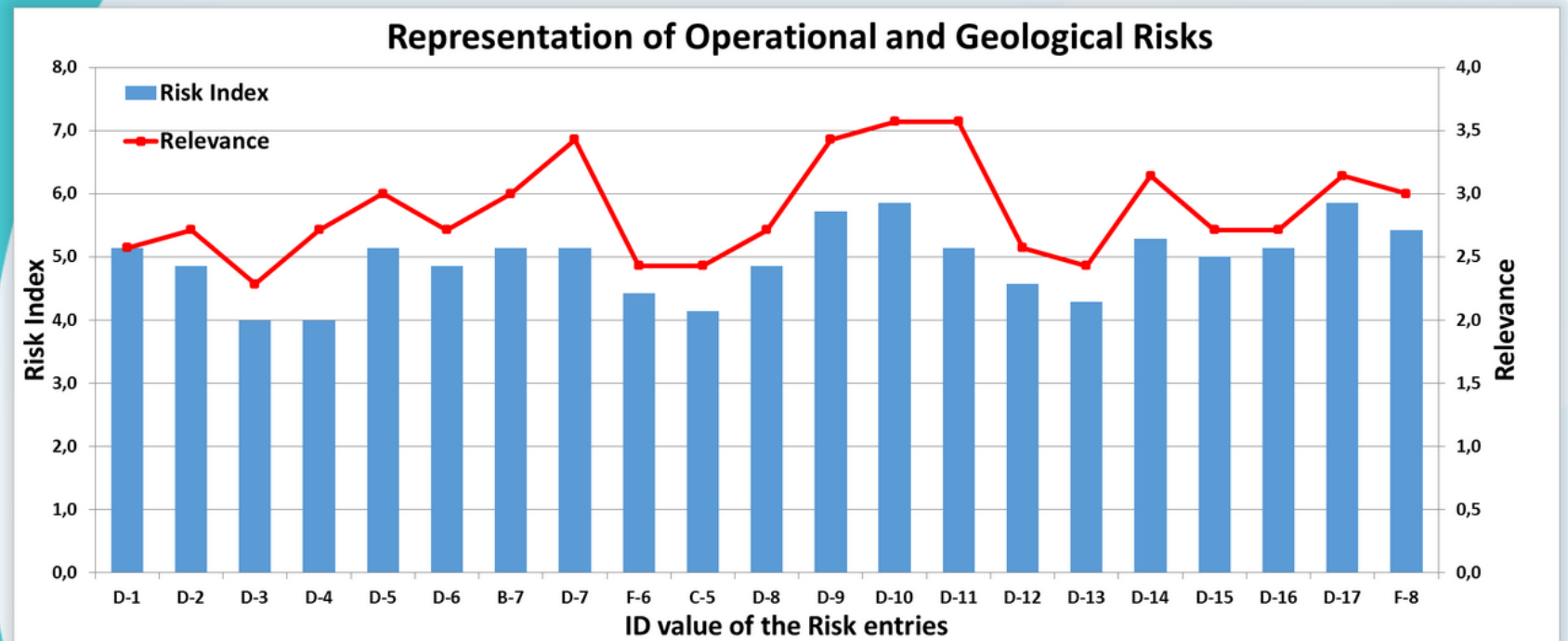
Country risk analysis

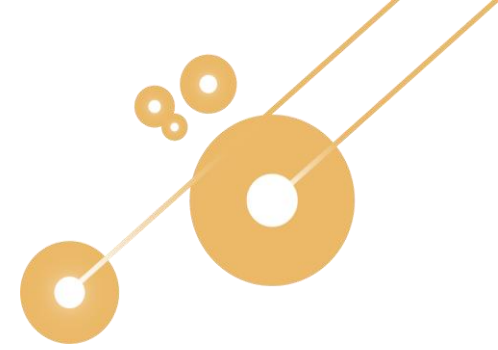
How likely is it and what are the associated consequences ?

