

H2020 WORK PROGRAMME

D7.6 – TECHNOLOGICAL AND NON-TECHNOLOGICAL RISKS 2

LEAD BENEFICIARY: ENSO INNOVATION

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LIST OF ABBREVIATIONS AND DEFINITIONS

The following abbreviations and key concepts will be used along this report.

EC: European Commission.

EU: European Union.

ISO: International Organization for Standardization.

PDCA: Plan-Do-Check-Act.

CRM: Critical Raw Materials

PGM: Platinum Group Metals

R&D: Research and development

BR: Bauxite Residue

REE: Rare Earth Elements

WP: Work Package

MgW: Magnesium low grade waste

Hazard: intrinsic property or the ability of something (e.g., work materials, equipment, work methods and practices) with the potential to cause harm, injury, and ill health.

Risk: effect of uncertainty on objectives.

Risk management: coordinated activities to direct and control an organisation regarding risks.

Risk management framework: set of components that provide the foundations and organisational arrangements for designing, implementing, monitoring, reviewing and continually improving risk management throughout the organisation.

Risk management policy: statement of the overall intentions and direction of an organisation related to risk management.

Risk attitude: organisation's approach to assess and eventually pursue, retain, take, or turn away from risk.

Risk management plan: scheme within the risk management framework specifying the approach, the management components, and resources to be applied to the management of risk.

Risk owner: person or entity with the accountability and authority to manage a risk.

Risk management process: systematic application of management policies, procedures, and practices to the activities of communicating, consulting, establishing the context, and identifying, analysing, evaluating, treating, monitoring, and reviewing risk.



Establishing the context: defining the external and internal parameters to be considered when managing risk and setting the scope and risk criteria for the risk management policy.

External context: external environment in which the organization seeks to achieve its objectives. External context can include:

Internal context: internal environment in which the organization seeks to achieve its objectives. Internal context can include:

Communication and consultation: continual and iterative processes that an organization conducts to provide, share, or obtain information and to engage in dialogue with stakeholders regarding the management of risk.

Stakeholder: person or organization that can affect, be affected by, or perceive themselves to be affected by a decision or activity. A decision maker can be a stakeholder.

Risk assessment: overall process of risk identification, risk analysis and risk evaluation.

Risk identification: process of finding, recognising, and describing risks.

Risk source: element which alone or in combination has the intrinsic potential to give rise to risk. A risk source can be tangible or intangible.

Event: occurrence or change of a particular set of circumstances.

Consequence: outcome of an event affecting objectives.

Likelihood: chance of something to happen.

Risk profile: description of any set of risks. The set of risks can contain those that relate to the whole organisation, part of the organisation, or as otherwise defined.

Risk analysis: process to comprehend the nature of risk and to determine the level of risk. Risk analysis provides the basis for risk evaluation and decisions about risk treatment. Risk analysis includes risk estimation.

Risk criteria: terms of reference against which the significance of a risk is evaluated. Risk criteria are based on organisational objectives, and external and internal context. Risk criteria can be derived from standard, laws, policies, and other requirements.

Level of risk: magnitude of a risk or combination of risks, expressed in terms of the combination of consequences and likelihood.

Risk evaluation: process of comparing the results of risk analysis with risk criteria to determine whether the risk and/or its magnitude is acceptable or tolerable. Risk evaluation assists in the decision about risk treatment.

Risk treatment: process to modify risk.

Control: measure that modifies risk.



Residual risk: risk remaining after risk treatment.

Monitoring: continual checking, supervising, critically observing or determining the status to identify the change from the performance level required or expected. Monitoring can be applied to a risk management framework, risk management process, risk, or control.

Review: activity undertaken to determine the suitability, adequacy, and effectiveness of the subject matter to achieve established objectives. Review can be applied to a risk management framework, risk management process, risk, or control.



EXECUTIVE SUMMARY

BIORECOVER project aims to apply new sustainable and safe extractive technologies to obtain a wide range of CRMs from unexploited secondary and primary sources. Within this context, it has been envisaged a project's risk management (Task 7.3 – Health, Safety and Risk Assessment). This task has relevance due to the potential effects to personal and facilities infrastructure. The processes developed in BIORECOVER project must be evaluated to identify the critical aspects which could cause damage and risks during the experiments and running behaviour.

Deliverable 7.6 "Technological and non-technological risks 2" is the second report on the risk management process involving the projects' risks. Based in the work previously made by VERTECH, ENSO reviewed the methodology and the risks identified. This Deliverable sets the current status of the risks previously identified in deliverable 7.5 and includes those new risks detected.



1 FRAMEWORK FOR RISK MANAGEMENT

The success of the risk management (coordinated activities to direct and control an organisation regarding risk) will depend on the foundations and arrangements set out by the management framework. Thanks to this, the framework assists the risk management process to effectively manage risk and the outcomes of that will be properly reported and used as a basis for decision-making in the overall project management strategy. In other words, the risk management framework ensures that the process for managing risks is fully integrated in the overall project organisation. The different parts of the risk management framework and its interrelations are shown in Figure 1.

