- IDEALFUEL -

Lignin as a feedstock for renewable marine fuels

GRANT AGREEMENT No. 883753

HORIZON 2020 PROGRAMME - TOPIC LC-SC3-RES-23-2019
"Development of next generation biofuel and alternative renewable fuel technologies for aviation and shipping"

Deliverable Report

D8.2 – Risk and Mitigation Plan

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Disclaimer/ Acknowledgment

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Publishable summary

The EU H2020 project IDEALFUEL aims to develop an efficient and low-cost chemical pathway to convert lignocellulosic biomass into a Biogenic Heavy Fuel Oil (Bio-HFO) with ultra-low sulphur levels that can be used as drop-in fuel in the existing maritime fleet. This deliverable D8.2 describes the Risk and Mitigation Plan (RMP) for the IDEALFUEL project. The RMP defines how risks associated with the IDEALFUEL project will be identified, analysed, and managed. It outlines how risk management activities will be performed, recorded, and monitored throughout the lifetime of the project.

Risk identification will involve all consortium members and will include an evaluation of external factors that might hamper or endanger the main goal of the project being the introduction of Bio-HFO to the market. Careful attention will be given to external factors like legislation, financial feasibility (economics), public acceptance etc.
All risks will be assessed on Impact and Probability, and the combination of both is called “the effect”. It will determine which risks will need a mitigation planning. For this purpose, a Risk Management Tool has been made in Excel.

This deliverable is an extension of the risks identified in the Description of the Action of the Grant Agreement. The updated Risk Management Tool is presented and discussed. A Risk Log is defined listing the risks with the highest perceived impact and probability.

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1 Introduction

1.1 Scope

The IDEALFUEL project, like all projects, will experience risks that can have an impact on or threaten the success of the project. Therefore, an effective Risk and Mitigation strategy is essential. The general context of Risk and Mitigation planning is the process of identifying and assessing specific risks and then developing actions to support opportunities and reduce threats to the overall project objectives. Some risks have already been identified at the proposal stage, whereas others will emerge during subsequent phases of the project. This document is delivered in the context of the IDEALFUEL project as a follow up deliverable and is envisioned as a dynamic, changing document, intended to support management decision making.

A risk is an event or condition that, if it occurs, could have a negative effect on the project's objectives. Risk Management is the process of identifying, assessing, responding to, monitoring, and reporting risks. This Risk and Mitigation Plan (RMP) defines how risks associated with the IDEALFUEL project will be identified, analysed, and managed. It outlines how risk management activities will be performed, recorded, and monitored throughout the lifetime of the project and provides a tool for recording and prioritizing risks.
In the IDEALFUEL project risk management and its associated mitigation efforts is differentiated in two areas:

1. **Risks related to the projects research progress (Internal Risks).**
   The risks grouped in this area range from technical risks which can be directly related to the project progress, e.g. management issues, Bio-HFO production, catalyst development, and combustion testing.

2. **Risks due to external factors (External Risks)**
   The risks grouped in this area are risks that cannot be directly influenced by the IDEALFUEL consortium. Typically these risks could hamper market introduction of the Bio-HFO due for example to proposed policies, procedures, and standards.

Risk management includes up-front planning of how risks will be mitigated and managed once identified. Therefore, risk mitigation strategies and specific action plans are taken care off in the IDEALFUEL project via a dedicated task 8.3. Typically risk mitigation plans should characterize[1]:

- the root causes of risks that have been identified and quantified in earlier phases of the risk management process;
- Evaluate risk interactions and common causes;
- Identify alternative mitigation strategies, methods, and tools for each major risk;
- Assess and prioritize mitigation alternatives;
- Select and commit the resources required for specific risk mitigation alternatives;
- Communicate planning results to all project participants for implementation.

1.2 Objectives of the Risk and Mitigation Plan

This report will not only focus on the identification of risks and mitigation that can hamper the project progress but also assess risks coming from the outside that can hamper in the future the market introduction of this Bio-HFO. The Risk and Mitigation Plan is created and managed by the coordinator TUE in the IDEALFUEL project and is monitored and updated on a regular basis throughout the lifetime of the project. The objectives of the Risk and Mitigation Plan (RMP) are to explore risk response strategies for the items identified in the qualitative and quantitative risk analysis. This plan proposes policies, procedures, goals, and responsibility standards for the introduction of Bio-HFO. Once thoroughly analysed the critical set of risks, a better position is established to determine the best course of action to mitigate those risks. This strategy will be used to develop a risk management and mitigation plan, which will be updated on a regular basis based on developing knowledge in the project IDEALFUEL. Active input from all consortium members in identifying and managing risks is required.

