



# BalticSeaH2

## Cross-border Hydrogen Valley around the Baltic Sea

D1.3 Draft plan for hydrogen safety management in the Main Valley

WP1 – Project Coordination and Management

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## Acronyms and abbreviations

Acronym	Full name
ATEX	ATmosphères EXplosibles
ABB	ABB Oy
CLIC	CLIC Innovation Ltd
D	Deliverable report
EHSP	European Hydrogen Safety Panel
FLX	Flexens Ltd
FMECA	Failure modes, effects, and criticality analysis
GA	Grant Agreement





GG	Gasgrid Finland Ltd
HAZID	Hazard Identification
HAZOP	Hazard and Operability Analysis
HLN	Helen Ltd
JRC	Joint Research Centre
JU	Joint Undertaking
P2X	Power-to-X
SEG	Safety Expertise Group
SM	Safety Manager
Т	Task
UCST	Use Case Safety Template
VTT	VTT Technical Research Centre of Finland Ltd
WP	Work package





## **Executive summary**

This document contains the Draft plan for hydrogen safety management in the Main Valley for the BalticSeaH2 project (Grant Agreement No. 101112047).

Plan for hydrogen safety management in the Main Valley. The initial safety management plan will establish a management framework and internal processes for the Main Valley to ensure that the technical activities in the BalticSeaH2 project for the hydrogen production and end-use Cases, including required hydrogen transmission and distribution, are carried out in a responsible, thorough, and safe way.

Deliverable will be reviewed by the European Hydrogen Safety Panel (EHSP) in the context of the activities the EHSP provides to the Clean Hydrogen JU. As a reference, guidance documentation on safety planning has been developed by the EHSP' <u>https://www.clean-hydrogen.europa.eu/get-involved/european-hydrogen-safety-panel-0/reference-documents\_en</u>

## 1. Introduction

The purpose of this hydrogen safety management plan draft is to set common guidelines and framework for the safety management of the Use Cases in the Main Valley of the BalticSeaH2 project. The safety management guidelines described in this draft plan concern the initial pre-demonstrational safety planning of the Use Cases. This plan will be updated to serve the evolving demands of hydrogen safety management as the project demonstrations proceed. Deliverables 1.5 and 1.6 are updates of this document. The updating of this plan is further described in Chapter 4.

The safety planning and management of the Main Valley is conducted as a part of Task 1.4 (Hydrogen safety planning and management for the Main Valley). T1.4 also sets guidelines for safety monitoring and reporting throughout the entire project (M1 – M60). T1.4 is led by VTT and contributed to by HLN, FLX, ABB and GG. The safety planning and management processes and experiences of the project will be collected, synthesized, and analysed in T7.4 (Development of safety planning and management guidelines for hydrogen) to produce a Hydrogen safety planning and management handbook (D7.5).

#### 1.1. Main Valley Use Cases

In BalticSeaH2, the Use Cases of the Main Valley serve the purpose of demonstrating hydrogen production, storage, transmission and distribution, and consumption in the Estonia-Finland region. These demonstrations are conducted under Work Packages 3 and 4 and they proceed on different paces.

#### 1.2. Safety Manager and Safety Expertise Group

Under T1.4, a Safety Manager (SM) will be appointed among the Task Contributors. The SM will oversee the preparation and execution of the safety planning of the individual Main Valley Use Cases. The SM will also lead a Safety Expertise Group (SEG) that will function as a platform for sharing safety-related concerns and solutions and for developing common procedures for hydrogen safety designing and





execution. The SEG will consist of safety experts that represent each Use Case of the project. A safety expert is appointed for each Use Case.

## 2. Use Case safety planning

The responsibility for the safety planning and management in the Use Cases is on the appointed safety experts of the Use Case. Assistance for the safety management processes will be provided by the SEG and the SM.