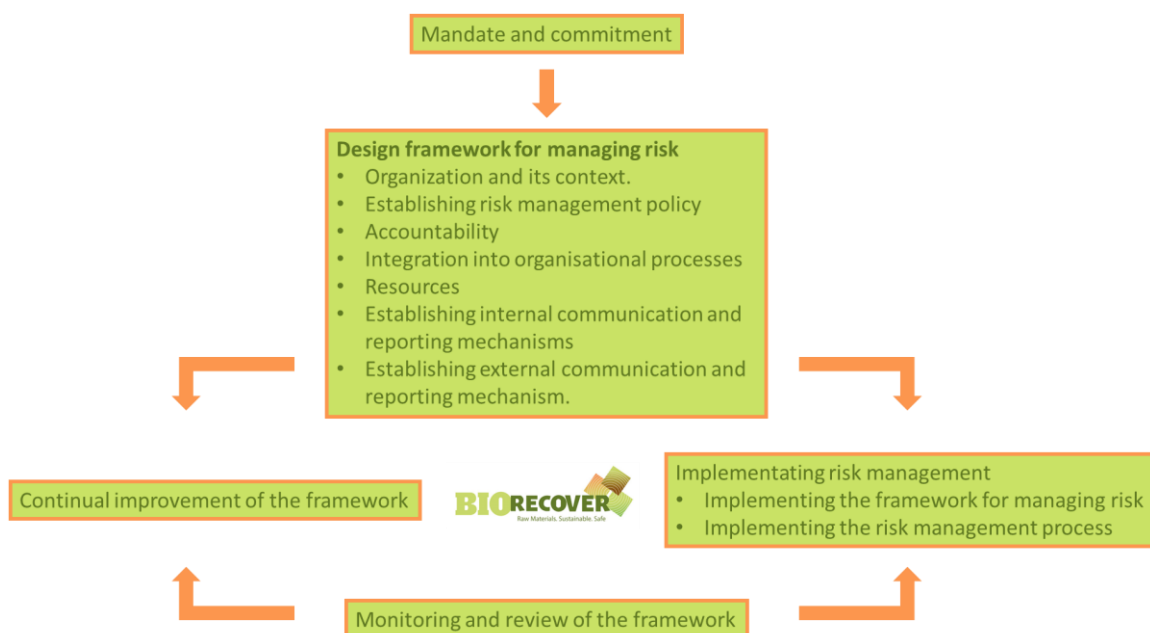


FIGURE 1. RELATIONSHIP BETWEEN THE COMPONENTS OF THE FRAMEWORK FOR MANAGING RISK (International Organization for Standardization 2018)

BIORECOVER consortium is aware of the importance of risk management in R&D projects. The achievement of the project’s objectives depends on how the consortium handles the organisational, financial, and scientific/technical risks. Hence, the commitment of the project with risk management is reflected in the implementation of this risk management process (part of the Task 7.3 – Health, Safety and Risk Assessment).

As part of this activity, the consortium endorses the risk management policy and the assignment of roles and responsibilities, as well as it supports and participates in all the actions carried out within the Project Risk Management.

The project consortium is committed to comply with the following risk management principles (International Organization for Standardization 2018):

Risk management creates and protects value.



- Risk management is an integral part of all organizational processes.
- Risk management is part of decision making.
- Risk management explicitly addresses uncertainty.
- Risk management is systematic, structured, and timely.
- Risk management is based on the best available information.
- Risk management is tailored.
- Risk management takes human and cultural factors into account.
- Risk management is transparent and inclusive.
- Risk management is dynamic, iterative, and responsive to change.
- Risk management facilitates continual improvement of the organization.

The main purpose of the H2020 projects' risk management processes is to ensure the satisfactory achievement of the project's objectives, overcoming the critical risks to its implementation. Consequently, following the objectives of the project described in Deliverable 7.5.

ENSO developed a Risk questionnaire that was completed by BIORECOVER partners during June 2020. They are initially familiar with Risk management processes, since all partners involved in the project have wide experience in H2020 projects, where risk management is very common. Nevertheless, ENSO provided guidance to the partners when needed.



2 RISK MANAGEMENT PROCESS

2.1 Context

The first report (D7.5) of Task 7.3 made by Vertech Group was focused on documenting and applying the ISO 31.000 Risk Management methodology during the project implementation. A preliminary Risk Assessment was developed in BIORECOVER's initial proposal with the objective to identify and evaluate the main risks affecting the rate of success of the project. In this deliverable, the contingency and mitigation actions addressed in BIORECOVER proposal are followed up, continuously updating, and monitoring the risks as part of the project Risk Management.

The scope of this risk management is the identification and evaluation of administrative, financial, technological, IPR, exploitation and dissemination risks related to the BIORECOVER project execution, addressing contingency and mitigation plans for significant risks. Risk management during the execution of the project is focused on overcoming potential threats to achieve the objectives of BIORECOVER.

ENSO is responsible to coordinate the risk management activities, gathering the information and assessing all risk management steps. The Project General Assembly is responsible to carry out the review and improvements of the risk management process during project meetings, as the main decision organism in the project. Meanwhile, the different partners take accountability for the risk assessment and treatment related to the activities they carry out, always guided by the risk manager ENSO.

2.2 Risk criteria

For deliverable 7.6, the risk matrix established in D7.5 by Vertech Group was updated in order to establish a common structure with respect to the matrix used in the Health and Safety Study to maintain a more coherent system throughout the project.

The consortium must define the criteria to evaluate the significance of risk, and whereas it should be treated. The Horizon2020 guidelines (European Commission 2018) recommend tailoring mitigation measures to those critical risks whose impact may cause that the stated project's objectives are not achieved. More specifically, they define critical risk as a "plausible event or issue that could have a high adverse impact on the ability of the project to achieve its objectives". The following factors will be considered:

- Nature and types of risks assessed. For project implementation, the categories in which the risks are classified are administrative, financial, technological, IPR, exploitation and dissemination.
- **Likelihood:** The likelihood is the estimated probability that the risk will materialise even after taking account of the mitigating measures put in place. The likelihood will be described semi-qualitatively (
- Table 1).



TABLE 1. LIKELIHOOD CRITERIA.

Likelihood	Description	Score
Almost certain	The event is expected to occur in most circumstances the event has a regular occurrence.	E
Likely	There is a strong possibility the event will occur. The event has a frequent occurrence.	D
Possible	The event might occur at some time. The event has casual occurrence.	C
Unlikely	Not expected, but there is slight possibility it may occur at some time.	B
Rare	Highly unlikely, but it may occur in exceptional circumstances. It could happen, but probably never will.	A

- **Consequences:** Consequences of the risk are the outcome of an event affecting objectives. It can be certain or uncertain and can have positive or negative effects on objectives. The consequences will be described semi-qualitative in function of its impact on project's objective (Table 2).

TABLE 2. CONSEQUENCES CRITERIA.