[1] The owner's role in project Risk Management, National Academies Press, (2005). ISBN 0-309-54754-7

2 Risk Mitigation Procedures

Best practices in this area require that the known and perceived risks will be prioritized according to the degree and likelihood of the disadvantageous results that are anticipated to take place. Followed by a thorough analyses and documentation of all such risks according to their levels of priority in a form known as the risk mitigation plan. After which, the development and integration of the corresponding risk mitigation strategies follows.

Generally three key questions can be posed for risk mitigation:

- What can be done and what options are available?
- What are the trade-offs in terms of all costs, benefits, and risks among the available options?
- What are the impacts of current decisions on future options?

An understanding of these three questions is essential to risk mitigation and risk management planning for market introduction of the marine Bio-HFO. *Question 1* addresses the available risk response options, which are presented in the following section. An understanding of *questions 2 and 3* is necessary for risk planning because they determine the impact of both the immediate mitigation decisions and the flexibility of risk mitigation and planning on future events.

2.1 Process

TUE as coordinator is responsible for the RMP, and will work together with the consortium members in order to ensure that risks are actively identified, analysed, and managed throughout the life of the project. Risks will be identified as early as possible in the project so as to minimize their impact. The steps for accomplishing this are outlined in the following sections. As such the coordinator will act as the Risk Manager for this project.

2.2 Risk Identification

Risk identification will involve the consortium members and will include an evaluation of external factors that might hamper or endanger the main goal of the project being the introduction of marine Bio-HFO to the market. Careful attention will be given to external factors like legislation, financial feasibility (economics), public acceptance etc.

An Excel based Risk Management Tool has been generated and will be kept up to date. The qualitative Risk Analysis as described below is part of the tool.

2.3 Risk Analysis

All risks identified will be assessed to identify the possible effect on the project objective. Qualification (ranking) will be used to determine which risks are the top risks to pursue and respond to and which risks can be ignored.

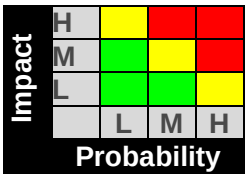
The probability and impact of occurrence for each identified risk will be assessed by the Risk Manager, with input from the consortium members:

Probability

- High – Greater than 75% probability of occurrence
- Medium – Between 25% and 75% probability of occurrence
- Low – Below 25% probability of occurrence

Impact

- High – Risk that has the potential to greatly impact project objective
- Medium – Risk that has the potential to slightly impact the project objective
- Low – Risk that has relatively little impact on the project objective



Risks that fall within the RED and YELLOW zones will have risk response planning which may include a risk mitigation and a risk contingency plan.

Based on the qualitative risk analysis, the risks will be prioritized into a "Top 10 Risk List".

2.4 Risk Response Planning

Each major risk (those falling in the Red & Yellow zones) will be assigned to a consortium team member. For each major risk, one of the following approaches will be selected to address it:

- **Avoid** – eliminate the threat by eliminating the cause
- **Mitigate** – Identify ways to reduce the probability or the impact of the risk
- **Accept** – Nothing will be done
- **Transfer** – Make another party responsible for the risk (buy insurance, outsourcing, etc.)

For each risk that will be mitigated, the consortium members will identify ways to prevent the risk from occurring or reduce its impact or probability of occurring. For each major risk that is to be mitigated or that is accepted, a course of action will be outlined in the event that the risk does materialize in order to minimize its impact. This course of action should however be reasonably and within the overall scope of the project.

2.5 Risk Monitoring, Controlling and Reporting

The level of risk will be tracked, monitored and reported throughout the project lifecycle. The identified risks and mitigation actions listed in the Risk Management Tool is divided into external and internal risk, which is shown in Appendix **Error! Reference source not found.** and **Error! Reference source not found.** respectively. Note that the Risk Management Tool will be updated regularly in the course of the project. A "Top 10 Risk Log" will be maintained by the Risk Manager (TUE) and is available for review by all consortium members and will be regularly discussed and updated together with the project partners. The Risk Log will be generated from the Risk Management Tool. Furthermore, it will be reported as a component of the periodic project status reporting process.