HUNGARY, POROUS RESERVOIRS

- Socio-economic risks
- Operational and geological risks
- Drilling risks

- B-7 : Other users of the subsurface
- C-5 : Human error
- D-1 : Low initial flow rate
- D-2 : Degrading flow rate
- D-3 : Low initial temperature
- D-4 : Degrading temperature
- D-5 : Different initial pressure
- D-6 : Pressure changes
- D-7 : Different fluid chemistry
- D-8 : Fluid chemistry changes
- D-9 : Target formation missing
- D-10 : Insufficient fluid in formation





Risk management

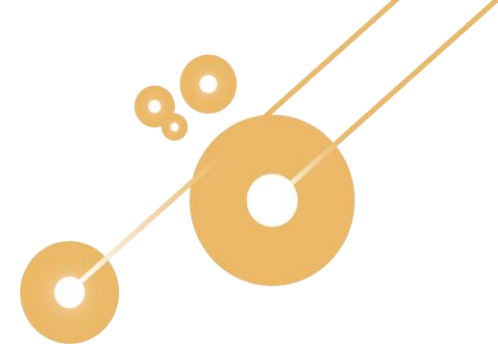
What can we do about it?

ONLINE RISK REGISTER

TARGET FORMATION HAS NO/INSUFFICIENT FLUID FOR COMMERCIAL PRODUCTION

- Category : Risks due to subsurface uncertainties
- Id : D-10
- Phases :
 - Drilling / Testing
- Consequences :
 - Economic / Performance / Acceptability

- Mitigation :
 - Technical :
 - Thorough geologicals survey/core sample analysis
 - Accurate collection an interpretation of expected geology for securing information on the target reservoir
 - Doing new surface geophysical measurements for the better understanding of expected geology for securing information on the target reservoir
 - Legal / Policy :
 - Insurance : Dedicated fund

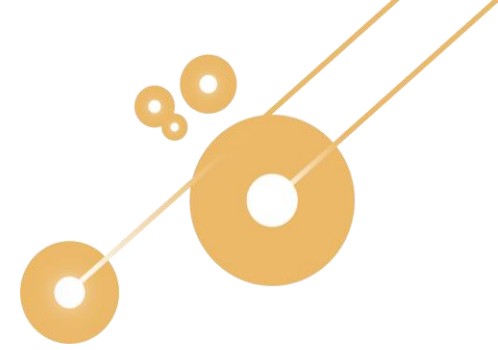


Project risk analysis

How likely is it and what are the associated consequences ?