Consequence	Description	Score
Severe	A risk event that, if it occurs, will have a severe impact on achieving desired results, to the extent that one or more objectives will not be achieved.	5
Major	A risk event that, if it occurs will have a significant impact on achieving desired results, to the extent that one or more stated outcome objectives will fall below acceptable levels.	4
Moderate	A risk event that, if it occurs, will have a major impact on achieving desired results, to the extent that one or more stated outcome objectives will fall below goals but above minimum acceptable levels.	3
Minor	A risk event that, if it occurs, will have a minor impact on achieving desired results, to the extent that one or more stated outcome objectives will fall below goals but well above minimum acceptable levels.	2
Insignificant	A risk even that, if it occurs, will have little or no impact on achieving outcome objectives.	1

- **Risk Level:** It is the magnitude of a risk or combination of risks, expressed in terms of the combination of consequences and likelihood. In this project, it is measured following a



semi-quantitative method rating the likelihood (A to E) and consequence levels (1 to 5). The rate assigned to the level of risk will be obtained as the average between the likelihood and the consequences score.

TABLE 3 RISK MATRIX

		Consequence				
		Insignificant (1)	Minor (2)	Moderate (3)	Major (4)	Severe (5)
Likelihood		1	2	3	4	5
Rare (A)	1	1	2	3	4	5
Unlikely (B)	2	2	4	6	8	10
Possible (C)	3	3	6	9	12	15
Likely (D)	4	4	8	12	16	20
Almost Certain (E)	5	5	10	15	20	25

Depending on the level of the risk, it is classified as low, medium, high and extreme. Low risks are considered as negligible, and there is no need for implement any treatment measure. Medium and high risks, which are still acceptable, must be treated tailoring any effective measures for its mitigation or control. Extreme risks, which are unacceptable, must be urgently treated before the causes of the events occur.

TABLE 4 RISK TOLERANCE

Score	Descriptor
16-25	Extreme
11-15	High
5-10	Medium
1-4	Low

Depending on the level of the risk, different levels of the organisation will be involved in its management (always with the support and guidance of the Risk Manager). For low risks, it is considered that the task leader and its team can manage it, monitoring its progress and, if decided, implementing treatments measures. For medium and high risk, the task leader will be responsible for executing mitigation measures and managing the risk, but the WP leader will also oversee the management process. Regarding extreme risk, affecting in a severe way the project's objective, the GA together with the task leader will be involved in the decision making related to how the risk is going to be managed and treated.



Regardless of the result of the evaluation of individual risks, if the consortium detects that a certain set of low risks are affecting the same outcome (objective) of the project, an integral package of mitigation measures for treating them will be tailored.

2.3 Risk assessment methodologies

Every partner has been provided with a Risk register template so they can document the project's risk management process and report it properly to the Risk Manager and the rest of the consortium.

Methodology regarding Risk Identification, Analysis and Treatment have been reported under Deliverable 7.5



3 RISK ASSESSMENT RESULTS

3.1 Risk identification

“The organization should identify sources of risk, areas of impacts, events (including changes in circumstances) and their causes and their potential consequences. The aim of this step is to generate a comprehensive list of risks based on those events that might create, enhance, prevent, degrade, accelerate, or delay the achievement of objectives” (International Organization for Standardization 2018).

In the next table, the list of risks previously identified in the deliverable 7.5 was established, their current status was evaluated and it was determined if there were new possible risks identified according to the questionnaire sent to the leaders of the corresponding WP and answered so far.

Regarding the questionnaires that were not answered, it was assumed that the same level of risk previously identified was maintained.

This is a continuously updated list of hazards that evolves together with the project. ENSO, in charge of Risk management, gathers the information about new risks found out by the consortium.



TABLE 5 PROJECT RISK IDENTIFICATION

Risk Management Register				NEW RESULTS (June 2022)					PREVIOUS (Nov 2020)	
Nº	WP Leader	Risk	Risk management mitigation measures	Likelihood	Conseq.		Partner	Likelihood	Conseq.	
1	MYTILINE OS (WP1)	The properties of the provided source/s are significantly different from those considered in the project	The process is able to adapted to raw materials. Also, the possibility of supplying other raw materials is guaranteed by the consortium	Possible (C)	Moderate (3)	M	LNU / UCPH	Possible (C)	Moderate (3)	M
2	UCPH (WP2)	Difficulties to identify the most suitable indigenous strains	Test microorganisms already available in the microbial libraries of the partners or public microbial libraries	Likely (D)	Moderate (3)	H	UCPH	Likely (D)	Moderate (3)	H
3	UCPH (WP2)	Bacterial strains for pre-treatment not able to growth on BR	Additional conditioning steps of existing technologies will be used in combination with biorecover technology	Likely (D)	Moderate (3)	H	UCPH	Likely (D)	Moderate (3)	H
4	LNU (WP3)	Pt/PGM difficult to be leachate by biotechnological means	Research on bioleaching process modifications able to improve the mobilisation efficiency	Possible (C)	Moderate (3)	M	CETIM	Possible (C)	Moderate (3)	M
5	TR (WP4)	Not have enough amount of bioleachate for recovery tests	Use synthetic leachate or dissolved by-products from partners while enough bioleachate is not available	Almost Certain (E)	Moderate (3)	H	LNU	Rare (A)	Major (4)	L
6	CETIM (WP5)	Delay in the process integration	Each stage will be evaluated individually in order to continue check their yield until integration	Likely (D)	Moderate (3)	H	MAGNA	Possible (C)	Moderate (3)	M