3 Status of the Risk and Mitigation Assessment

This Deliverable is an update of the identified Risk and Mitigations that have been provided in the proposal. As part of the RMP a risk management tool was developed. Together with the consortium partners, risks have been identified and their impact and probability estimated. This Deliverable will present an update of the assessment based on the work done and knowledge gathered during the last year.
In the grant agreement a total of 10 risks were identified and listed in table "1.3.5. WT5 Critical Implementation risks and mitigation actions". These risks have been included in the overall Risk Management Tool (see Appendix **Error! Reference source not found.** and **Error! Reference source not found.**) which have been identified by "yes" in the last column (In GA).

A Risk Log is generated based on the Risk Management Tool. The Risk Log lists the identified risks ranking them based on their overall Effect. The risk with the highest potential effect on the IDEALFUEL objectives is given number 1. Section 3.1 will discuss the Risk Log and associated actions to mitigate them in more detail.

3.1 Internal Risk Log

Based on the updated Risk Management Tool the Risk Log of the internal risks that can hamper the project progress has been generated. It basically ranks the risks with the highest Effect (Impact x Possibility) from high to low. The result is presented in table 1 below.

Table 1: Risk Log

Risk Rank	Risk Nr.		Effect
1	GA3	Lack of fuel availability for WP4 and 5	6
2	GA5	Technical issues delay pilot-scale production of optimized HDO catalyst, with a potential effect on further project tasks.	6
3	GA4	Producing Bio-HFO is of insufficient quality as marine fuel.	4
4	GA6	Final upgraded Bio-HFO fuel not fully meeting the specs listed as a target (see WP2 description).	4
5	GA7	Unexpected high emissions, in particular NOx, HC during transient conditions	4
6	-	Underperforming partner	4
7	-	Impact COVID19	4
8	GA1	No suitable, large scale reactor available, or delayed, e.g. due to breakdown or other unforeseen factor	**3**
9	-	Loss of key staff in the IDEALFUEL project	**3**
10	-	Defaulting partner	**3**

4 Conclusion

This Risk and Mitigation Plan is delivered in the context of the IDEALFUEL project as a baseline deliverable, but is envisioned as a dynamic, changing document, intended to support management decision making and will be updated regularly. All consortium members are expected to participate activity in risk identification and mitigation.

Acknowledgement

The author(s) would like to thank the partners in the project for their valuable comments on previous drafts and for performing the review.

Project partners:

#	Partner short name	Partner Full Name
1	TUE	Technische Universiteit Eindhoven
2	VERT	Vertoro BV
3	T4F	Tec4Fuels
4	BLOOM	Bloom Biorenewables Ltd
5	UNR	Uniresearch B.V.
6	WinGD	Winterthur Gas & Diesel AG
		(Formerly SeaNRG, is now GOODFUELS #12)
8	TKMS	Thyssenkrupp Marine Systems GMBH
9	OWI	OWI – Science for Fuels gGmbH
10	CSIC	Agencia Estatal Consejo Superior De Investigaciones Cientificas
11	VARO	Varo Energy Netherlands BV
12	GOOD	GoodFuels B.V.