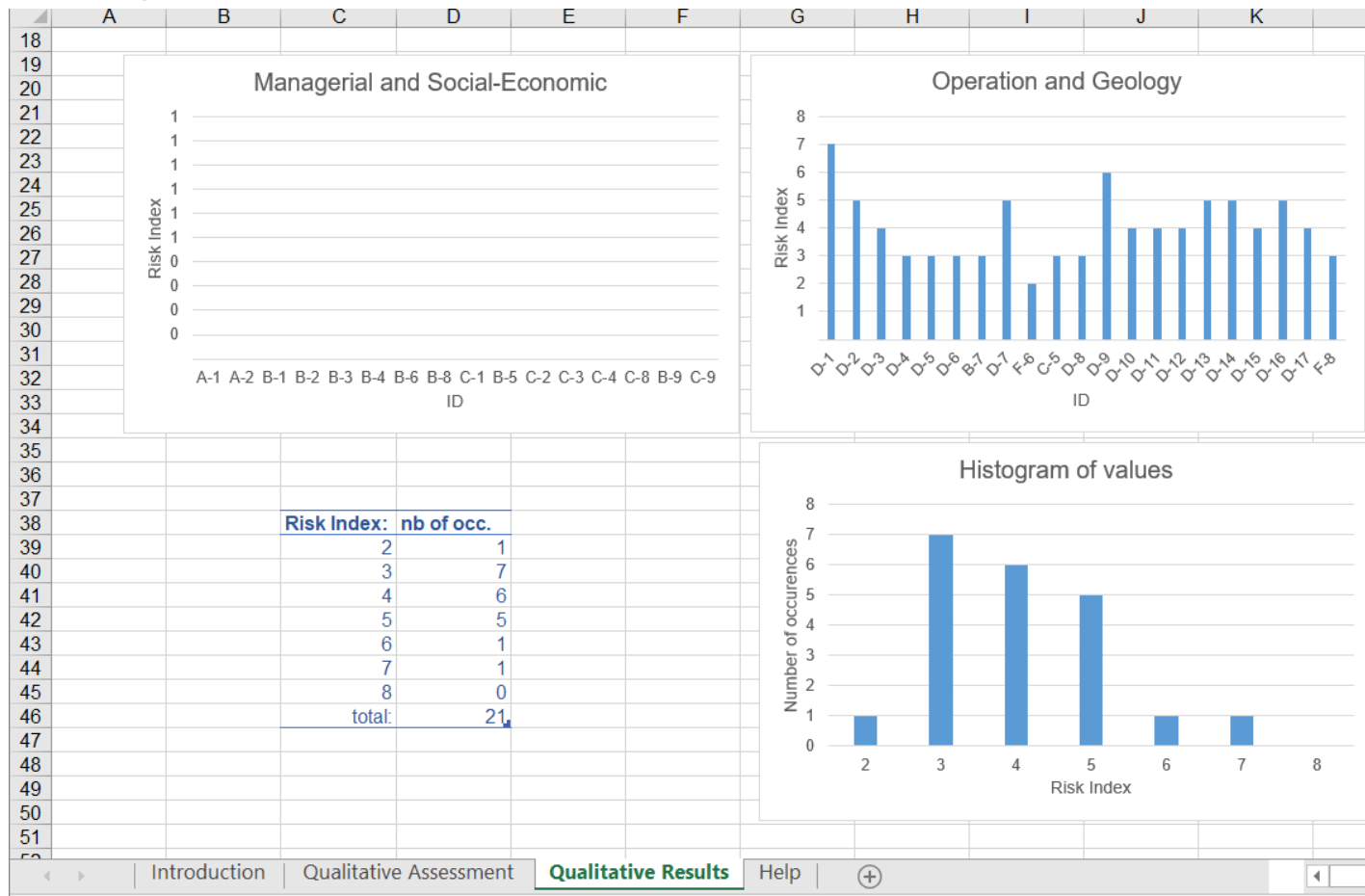
A	B	G	J	K	L	M
	Date	07/01/2020		Acceptability thresholds		
	Name of project	DEMO		1st	5	
	Version of assessment	1		2nd	7	
	Additional details	This is a demonstration for GEORISK webinar				
Topic	ID	Description	Likelihood	Risk Evaluation		Comments
				Damage Level	RI	
	D-1	Flow rate lower than expected (reservoir)	3	4	7	
	D-2	Flow rate degrades over time	2	3	5	
	D-3	Temperature lower than expected (reservoir)	2	2	4	
	D-4	Temperature degrades too quickly	1	2	3	
	D-5	Pressure lower/higher than expected	1	2	3	
	D-6	Pressure is changing during the operation in an unexpected way	1	2	3	
	B-7	Neighbouring operators cause negative changes to the reservoir parameters.	2	1	3	
	D-7	Fluid chemistry/ gas content / physical properties are different from expected	3	2	5	
	F-6	NCG Production	1	1	2	
	C-5	Human error leading to failure during work (including either insufficient background and/or regulations)	2	1	3	
	D-8	Fluid chemistry/ gas content / physical properties change	2	1	3	
	D-9	Target formation is missing in the well (unexpected geology, insufficient exploration)	2	4	6	
	D-10	Target formation has no/insufficient fluid for commercial production	2	2	4	
	D-11	Geological lithology or stratigraphy is different than expected	2	2	4	
	D-12	Excessive scaling in the geothermal loop	3	1	4	
	D-13	Excessive corrosion in the geothermal loop	4	1	5	
	D-14	Particle production ("sanding")	2	3	5	

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Project risk analysis

How likely is it and what are the associated consequences ?



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Next actions

Todo list

Improve the look

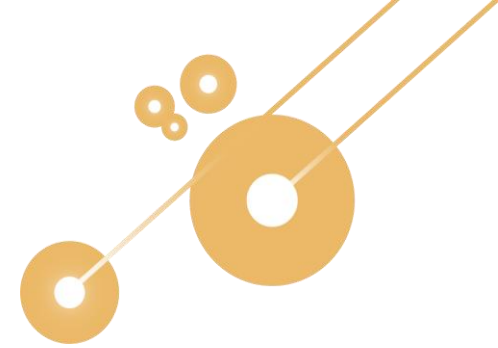
Improve content of risk sheets (mitigation measures)

Improve presentation of risk analysis results (other graphs)