			takes place							
7	CETIM (WP5)	Decrease in performance of the integrated system respect to lab-scale individual-steps tests	Operating conditions will be changed to minimise the differences among individual steps and the integrated process	Possible (C)	Moderate(3)	M	ALGAENE RGY	Possible (C)	Moderate (3)	M
8	TR (WP4)	Selectivity and/or purity of the recovered metal is not enough	The use of a combination of post-treatments will be studied in order to reach high selectivity and purity	Possible (C)	Major (4)	H	MAGNA	Possible (C)	Severe (5)	H
9	TR (WP4)	Characteristics or quality of recovered metals do not fit the requirements set by the end-users	Recovered materials validation studies will be carried out with commercial materials simulating expected chemical and physical characteristics	Possible (C)	Severe (5)	H	MAGNA	Possible (C)	Severe (5)	H
10	JM (WP6)	The efficiency of the produced salt & sponges for catalysis is not similar to their commercial equivalents	Potential corrective actions to improve efficiency. Different activation treatments could be applied to activate the catalysts/improve efficiency	Possible (C)	Moderate (3)	M	MAGNA	Possible (C)	Moderate (3)	M
11	CETIM (WP9)	Lack of adherence to the common vision for the project	Kick-off meeting for all partners to ensure alignment. Regular project communications & alignment. Regular project communication & update meetings within and across related WPs. Professional project management	Possible (C)	Moderate (3)	M	ALL	Unlikely (B)	Moderate (3)	M



12	TR (WP ₄)	Chosen microalgae species do not have sufficient absorbent capacity for the recovery of critical raw materials	AlgaEnergy has planned to carry out biosorption tests with at least four different species of microalgae. In the event that the results are not adequate, the company may have other strains available to carry out new evaluations.	Unlikely (B)	Minor (2)	L	ALGAENERGY	Unlikely (B)	Minor (2)	L
13	LNU (WP ₃)	REEs difficult to be leachable by biotechnological means	Testing of different leaching strategies to find a suitable purpose	Rare (A)	Major (4)	L	LNU	Rare (A)	Major (4)	L
14	LNU (WP ₃)	Mg ores difficult to be leachable by biotechnological means	Testing of different leaching strategies to find a suitable purpose	Rare (A)	Major (4)	L	LNU	Rare (A)	Major (4)	L
15	ENSO (WP ₇)	Biotechnological processes too expensive for economic case	Investigation of low-cost processes	Unlikely (B)	Major (4)	M	LNU	Unlikely (B)	Major (4)	H
16	CETIM (WP ₉)	Poor communication between partners, inadequate planning or delays due to the COVID. Delays in sending results from a WP that affects to further WPs (includes material exchange)	Clear definition of responsibilities, Effective communication between partners, Reconsider alternative pathways to advance in R&D activities until the reception of information to avoid the accumulation of delays	Likely (D)	Moderate (3)	H	ALL	Unlikely (B)	Major (4)	H
17	CETIM (WP ₉)	External factors (ie COVID) may delay	Ensure communication between project partners to enable early	Unlikely (B)	Minor (2)	L	All	Unlikely (B)	Moderate (3)	M



		project deliverables, dependencies between partners, leading to tasks in unfinanced time periods	warning of potential inter-partners dependencies							
18	CETIM (WP9)	Lockdowns and mobility limitations due to the COVID-19 global pandemic: impossibility to access lab/field, home lockdown, service and goods providers closed, limitations on number of workers at office/university, selection/hiring procedures halted	Advance in desk work in teleworking mode (deliverables, reports, publications). Deploy staff to lab/field work as soon as possible, according to national limitations, and in full compliance with all safety measures. Work with pre-existing samples of similar characteristics when access to new samples is not possible due to lockdown limitations. Organise all events (meetings, conferences...) in virtual mode. Preparation of protocols to obtain samples from partners instead of travelling to perform the sampling in situ.	Rare (A)	Moderate (3)	L	All	Almost Certain (E)	Severe (5)	E
19	ENSO (WP7)	Do not provide us with data for life cycle analysis or that is not of quality	Keep in touch with partners and use reference or bibliographic data to complete the analysis	Unlikely (B)	Major (4)	M	CETIM, ALGAENE RGY, TR, UWITS	--	--	--
20	TR (WP4)	The real bioleachate has a lower REE composition than expected.	Include an REE concentration step before the recovery step	Almost Certain (E)	Moderate (3)	H	TR	--	--	--



21	CETIM (WP5)	Biosynthesis of Mg nanoparticles with fungi extracellular extracts not successful	Research and use of commercial enzymes and alternative compounds such as amylases or polyphenols	Possible (C)	Major (4)	H	TR	--	--	--
22	JM (WP6)	Biological processes are yielding PGM sulphates rather than nitrates. This could have an impact on the activity of the final catalysts produced	Routes will need to be established to replace the sulphate counterion of the metals with another one which will be benign to catalysis (e.g. nitrate, oxide)	Likely (D)	Minor (2)	M	JM	--	--	
23	CETIM (WP7)	Not achieving a geopolymer material from the wastes after treatment	Modify parameters involved in geopolymerization process and test another alkali solutions	Unlikely (B)	Major (4)	M	ALL	--	--	
24	CETIM (WP7)	Not achieving the minimum mechanical properties to give birth to an alternative cement	Modify parameters involved in geopolymerization process and test another alkali solutions	Possible (C)	Moderate (3)	M	ALL	--	--	



3.2 Risk analysis and evaluation

Once the risks have been identified, they must be analysed and evaluated in order to clarify its importance and the need of being treated in the mitigation and contingency plan. The aim of risk analysis is to address the potential severity of the harm and the likelihood of occurrence so the hazardous events identified can be grouped and assessed together. Afterwards, the risk evaluation step classifies the analysed risks to establish its tolerability.

The risk register (in Annex A) contains the evaluation of risk's levels after the implementation (or not) of the mitigation measures.

4 RISK TREATMENT

Risk treatment involves selecting one or more options for modifying risks and implementing those options. After implementation, treatments modify the characteristics of the risks (likelihood and consequences). This is reflected in the risk register (Annex A).

During the monitoring and review of these measures, the effectiveness of the treatments will be assessed and whether it is necessary to modify them or tailor new treatment options. Every risk treatment leads to a residual risk, which is also monitored as any other project's risk.

5 RISK MONITORING AND REVIEW

Monitoring and review are crucial parts of the Plan-Do-Check-Act management cycle. The need to monitor and review the risk assessment and risk treatment has already been addressed in previous sections of the Project Risk Management Plan.