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Appendix A – Internal Risks

Bio-HFO production

ECAS ID	Risk			Impact 1 = Low 2 = Medium 3 = High	Probability 1 = Low 2 = Medium 3 = High	Effect	Risk Mitigation		Remaining Risk			State of play of the mitigation measures				
	Identified Risk	Involved WPs	Effect	I	P	E	Approach	Action	I	P	E	Action by:	Status:	Ready:	Comments	In GA
1	No suitable, large scale reactor available, or delayed, e.g. due to breakdown or other unforeseen factor	2	Project work delayed or reduced ability to deliver	1	3		Mitigate	Outsource to third-party biorefineries that have suitable equipment, e.g. Attis Innovations (USA) or Sekab (SE)	1	2		VER	Open		No action needed yet	yes
2	CLO processes do not scale up properly due to unforeseen factors	2	Reduced ability to deliver	1	2		Mitigate	In the project 2 routes will be tested, i.e. route#1 Vertoro androute#2 Bloom, if one of them does not scale properly the other process will act as a backup facility	1	1		VER / BLOOM	Open		No action needed yet	yes
3	Lack of fuel availability for WP4 and 5	2,3,4,5	Project work delayed since project partners depend on these fuels and could not start their work	2	3		Mitigate	Surrogate fuels can be used, blending with HFO for the largescale engine testing to test the effect of only a few percent of Bio-HFO on the engine performance.	1	1		ALL	Open		This carefully monitored and discussed within the consortium. No action needed yet.	yes
4	Producing Bio-HFO is of insufficient quality as marine fuel.	3,4,5	Project work delayed since project partners depend on these fuels and could not start their work	2	2		Mitigate	Good quality of Bio-HFO is absolutely required. Numerous technical solutions are available to improve fuel quality, however might prove too costly. Combination of further conditioning and additivation may be considered if too much off-spec oil is produced.	1	2		GOOD	Open		No action needed yet	no
5	Technical issues delay pilot-scale production of optimized HDO catalyst, with a potential effect on further project tasks.	3,4,5	Project work delayed since project partners depend on these fuels and could not start their work	2	3		Mitigate	Resort to commercially available catalysts, e.g. Co-MoOx/Al2O3 as fallback option. Even if not ad-hoc developed for optimal performance on CLO feeds, they would enable, after carbidization activation, the HDO process upscaling to be carried out, likely at the expenses of the yield to the final biofuel.	2	2		CSIC/VER	Open		Commercial catalysts are being tested as a reference case. This screening will give directions of a potential commercial catalysts that can be used on short notice. Further implementation of the mitigation activities will be done when needed.	yes
6	Final upgraded Bio-HFO fuel not fully meeting the specs listed as a target (see WP2 description).	3,4,5		2	2		Mitigate	Fuel formulation and blending recipes with conventional HFO can be adapted to avoid propagation of this risk to WP5.	1	2		OWI/GOOD	Open		No action needed yet	yes
																no

Engine tasks

ECAS ID	Risk			Impact 1 = Low 2 = Medium 3 = High	Probability 1 = Low 2 = Medium 3 = High	Effect	Risk Mitigation		Remaining Risk			State of play of the mitigation measures				
	Identified Risk	Involved WPs	Effect	I	P	E	Approach	Action	I	P	E	Action by:	Status:	Ready:	Comments	In GA
7	Unexpected high emissions, in particular NOx, HC during transient conditions	5		2	2		Mitigate	More efforts needs to be implemented to analyse the fuel and ignition timing of this fuel. The consortium has key research facilities available to assess this in more detail if required	1	1		TUE/WINGD	Open		No action needed yet	no
8	Single cylinder buildup delays	5		1	2		Mitigate	The results of the 2-stroke engine will become available later but this has virtually no impact on other partners. Other (external) facilities are available to do this testing if needed.	1	1		WINGD	Open		No action needed yet	no