The tool for the initial safety management in the Use Case is the Use Case Safety Template (UCST) filled separately for each Use Case by their representatives (preferably the safety expert) and sent to the SM. When properly filled, the template can be used to identify how hydrogen safety is planned and managed in the Use Case. The template is a living document that will be updated and sent to the SM whenever the information it contains changes. The initial UCSTs are expected to be filled and sent to the SM by the Use Case representatives as soon as possible. This must be done before the practical demonstration can be started.

The inputs and answers of filled UCSTs are analysed to determine whether safety planning and management is conducted on a sufficient level in the Use Cases. If there are unclear, insufficient, or missing inputs, they will be re-filled or complemented with additional questions until they are on the level required by the SM. The analysis of the filled UCSTs is done by the SM who, along with the SEG, makes the decision on whether the inputs of the UCST are sufficient for the assessment of the quality of the safety planning of the Use Case.

The analysis of UCST inputs is focused on the following aspects:

- Can the danger and risks posed by hydrogen and other hazardous substances and phenomena be properly assessed for each phase of the demonstration?
- Can the risk assessment and hazard identification procedures be expected to be taken clearly, objectively, and comprehensively?
- Are the projected risk mitigation procedures sufficient, applicable, and reliable?
- Can the planned demonstration site and its devices and buildings be classified as safe for working?
- Are the possible requirements for restrictive safety zones (e.g., ATEX zones) properly considered?
- If the demonstration concerns a public place or traffic, is the safety of the public and other traffic users properly considered and ensured and can the relevant risk assessment hazard identification procedures be expected to be taken clearly, objectively, and comprehensively?
- Are the relevant regulations, codes, and standards considered properly?
- Is the operational safety and its procedures considered properly?
- Is the safety training and education planned properly for the personnel of the demonstration?
- Is the monitoring of the safety planned properly? Is the monitoring comprehensive, objective, and sufficiently frequent?
- Can the safety situation of the Use Case be expected to be reported properly to the SM and, if necessary, to the local authorities?
- Can the personnel of the Use Case be expected to respond to an emergency properly?





• Does the description of the demonstration and its contents raise any other safety-related questions and concerns?

Further execution of Use Case demonstration is not allowed until these aspects are fully clear to the SM and the safety expert of the Use Case.

#### 2.1. Use Case Safety Template

Initially, the Use Case Safety Template (UCST) sets guidelines for the safety planning by addressing specific topics relevant to the hydrogen safety of the Use Case demonstration. Questions and requests related to the topics are used to gather definitive inputs and answers to the UCST. A properly filled UCST will give answers to following questions regarding the safety planning and management of the Use Case the template concerns:

- What kind of hydrogen demonstration is the Use Case about?
  - If the Use Case will demonstrate hydrogen production, what will be the production capacity and production method?
  - If the Use Case will demonstrate hydrogen storage, what will be the storage conditions and capacities? This question is answered for all Use Cases as hydrogen is stored in some way in each of them.
  - If the Use Case will demonstrate hydrogen transmission or transportation, what will be the transmission capacity and method? This question is answer if any form of hydrogen transmission, transportation or distribution occurs during the demonstration.
  - If the Use Case will demonstrate hydrogen consumption, what will be the maximum consumption rate and how will the hydrogen be consumed or used?
- At which state will hydrogen appear in the demonstration (compressed gas, liquid, chemically bound, etc.)? What are the highest projected quantities and pressures achieved during the demonstration?
- What will the demonstration site be like?
  - What kind of devices or equipment will be used onsite?
  - $\circ$   $\;$  What kind of structures and buildings will be located and used onsite?
  - In what kind of environment will the hydrogen be stored and used?
  - How many people will be working onsite?
  - $\circ$   $\;$  Will there be any other hazardous substances or phenomena present onsite?
  - Will the demonstration site be partially located in a public area or in traffic?
- What are the regulations, policies and codes that will apply to the Use Case? Which authorities are concerned during the planning and operation of the demonstration?
- How is the hazard identification and risk assessment conducted in the Use Case?