Each partner responsible for any risks has the accountability for the monitoring of risks and its treatment during the project implementation. They will have the autonomy to handle these issues during their daily activity and report them regularly in the Project Meetings and WP Technical Meetings, as reflected in the Annex A, Risk Register. However, it is recommended to report any deviation from the Risk Management Plan to the Risk Manager and, if necessary, to WP leader and Project Coordinator.

If the partner or person responsible for any task in the project detects an emerging risk, he or she has the duty to carry out the risk assessment in order to evaluate the emergency of acting on the risk and report the situation to the Risk Manager and WP Leader.



6 CONCLUSIONS

The first Deliverable 7.5 of the Task 7.3 reports series (D7.5 – D7.7) has been focused on the construction of the project risk management process framework and the first inputs and reviews of the system. This second deliverable (D7.6) focused on reviewing the current status of the primarily identified risks and identifying new risks and their ways to mitigate them.

In this way, greater integration and communication is maintained with the leaders of the WP to maintain a follow-up of the risk and its evolution in the progress of the project.

Regarding the data obtained in the project risk table, the current status of the previously identified risks and their mitigation measure were obtained. New possible risks and their level of risk were determined. Obtaining to date, according to the questionnaires answered, 6 new risks were identified, 4 Medium and 2 high; and its mitigation measures.

In contrast, by reevaluating the risks obtained in deliverable 7.5, risk number 5 generated an increase in its level from low to high due to a large increase in its likelihood. On the other hand, 7 previously identified risks remained at the same level, although in some they varied their likelihood and consequence. Finally, 3 risks managed to be reduced from high to medium, from medium to low and from extreme to low respectively.

In the coming months, the evolution of these risks will be prioritized and analysed, meetings will be considered in order to find out the reason for the increase in the level of risk in those in which this case has occurred.



7 REFERENCES

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ANNEX A. BIORECOVER RISK REGISTER

Annexe A. Project's risk register

RISK ID and type	Po1 Technical							
WP and/or task:	WP2, Wp3, Wp5							
Main responsible:	LNU, UCPH							
Other risk owners:								
RISK IDENTIFICATION								
RISK DESCRIPTION AND CONSEQUENCES	The properties of the provided source/s are significantly different from those considered in the project.							
RISK ANALYSIS	Rate	Date	Rate	Date	Rate	Date	Rate	Date
LIKELIHOOD	A	2020/11	C	2020/11	-	2022/06		
CONSEQUENCES	3	2020/11	3	2020/11	-	2022/06		
RISK EVALUATION	Rate	Date	Rate	Date	Rate	Date	Rate	Date
	Medium (LNU)	2020/11	Medium (UCPH)	2020/11	-	2022/06		
RISK TREATMENT	Description							Date
Measure 1	The process is flexible and to able to adaptable to raw materials. Furthermore, the possibility of supplying other raw materials is granted by the capacities of the consortium.							2020/11
Residual risk								
Measure performance								

RISK ID and type	Po2 Technical							
WP and/or task:	WP2, Wp3, Wp4							
Main responsible	LNU, TR							
Other risk owners:								
RISK IDENTIFICATION								
RISK DESCRIPTION AND CONSEQUENCES	Difficulties to identify the most suitable indigenous strains.							
RISK ANALYSIS	Rate	Date	Rate	Date	Rate	Date	Rate	Date
LIKELIHOOD	B	2020/11	B	2020/11	D	2020/11	D	2022/06
CONSEQUENCES	3	2020/11	1	2020/11	3	2020/11	3	2022/06
RISK EVALUATION	Rate	Date	Rate	Date	Rate	Date	Rate	Date
	Medium (LNU)	2020/11	Low (TR)	2020/11	High (UCPH)	2020/11	High (UPCH)	2022/06
RISK TREATMENT	Description							Date
Measure	Test microorganisms already available in the microbial libraries of the partners or public microbial libraries.							2020/11
Residual risk								
Measure performance								



RISK ID and type	Po₃ Technical							
WP and/or task:	WP ₂							
Main responsible	UCPH							
Other risk owners:								
RISK IDENTIFICATION								
RISK DESCRIPTION AND CONSEQUENCES	Bacterial strains for pre-treatment not able to growth on BR.							
RISK ANALYSIS	Rate	Date	Rate	Date	Rate	Date	Rate	Date
LIKELIHOOD	D	2020/12	D	2022/06				
CONSEQUENCES	3	2020/12	3	2022/06				
RISK EVALUATION	Rate	Date	Rate	Date	Rate	Date	Rate	Date
	High (UCPH)	2020/12	High (UPCH)	2022/06				
RISK TREATMENT	Description							Date
Measure 1	Additional conditioning steps of existing technologies will be used in combination with biorecover technology.							2019/08
Residual risk								
Measure performance								

RISK ID and type	Po₄ Technical							
WP and/or task:	WP ₃							
Main responsible	CETIM							
Other risk owners:	All technical partners							
RISK IDENTIFICATION								
RISK DESCRIPTION AND CONSEQUENCES	Pt/PGM difficult to be leachable by biotechnological means.							
RISK ANALYSIS	Rate	Date	Rate	Date	Rate	Date	Rate	Date
LIKELIHOOD	C	2020/12						
CONSEQUENCES	3	2020/12						
RISK EVALUATION	Rate	Date	Rate	Date	Rate	Date	Rate	Date
	Medium (CETIM)	2020/12						
RISK TREATMENT	Description							Date
Measure 1	Research on bioleaching process modifications (e.g. additives) able to improve the mobilisation efficiency.							2020/11
Residual risk								
Measure performance								