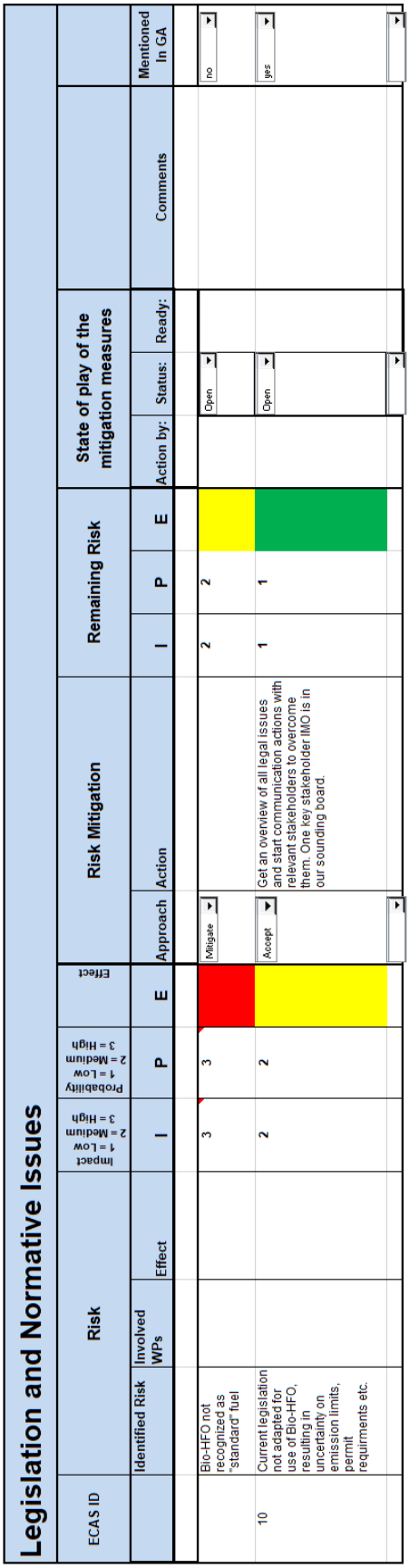
Lignin oil characterisation

ECAS ID	Risk			1 = Low 2 = Medium 3 = High	1 = Low 2 = Medium 3 = High	Effect	Risk Mitigation		Remaining Risk			State of play of the mitigation measures				
	Identified Risk	Involved WPs	Effect	I	P	E	Approach	Action	I	P	E	Action by:	Status:	Ready:	Comments	In GA
	Fuel properties measurements at different locations/partners are not consistent	2,3,4	Diffulties to define the route for next steps (e.g. catalysts development). More measurements are needed, that could delay the progress of the project	1	2		Mitigate	The consortium is setting up an measurement protocol for the key fuel properties.This protocal will support the consistency of the measurements between partners.	1	1		Vertoro	Open	no	Protocol is being setup at the moment, and will be updated regularly	no

Management

ECAS ID	Risk			Impact 1 = Low 2 = Medium 3 = High	Probability 1 = Low 2 = Medium 3 = High	Effect	Risk Mitigation		Remaining Risk			State of play of the mitigation measures				
	Identified Risk	Involved WPs	Effect	I	P	E	Approach	Action	I	P	E	Action by:	Status:	Ready:		In GA
9	Loss of key staff in the IDEALFUEL project	ALL	Project work delayed or reduced ability to deliver	3	1		Mitigate	The consortium will implement diversity in its key staff to cover loss of staff. This is furthermore achieved by regular meetings of the coordinating team and the WPLB telephone conferences. Due to this open communication it is ensured that the consortium will receive the relevant information on all levels.	2	1		TUfe	Implemented	yes	Implemented but not needed	yes
	Change of project coordinator	ALL	Communication disruptive, delays in implementation of work	1	1		Avoid	This is being achieved by regular meetings of the coordinating team and the WPL board telephone conferences. Due to this open communication it is ensured that the consortium will receive the relevant information on all levels.	1	1		TUfe	Open			..
	Underperforming partner	ALL	Project work delayed or reduced ability to deliver	2	2		Mitigate	Several instruments will be implemented by the consortium to lower the risk of a underperforming partner. Among these instruments are the regular telephone conferences of the WPL board, process of quality check of the deliverables and milestones and a regular discussion with respect to risk monitoring.	1	1		TUfe	Implemented	yes	Several instruments have been implemented by the consortium to lower the risk of a underperforming partner. Among these instruments are the regular telephone conferences of the WPL board, process of quality check of the deliverables and milestones and a regular discussion with respect to risk monitoring.	..
	Defaulting partner	ALL	Project work delayed or reduced ability to deliver	3	1		Mitigate	Several instruments have been implemented by the consortium to lower the risk of a defaulting partner. Among these instruments are the regular telephone conferences of the WPL board, process of quality check of the deliverables and milestones and a regular discussion with respect to risk monitoring	2	1		TUfe	Implemented	yes	Several instruments have been implemented by the consortium to lower the risk of a defaulting partner. Among these instruments are the regular telephone conferences of the WPL board, process of quality check of the deliverables and milestones and a regular discussion with respect to risk monitoring	..
	Partner withdrawal	ALL	Project work delayed or reduced ability to deliver	3	1		Mitigate	The coordinating team has established an open-minded and trustful communication flow with the consortium partners by being pro-actively, very responsive and descriptive when clarifying any questions. The coordinating team has internalized and exemplified an exemplary function for communication and commitment to the project and the partners. This has contributed to a high level interactive and open-minded interplay among the partners to principally follow a clear joint collaboration to successfully implement the project. Initially planned for WP Leaders only, the coordinating team has also invited the other partners to these e-conferences to show that all need to know the status and the issues for discussion and clarification in all work packages at any time. Communication has taken place regularly and very often by email and phone, bilaterally and with specific groups to ensure a stable exchange of all project-relevant progresses and issues and towards potential connections outside the project world. Consortium partners are therefore on the same track be able to	2	1		TUfe	Implemented	yes	The coordinating team has established an open-minded and trustful communication flow with the consortium partners by being pro-actively, very responsive and descriptive when clarifying any questions. The coordinating team has internalized and exemplified an exemplary function for communication and commitment to the project and the partners. This has contributed to a high level interactive and open-minded interplay among the partners to principally follow a clear joint collaboration to successfully implement the project. Initially planned for WP Leaders only, the coordinating team has also invited the other partners to these e-conferences to show that all need to know the status and the issues for discussion and clarification in all work packages at any time. Communication has taken place regularly and very often by email and phone, bilaterally and with specific groups to ensure a stable exchange of all project-relevant progresses and issues and towards potential connections outside the project world. Consortium partners are therefore on the same track be able to	..
	Impact COVID19	ALL	Project work delayed or reduced ability to deliver	2	2		Mitigate									