- What kind of strategies and procedures are taken to prevent risks and mitigate consequences in the Use Case?
- Will there be restrictive zones formed for safety management on the site?
- What kind of procedures are taken to ensure safe operation?
- How are the personnel of the demonstration trained and educate to operate safely?
- How are technical safety and operational safety monitored and reviewed during the demonstration? How often is the reviewing done?
- What procedures are taken in the case of an emergency?
- How are safety events reported and documented?

The UCST is attached to this report as Appendix 1, and it is based on a safety plan template provided as a reference document by the European Hydrogen Safety Panel (EHSP). The reference template is titled "Simple template for a safety plan interim publishable version". The reference template was retrieved on 2.10.2023 from <a href="https://www.clean-hydrogen.europa.eu/get-involved/european-hydrogen.safety-panel-0/reference-documents">https://www.clean-hydrogen.europa.eu/get-involved/european-hydrogen.safety-panel-0/reference-documents</a> en for the production of the UCST.

#### 2.2. Use Case safety plan approval

After the UCST has been analyzed, complementary questions have been answered and the safety plan of the Use Case has been considered sufficient and approved by the SM, an informal notice of approval is sent to the Use Case safety expert. This approval only acts as an indicator of mutual safety awareness within the project and therefore cannot be used as an official safety approval. Official safety approvals are only provided by local authorities. Official safety approvals may be required for the implementation of the Use Case demonstration. The safety expert of the Use Case is responsible for acquiring all the required official safety approvals.

The informal safety approval provided by the SM can be withdrawn if safety-related concerns arise in the Use Case.

## 3. Safety reporting

All safety-related events of the project will be reported to the Joint Research Centre (JRC) of the European Commission. Safety-related events, such as near misses, incidents or accidents, and the





absences of events will be reported to the JRC not less often than once a year. The reports are sent to a dedicated mailbox: <u>JRC-PTT-H2SAFETY@ec.europa.eu</u>

Unless otherwise specified, the reporting will be conducted by the SM. Information on the safety-events of the project will be provided to the SM by the Use Case safety expert or another Use Case representative aware of the safety situation of the Use Case.

In the case of a safety-event, the following information and attachments must be included in the report sent to the JRC:

- Filled up to date Use Case Safety Template (UCST)
- A detailed description of the event.
  - What happened?
  - How did the event develop?
  - How was the event noticed?
  - How many people and what kind of equipment were involved?
  - What was the immediate danger to people, property, and environment?
  - Was there an emergency response?
  - How was the event settled? What procedures followed the event?
- Date, time, and place of the event
- Known of assumed causes of the event
  - If the causes are not fully known, it must be clarified which reported causes are assumptions. The assumptions must be justified.
- Consequences of the event
  - If predicted future consequences of the event are reported, the predictions must be justified.
- A description of the safety improvement methods used to prevent similar events from happening in the future
- Name and contact information of the person providing the information about the event

When reporting an absence of events, the report must include the filled up to date UCST and a phrase that confirms there has not been a safety-related event since the previous report on that specific Use Case.

### 4. Updating the safety plan

Under the guidance of the SEG, VTT and the SM will update this plan at least twice during the implementation of the BalticSeaH2 project. The impacts of possible new laws, certifications, or regulations that may arise during the project will also be integrated to the updated versions of this plan. If deemed necessary, tools and methods other than the UCST can also be implemented to the safety planning processes of T1.4.





The following deliverables are updates of this document:

- D1.5 Update 1 of the plan for hydrogen safety management in the Main Valley
  - o Dissemination level: SEN Sensitive
  - Lead beneficiary: VTT
  - Due month: 24
- D1.6 Update 2 of the plan for hydrogen safety management in the Main Valley
  - o Dissemination level: SEN Sensitive
  - Lead beneficiary: VTT
  - Due month: 48

Besides the formation of D1.5 and D1.6, this draft plan will be updated whenever necessary. Each version of this deliverable (D1.3) will be separately sent to the T1.4 Contributors and to the European Hydrogen Safety Panel (EHSP) for evaluation.