RISK ID and type	Po5 Technical							
WP and/or task:	WP4							
Main responsible	ALGAENERGY, LNU, TR							
Other risk owners:								
RISK IDENTIFICATION								
RISK DESCRIPTION AND CONSEQUENCES	Not have enough amount of bioleachate for recovery tests.							
RISK ANALYSIS	Rate	Date	Rate	Date	Rate	Date	Rate	Date
LIKELIHOOD	B	2020/11	A	2020/11	C	2020/11	E	2022/06
CONSEQUENCES	2	2020/11	4	2020/11	2	2020/11	3	2022/06
RISK EVALUATION	Rate	Date	Rate	Date	Rate	Date	Rate	Date
	Low (ALGAENERGY)	2020/11	Low (LNU)	2020/11	Low (TR)	2020/11	High (TR)	2022/06
RISK TREATMENT	Description							Date
Measure 1	Use synthetic leachate or dissolved by-products from partners while enough bioleachate is not available.							2020/11
Residual risk								
Measure performance								

RISK ID and type	Po6							
WP and/or task:	WP5, WP6, WP7							
Main responsible	MAGNA, FAE, CETIM							
Other risk owners:								
RISK IDENTIFICATION								
RISK DESCRIPTION AND CONSEQUENCES	Delay in the process integration							
RISK ANALYSIS	Rate	Date	Rate	Date	Rate	Date	Rate	Date
LIKELIHOOD	C	2020/11	C	2020/11	C	2020/11	D	2022/06
CONSEQUENCES	3	2020/11	1	2020/11	2	2020/11	3	2022/06
RISK EVALUATION	Rate	Date	Rate	Date	Rate	Date	Rate	Date
	Medium (MAGNA)	2020/11	Low (FAE)	2020/11	Low (AlgaEnergy)	2020/11	High (CETIM)	2022/06
RISK TREATMENT	Description							Date
Measure 1	Each stage will be evaluated individually in order to continue check their yield until integration takes place.							2020/11
Residual risk								
Measure performance								



RISK ID and type	Po7							
WP and/or task:	WP5							
Main responsible	ALGAENERGY							
Other risk owners:								
RISK IDENTIFICATION								
RISK DESCRIPTION AND CONSEQUENCES	Decrease in performance of the integrated system respect to lab-scale individual-steps tests.							
RISK ANALYSIS	Rate	Date	Rate	Date	Rate	Date	Rate	Date
LIKELIHOOD	C	2020/11	C	2022/06				
CONSEQUENCES	3	2020/11	3	2022/06				
RISK EVALUATION	Rate	Date	Rate	Date	Rate	Date	Rate	Date
	Medium (ALGAENERGY)	2020/11	Medium (CETIM)	2022/06				
RISK TREATMENT	Description							Date
Measure 1	Operating conditions will be changed to minimise the differences among individual steps and the integrated process.							2020/11
Residual risk								
Measure performance								

RISK ID and type	Po8							
WP and/or task:	WP4							
Main responsible	TR, MAGNA, ALGAENERGY							
Other risk owners:								
RISK IDENTIFICATION								
RISK DESCRIPTION AND CONSEQUENCES	Selectivity and/or purity of the recovered metal is not enough.							
RISK ANALYSIS	Rate	Date	Rate	Date	Rate	Date	Rate	Date
LIKELIHOOD	C	2020/11	C	2020/11	C	2022/06		
CONSEQUENCES	5	2020/11	3	2020/11	4	2022/06		
RISK EVALUATION	Rate	Date	Rate	Date	Rate	Date	Rate	Date
	High (MAGNA)	2020/11	Medium (ALGAENERGY)	2020/11	High (TR)	2022/06		
RISK TREATMENT	Description							Date
Measure 1	The use of a combination of post-treatments will be studied in order to reach high selectivity and purity.							2020/11
Residual risk								
Measure performance								



RISK ID and type	P09										
WP and/or task:	WP2, WP3, WP4, WP5, WP6, WP7										
Main responsible	MAGNA, FAE, LNU, TR										
Other risk owners:											
RISK IDENTIFICATION											
RISK DESCRIPTION AND CONSEQUENCES	Characteristics or quantity of recovered metals do not fit the requirements set by the end-users.										
RISK ANALYSIS	Rate	Date	Rate	Date	Rate	Date	Rate	Date	Rate	Date	
LIKELIHOOD	C	2020/11	C	2020/11	A	2020/11	B	2020/11	C	2022/06	
CONSEQUENCES	5	2020/11	3	2020/11	4	2020/11	2	2020/11	5	2022/06	
RISK EVALUATION	Rate	Date	Rate	Date	Rate	Date	Rate	Date	Rate	Date	
	High (MAGNA)	2020/11	Medium (FAE)	2020/11	Low (LNU)	2020/11	Low (TR)	2020/11	High (TR)	2022/06	
RISK TREATMENT	Description							Date			
Measure 1	Recovered materials validation studies will be carried out with commercial materials simulating expected chemical and physical characteristics.							2020/11			
Residual risk											
Measure performance											

RISK ID and type	P10										
WP and/or task:	WP2, WP3, WP4, WP5, WP6, WP7										
Main responsible	MAGNA, TR										
Other risk owners:											
RISK IDENTIFICATION											
RISK DESCRIPTION AND CONSEQUENCES	The efficiency of the produced salt and sponges for catalysis is not similar to their commercial equivalents.										
RISK ANALYSIS	Rate	Date	Rate	Date	Rate	Date	Rate	Date	Rate	Date	
LIKELIHOOD	C	2020/11	B	2020/11							
CONSEQUENCES	3	2020/11	2	2020/11							
RISK EVALUATION	Rate	Date	Rate	Date	Rate	Date	Rate	Date	Rate	Date	
	Medium (MAGNA)	2020/11	Low (TR)	2020/11							
RISK TREATMENT	Description							Date			
Measure 1	Potential corrective actions to improve efficiency. Different activation treatments could be applied to activate the catalysts/improve efficiency.							2020/11			
Residual risk											