Appendix B – External risks



Legislation and Normative Issues																				
ECAS ID	Risk							Risk Mitigation			Remaining Risk			State of play of the mitigation measures			Comments	Mentioned In GA
	Identified Risk	Involved WPs	Effect	Impact 1 = Low 2 = Medium 3 = High	Probability 1 = Low 2 = Medium 3 = High		Effect	Approach	Action		I	P	E	Action by:	Status:	Ready:		
	Bio-HFO not recognized as "standard" fuel			3	3			Mitigate	Get an overview of all legal issues and start communication actions with relevant stakeholders to overcome them. One key stakeholder IMO is in our sounding board.		2	2			Open			no
10	Current legislation not adapted for use of Bio-HFO, resulting in uncertainty on emission limits, permit requirments etc.			2	2			Accept			1	1			Open			yes

Economy

ECAS ID	Risk			Impact 1 = Low 2 = Medium 3 = High	Probability 1 = Low 2 = Medium 3 = High	Effect	Risk Mitigation		Remaining Risk			State of play of the mitigation measures				
	Identified Risk	Involved WPs	Effect	I	P	E	Approach	Action	I	P	E	Action by:	Status:	Ready:	Comments	In GA
	Bio-HFO more expensive than competing fuel		High price will hamper market introduction	3	3		Accept		2	3			Implemen			no
	Logistics of Bio-HFO not in place		Chicken-egg discussion hampering market introduction.	2	2		Mitigate		1	2			Implement			no

Storage and Transport

ECAS ID	Risk			Impact 1 = Low 2 = Medium 3 = High	Probability 1 = Low 2 = Medium 3 = High	Effect	Risk Mitigation		Remaining Risk			State of play of the mitigation measures				
	Identified Risk	Involved WPs	Effect	I	P	E	Approach	Action	I	P	E	Action by:	Status:	Ready:	Comments	In GA
	Standard storage systems not suitable for Bio-HFO		Storage system will not function, leakages	3	3		Mitigate		2	2			Open			no

Appendix C – Quality Assurance Review Form

The following questions should be answered by all reviewers (WP Leader, reviewer, Project Coordinator) as part of the Quality Assurance procedure. Questions answered with NO should be motivated. The deliverable author will update the draft based on the comments. When all reviewers have answered all questions with YES, only then can the Deliverable be submitted to the EC.

NOTE: This Quality Assurance form will be removed from Deliverables with dissemination level "Public" before publication.

Question	WP Leader	Reviewer	Project Coordinator
	NAME (Organisation)	Eva Bogelund (UNR)	NAME (Organisation)
1. Do you accept this Deliverable as it is?	Yes / No (elaborate)	Yes	Yes / No (elaborate)
2. Is the Deliverable complete? - All required chapters? - Use of relevant templates?	Yes / No (elaborate)	Yes	Yes / No (elaborate)
3. Does the Deliverable correspond to the DoA? - All relevant actions preformed and reported?	Yes / No (elaborate)	Yes	Yes / No (elaborate)
4. Is the Deliverable in line with the IDEALFUEL objectives? - WP objectives - Task Objectives	Yes / No (elaborate)	Yes	Yes / No (elaborate)
5. Is the technical quality sufficient? - Inputs and assumptions correct/clear? - Data, calculations, and motivations correct/clear? - Outputs and conclusions correct/clear?	Yes / No (elaborate)	Yes	Yes / No (elaborate)
6. Is created and potential IP identified and are protection measures in place?	Yes / No (elaborate)	Yes	Yes / No (elaborate)
7. Is the Risk Procedure followed and reported?	Yes / No (elaborate)	Yes	Yes / No (elaborate)
8. Is the reporting quality sufficient? - Clear language - Clear argumentation - Consistency - Structure	Yes / No (elaborate)	Yes	Yes / No (elaborate)