## 5. Funding statement

Co-funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the Clean Hydrogen Partnership. Neither the European Union nor the granting authority can be held responsible for them.





## Appendix 1 – Use Case Safety Template

The Use Case Safety Template attached below is a slightly modified version of the one sent to the Use Case representatives to be filled. The UCST also contains a checklist after the input tables that serves the purpose of reminding the Use Case representative about relevant safety-related milestones, such as finishing the preparation of certain safety-related documents. The checklist following the input tables is not considered in the safety planning and management processes as its purpose is to act as a guide for the representatives of the Use Cases.



Use Case Safety Template		Use Case Tit	le	
Project acronym:	BalticSeaH2	Template filled by Firstname Las	tname (Organisation) on dd.mm.yyyy	Template produced by Eetu Kuokkanen (VTT) on 10.10.2023
Project number:	101112047	Version x (N	lo. of versions: x)	Page <b>1</b> of <b>5</b>

No.	Topic	Explanation	Input
1	Use Case information		
1A	Use Case Title	The title of the Use Case.	
1B	WP and task number	Number of the project Work Package and Work Task the demonstration concerns.	
1C	Duration and timespan	The estimated timespan and the duration (in months) of the Use Case.	
1D	Use Case description	A short description of the Use Case and its goals.	
1E	Use Case Lead and other Contributors	Name of the leading organization and a list of the names of other Contributing organizations.	Lead: Contributors:
1F	Use Case coordinator	Name and contact information of the person responsible for coordinating the Use Case.	
1G	Use Case safety expert	Name and contact information of the person responsible for managing the safety in the Use Case.	
1H	Type of hydrogen demonstration	Check the boxes that represent the type of hydrogen demonstration (hydrogen production, storage, transmission, or consumption) in the Use Case.	□ Production Production capacity:tonnes/a Production method: □ Electrolyser □ Other, what:
		Check the "transmission" box and specify the transmission properties if there will be any hydrogen transmission, transportation or distribution done in the demonstration of the Use Case.	□ Storage □ Transmission Transmission capacity:kg/d /kg/shipment Transmission/transportation method: □ Pipeline □ Road transport □ Maritime transport □ Other, what:
			□ Consumption Max. consumption rate: MW /kg/d Consumption method: □ Fuel cells □ Incineration (turbines, engines, boilers, etc.) □ P2X application, what: □ Chemical industry, what: □ Other, what:
1I	The state of hydrogen	In which of the listed states does hydrogen appear during the demonstration? Also specify the total capacities (in kilograms) and the highest designed pressures (in bar(g)). If chemically bound or otherwise bound hydrogen appears in the demonstration, name the "binding substance" (e.g., methane) or the "other form of hydrogen" (e.g., metal hydride) in which the hydrogen is bound.	<ul> <li>□ Compressed gas   Capacity:kg   Max. pressure:bar(g)         Types of the storage vessels:kg         □ Liquified gas   Capacity:kg         □ Chemically bound   Capacity:kg   Max. pressure:bar(g)         Binding substance:         Types of the storage vessels:         Other form of hydrogen,         what:</li> </ul>

Use Case Safety Template		Use Case Tit	tle	
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Project number:	101112047	Version x (N	Io. of versions: x)	Page <b>2</b> of <b>5</b>