Measure performance		
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RISK ID and type	P11 Communication and Administrative							
WP and/or task:	WP2, WP3, WP4, WP5							
Main responsible	LNU, TR, UCPH							
Other risk owners:								
RISK IDENTIFICATION								
RISK DESCRIPTION AND CONSEQUENCES	Lack of adherence to the common vision for the project.							
RISK ANALYSIS	Rate	Date	Rate	Date	Rate	Date	Rate	Date
LIKELIHOOD	A	2020/11	A	2020/11	B	2020/11	C	2022/06
CONSEQUENCES	3	2020/11	1	2020/11	3	2020/11	3	2022/06
RISK EVALUATION	Rate	Date	Rate	Date	Rate	Date	Rate	Date
	Low (LNU)	2020/11	Low (TR)	2020/11	Medium (UCPH)	2020/11	Medium (CETIM)	2022/06
RISK TREATMENT	Description							Date
Measure 1	Kick-off meeting for all partners to ensure alignment. Regular project communications & alignment. Regular project communication & update meetings within and across related WPs. Professional project management.							2020/11
Residual risk								
Measure performance								

RISK ID and type	P12 Technical							
WP and/or task:	WP4- ST 4.2.2							
Main responsible	ALGAENERGY							
Other risk owners:								
RISK IDENTIFICATION								
RISK DESCRIPTION AND CONSEQUENCES	Chosen microalgae species do not have sufficient absorbent capacity for the recovery of critical raw materials.							
RISK ANALYSIS	Rate	Date	Rate	Date	Rate	Date	Rate	Date
LIKELIHOOD	B	2020/11						
CONSEQUENCES	2	2020/11						
RISK EVALUATION	Rate	Date	Rate	Date	Rate	Date	Rate	Date
	Low (ALGAENERGY)	2020/11						
RISK TREATMENT	Description							Date
Measure 1	AlgaEnergy has planned to carry out biosorption tests with at least four different species of microalgae. In the event that the results are not adequate, the company may have other strains available to carry out new evaluations.							2020/11



Residual risk		
Measure performance		

RISK ID and type	P13 Technical							
WP and/or task:	WP3							
Main responsible	LNU							
Other risk owners:								
RISK IDENTIFICATION								
RISK DESCRIPTION AND CONSEQUENCES	REEs difficult to be leachable by biotechnological means.							
RISK ANALYSIS	Rate	Date	Rate	Date	Rate	Date	Rate	Date
LIKELIHOOD	A	2020/11						
CONSEQUENCES	4	2020/11						
RISK EVALUATION	Rate	Date	Rate	Date	Rate	Date	Rate	Date
	Low (LNU)	2020/11						
RISK TREATMENT	Description							Date
Measure 1	Testing of different leaching strategies to find a suitable purpose.							2020/11
Residual risk								
Measure performance								

RISK ID and type	P14 Technical							
WP and/or task:	WP3							
Main responsible	LNU							
Other risk owners:								
RISK IDENTIFICATION								
RISK DESCRIPTION AND CONSEQUENCES	Mg ores difficult to be leachable by biotechnological means.							
RISK ANALYSIS	Rate	Date	Rate	Date	Rate	Date	Rate	Date
LIKELIHOOD	A	2020/11						
CONSEQUENCES	4	2020/11						
RISK EVALUATION	Rate	Date	Rate	Date	Rate	Date	Rate	Date
	Low (LNU)	2020/11						
RISK TREATMENT	Description							Date
Measure 1	Testing of different leaching strategies to find a suitable purpose.							2019/08
Residual risk								
Measure performance								



RISK ID and type	P15 Business-related							
WP and/or task:	WP7							
Main responsible	LNU							
Other risk owners:								
RISK IDENTIFICATION								
RISK DESCRIPTION AND CONSEQUENCES	Biotechnological processes too expensive for economic case.							
RISK ANALYSIS	Rate	Date	Rate	Date	Rate	Date	Rate	Date
LIKELIHOOD	B	2020/11	B	2022/06				
CONSEQUENCES	4	2020/11	4	2022/06				
RISK EVALUATION	Rate	Date	Rate	Date	Rate	Date	Rate	Date
	Medium (LNU)	2020/11	Medium (ENSO)	2022/06				
RISK TREATMENT	Description							Date
Measure 1	Investigation of low-cost processes.							2020/11
Residual risk								
Measure performance								

RISK ID and type	P16 Business-related							
WP and/or task:	All WPs							
Main responsible	All partners							
Other risk owners:								
RISK IDENTIFICATION								
RISK DESCRIPTION AND CONSEQUENCES	Poor communication between partners, inadequate planning or delays due to the COVID. Delays in sending results from a WP that affects to further WPs (includes material exchange)							
RISK ANALYSIS	Rate	Date	Rate	Date	Rate	Date	Rate	Date
LIKELIHOOD	B	2020/11	B	2022/06				
CONSEQUENCES	4	2020/11	4	2022/06				
RISK EVALUATION	Rate	Date	Rate	Date	Rate	Date	Rate	Date
	Medium (LNU)	2020/11	Medium (ENSO)	2022/06				
RISK TREATMENT	Description							Date
Measure 1	<ul style="list-style-type: none"> • Clear definition of responsibilities • Effective communication between partners • Reconsider alternative pathways to advance in R&D activities until the reception of information to avoid the accumulation of delays 							2020/11
Residual risk								
Measure performance								

RISK ID and type	P17 Administrative
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WP and/or task:	All WPs							
Main responsible	All partners							
Other risk owners:								
RISK IDENTIFICATION								
RISK DESCRIPTION AND CONSEQUENCES	External factors (ie COVID) may delay project deliverables, dependencies between partners, leading to tasks in unfinanced time periods.							
RISK ANALYSIS	Rate	Date	Rate	Date	Rate	Date	Rate	Date
LIKELIHOOD	B	2020/12	B	2022/06				
CONSEQUENCES	3	2020/12	2	2022/06				
RISK EVALUATION	Rate	Date	Rate	Date	Rate	Date	Rate	Date
	Medium (UCPH)	2020/12	Low (CETIM)	2022/06				
RISK TREATMENT	Description							Date
Measure 1	Ensure communication between project partners to enable early warning of potential inter-partners dependencies.							2020/11
Residual risk								
Measure performance								