Add quantitative section to risk analysis spreadsheet

Add possibility to show updates of risk analysis

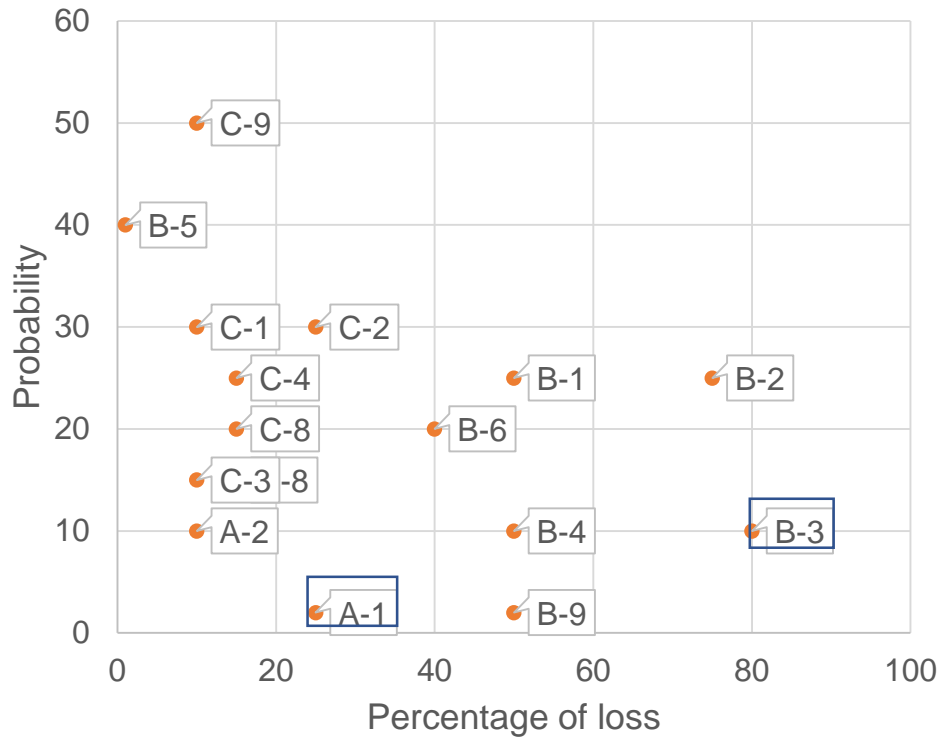
Any other suggestions welcome : t.leguenan@brgm.fr



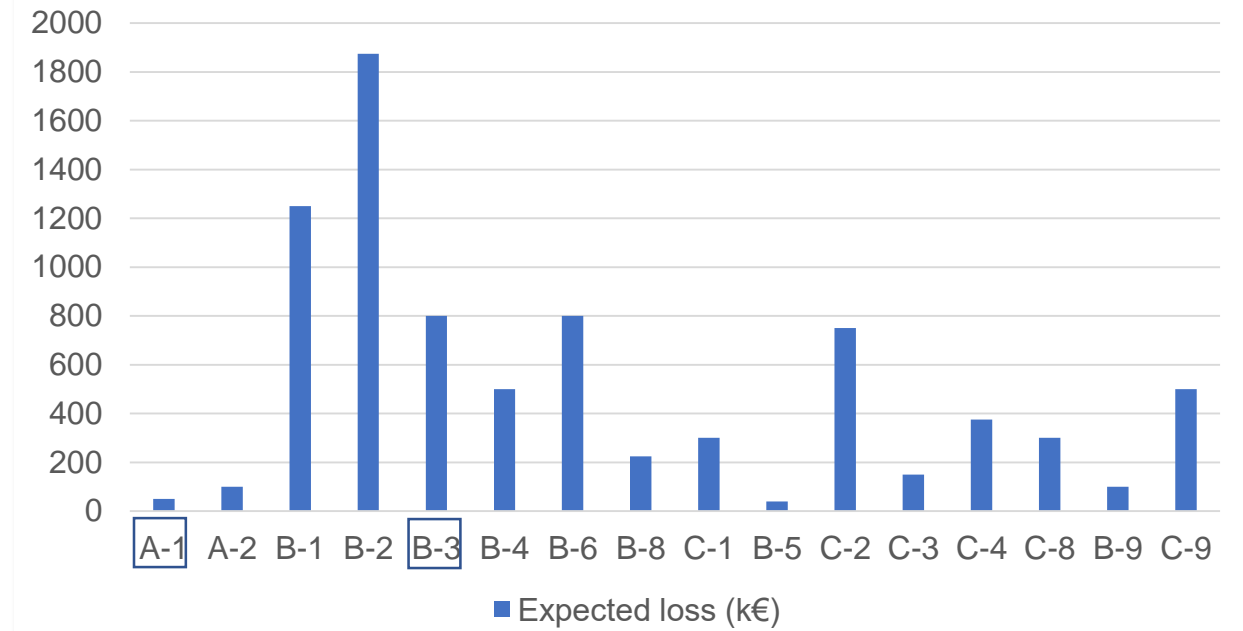


Results (qualitative analysis)

Risk Matrix



Total risk





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