1J	Use Case site	<ol> <li>Describe the site of the Use Case according to the following topics:         <ol> <li>Where will the demonstration take place?</li> <li>What kind of devices/equipment will be used for the demonstration?</li> <li>Will the demonstration be performed indoors or outside?</li> <li>What kind of structures/buildings will be located onsite and used?</li> <li>In what kind of environment will the hydrogen be stored and used?</li> <li>How many persons will be working onsite with the demonstration?</li> <li>Will there be any of the following on the site during the demonstration? If yes, specify and quantify:</li> </ol> </li> </ol>	1. 2. 3. 4. 5. 6. 7. 8. 9.
		<ul> <li>g. Loud noises (&gt; 70 dB)</li> <li>h. Very bright lights or lasers <ol> <li>Other dangerous substances or phenomena</li> </ol> </li> <li>8. Will the site be partially located in a public area?</li> <li>9. Will the Use Case be demonstrated in traffic? If yes, describe the route and the infrastructure projected to be used.</li> </ul> If the demonstration takes place on multiple sites answer the questions separately for each site.	

Use Case Safety Template		Use Case Tit	le	
Project acronym:	BalticSeaH2	Template filled by Firstname Lastname (Organisation) on dd.mm.yyyy		Template produced by Eetu Kuokkanen (VTT) on 10.10.2023
Project number:	101112047	Version x (N	lo. of versions: x)	Page <b>3</b> of <b>5</b>

No.	Торіс	Explanation	Input
2	Safety planning		
2A	Relevant regulations and policies	List all safety-related regulations, codes and policies that apply to the Use Case. Also describe which authorities are concerned during the planning and operation of the demonstration.	
28	Hazard identification and risk assessment	List all hazard identification and risk assessment procedures taken in the Use Case. What kind of safety analyses will be conducted (HAZID, HAZOP, FMECA, etc.)?	
2C	Risk prevention and mitigation strategies	List all strategies used to prevent risks and mitigate consequences in the Use Case. Also list the prevention and mitigation technologies (e.g., sensors, water sprinklers, safety automation, etc.) used in the safety management. What kind of process parameter limits (e.g., high pressure limit, etc.) will be used to identify risks?	
2D	Safety zoning	Will there be restrictive zones (e.g., ATEX zones) formed for safety management on the site?	

Use Case Safety Template			Use Case Title	
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Project number:	101112047	Version x (N	lo. of versions: x)	Page <b>4</b> of <b>5</b>

No.	Topic	Explanation	Input
3	Operational safety		
	management		
3A	Operational safety	During the operation, what kind of procedures are taken to ensure	
	procedures	safe demonstration?	
3B	Personnel training	Describe how the personnel of the Use Case demonstration are	
		trained and educated to operate safely.	
3C	Monitoring and reviews	Describe how technical safety and operational safety are monitored and regious d. How often and at what scale is the monitoring and	
		reviewing done?	
2D	Emergency response plan	Describe the procedures taken in the case of an emergency	
30	Emergency response plan	beschbe the procedures taken in the case of an emergency.	
3E	Reporting of safety events	Describe how safety events are reported and documented.	
0	1 0 2		

This template is based on the *Simple template for a safety plan interim publishable version* which is a reference document of the European Hydrogen Safety Panel (EHSP). The reference document was retrieved on 29.9.2023 from https://www.clean-hydrogen.europa.eu/get-involved/european-hydrogen-safety-panel-0/reference-documents\_en

Use Case Safety Template			Use Case Title	
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No.	Topic	Explanation	Input
4	Free description	This field can be used for describing safety-related topics left	
		undescribed in the previous fields of this template.	

#### A checklist for some of the required pre-demonstration safety management procedures and actions

Please keep in mind that documentation, procedures, and actions **not** listed in this checklist could also be required for the execution of the Use Case demonstration.

□ Use Case safety expert appointed

□ Use Case represented in the Safety Expertise Group of T1.4 (Main Valley Use Cases only)

□ Piping and Instrumentation Diagrams (P&ID) made

□ ATEX zoning planned and documented

□ Approval processes for the construction and operation of the Use Case site started with the local authorities

□ Hazard identification and risk assessment analyses conducted

□ Periodic safety monitoring and reporting planned