RISK ID and type	P18 Administrative							
WP and/or task:	All WPs							
Main responsible	All partners							
Other risk owners:								
RISK IDENTIFICATION								
RISK DESCRIPTION AND CONSEQUENCES	Lockdowns and mobility limitations due to the COVID-19 global pandemic: impossibility to access lab/field, home lockdown, service and goods providers closed, limitations on number of workers at office/university, selection/hiring procedures halted.							
RISK ANALYSIS	Rate	Date	Rate	Date	Rate	Date	Rate	Date
LIKELIHOOD	E	2020/12	A	2022/06				
CONSEQUENCES	5	2020/12	3	2022/06				
RISK EVALUATION	Rate	Date	Rate	Date	Rate	Date	Rate	Date
	Extreme	2020/12	Low	2022/06				
RISK TREATMENT	Description							Date
Measure 1	<p>Advance in desk work in teleworking mode (deliverables, reports, publications).</p> <p>Deploy staff to lab/field work as soon as possible, according to national limitations, and in full compliance with all safety measures.</p> <p>Work with pre-existing samples of similar characteristics when access to new samples is not possible due to lockdown limitations.</p> <p>Organise all events (meetings, conferences...) in virtual mode.</p> <p>Preparation of protocols to obtain samples from partners instead of travelling to perform the sampling <i>in situ</i>.</p>							2020/11



Residual risk		
Measure performance		

RISK ID and type	P19 Business-related							
WP and/or task:	WP7							
Main responsible	ENSO							
Other risk owners:								
RISK IDENTIFICATION								
RISK DESCRIPTION AND CONSEQUENCES	Do not provide us with data for life cycle analysis or that is not of quality							
RISK ANALYSIS	Rate	Date	Rate	Date	Rate	Date	Rate	Date
LIKELIHOOD	B	2022/06						
CONSEQUENCES	4	2022/06						
RISK EVALUATION	Rate	Date	Rate	Date	Rate	Date	Rate	Date
	Medium (ENSO)	2022/06						
RISK TREATMENT	Description							Date
Measure 1	Keep in touch with partners and use reference or bibliographic data to complete the analysis							2022/06
Residual risk								
Measure performance								

RISK ID and type	P20 Technical							
WP and/or task:	WP4							
Main responsible	TR							
Other risk owners:								
RISK IDENTIFICATION								
RISK DESCRIPTION AND CONSEQUENCES	The real bioleachate has a lower REE composition than expected.							
RISK ANALYSIS	Rate	Date	Rate	Date	Rate	Date	Rate	Date
LIKELIHOOD	E	2022/06						
CONSEQUENCES	3	2022/06						
RISK EVALUATION	Rate	Date	Rate	Date	Rate	Date	Rate	Date
	High (TR)	2022/06						
RISK TREATMENT	Description							Date
Measure 1	Include an REE concentration step before the recovery step.							2022/06
Residual risk								



Measure performance	
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RISK ID and type	P21 Technical							
WP and/or task:	WP5							
Main responsible	CETIM							
Other risk owners:								
RISK IDENTIFICATION								
RISK DESCRIPTION AND CONSEQUENCES	Biosynthesis of Mg nanoparticles with fungi extracellular extracts not successful							
RISK ANALYSIS	Rate	Date	Rate	Date	Rate	Date	Rate	Date
LIKELIHOOD	C	2022/06						
CONSEQUENCES	4	2022/06						
RISK EVALUATION	Rate	Date	Rate	Date	Rate	Date	Rate	Date
	High (TR)	2022/06						
RISK TREATMENT	Description							Date
Measure 1	Research and use of commercial enzymes and alternative compounds such as amylases or polyphenols							2022/06
Residual risk								
Measure performance								

RISK ID and type	P22 Technical							
WP and/or task:	WP6							
Main responsible	JM							
Other risk owners:								
RISK IDENTIFICATION								
RISK DESCRIPTION AND CONSEQUENCES	Biological processes are yielding PGM sulphates rather than nitrates. This could have an impact on the activity of the final catalysts produced							
RISK ANALYSIS	Rate	Date	Rate	Date	Rate	Date	Rate	Date
LIKELIHOOD	D	2022/06						
CONSEQUENCES	2	2022/06						
RISK EVALUATION	Rate	Date	Rate	Date	Rate	Date	Rate	Date
	Medium (JM)	2022/06						
RISK TREATMENT	Description							Date
Measure 1	Routes will need to be established to replace the sulphate counterion of the metals with another one which will be benign to catalysis (e.g. nitrate, oxide)							2022/06
Residual risk								



Measure performance	
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RISK ID and type	P23 Technical							
WP and/or task:	WP7							
Main responsible	CETIM							
Other risk owners:								
RISK IDENTIFICATION								
RISK DESCRIPTION AND CONSEQUENCES	Not achieving a geopolymer material from the wastes after treatment							
RISK ANALYSIS	Rate	Date	Rate	Date	Rate	Date	Rate	Date
LIKELIHOOD	B	2022/06						
CONSEQUENCES	4	2022/06						
RISK EVALUATION	Rate	Date	Rate	Date	Rate	Date	Rate	Date
	Medium (CETIM)	2022/06						
RISK TREATMENT	Description							Date
Measure 1	Modify parameters involved in geopolymerization process and test another alkali solutions							2022/06
Residual risk								
Measure performance								

RISK ID and type	P24 Technical							
WP and/or task:	WP7							
Main responsible	CETIM							
Other risk owners:								
RISK IDENTIFICATION								
RISK DESCRIPTION AND CONSEQUENCES	Not achieving the minimum mechanical properties to give birth to an alternative cement							
RISK ANALYSIS	Rate	Date	Rate	Date	Rate	Date	Rate	Date
LIKELIHOOD	C	2022/06						
CONSEQUENCES	3	2022/06						
RISK EVALUATION	Rate	Date	Rate	Date	Rate	Date	Rate	Date
	Medium (CETIM)	2022/06						
RISK TREATMENT	Description							Date
Measure 1	Modify parameters involved in geopolymerization process and test another alkali solutions							2022/06



Residual risk		
Measure performance		