

**Pre-normative REsearch for Safe use of   
Liquid Hydrogen (PRESLHY)**

**Fuel Cells and Hydrogen**

**Joint Undertaking (FCH JU)**

##### Grant Agreement Number 779613

Deliverable Number: X.Y

Title: Title of the deliverable as given in Part B

Authors: Authors

Submitted Date: 31 October 2018

Due Date: 31 October 2013

Report Classification: Public



|  |  |
| --- | --- |
| **Deliverable** | |
| Contractual delivery date | 31 October 2018 |
| Actual delivery date | 31 October 2018 |
| Deliverable Number | X.Y |
| Deliverable Name | Qualitative Risk Assessment of Hydrogen Liquefaction, Storage and Transportation |
| Internal document ID | DX.Y |
| Nature | Report |

|  |  |  |  |
| --- | --- | --- | --- |
| **Approvals** | | | |
|  | Name | Organisation | Date |
| WP Leader | Barbara Lowesmith | Loughborough University | 31 October 2013 |
| Coordinator | Alice Elliott | Shell | 31 October 2013 |

# Disclaimer

Despite the care that was taken while preparing this document the following disclaimer applies: The information in this document is provided as is and no guarantee or warranty is given that the information is fit for any particular purpose. The user thereof employs the information at his/her sole risk and liability.

The document reflects only the authors’ views. The FCH JU and the European Union are not liable for any use that may be made of the information contained therein.

# Publishable summary

Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Aenean commodo ligula eget dolor. Aenean massa. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Donec quam felis, ultricies nec, pellentesque eu, pretium quis, sem. Nulla consequat massa quis enim. Donec pede justo, fringilla vel, aliquet nec, vulputate eget, arcu. In enim justo, rhoncus ut, imperdiet a, venenatis vitae, justo. Nullam dictum felis eu pede mollis pretium. Integer tincidunt. Cras dapibus. Vivamus elementum semper nisi. Aenean vulputate eleifend tellus. Aenean leo ligula, porttitor eu, consequat vitae, eleifend ac, enim. Aliquam lorem ante, dapibus in, viverra quis, feugiat a, tellus. Phasellus viverra nulla ut metus varius laoreet. Quisque rutrum. Aenean imperdiet. Etiam ultricies nisi vel augue. Curabitur ullamcorper ultricies nisi. Nam eget dui. Etiam rhoncus. Maecenas tempus, tellus eget condimentum rhoncus, sem quam semper libero, sit amet adipiscing sem neque sed ipsum. Nam quam nunc, blandit vel, luctus pulvinar, hendrerit id, lorem. Maecenas nec odio et ante tincidunt tempus. Donec vitae sapien ut libero venenatis faucibus. Nullam quis ante. Etiam sit amet orci eget eros faucibus tincidunt. Duis leo. Sed fringilla mauris sit amet nibh. Donec sodales sagittis magna. Sed consequat, leo eget bibendum sodales, augue velit cursus nunc,

# Key words

Liquid hydrogen, QRA, accumulation, dispersion, fire, explosion, BLEVE

# Abbreviations

ach Air changes per hour

barg Shorthand for gauge pressure in bar

BBD Building Burning Distance

BLEVE Boiling Liquid Expanding Vapour Explosion

CFD Computational Fluid Dynamics

DDT Deflagration to Detonation Transition

HAZID Hazard Identification

GH2 Gaseous Hydrogen

LFL Lower Flammable Limit

LH2 Liquefied Hydrogen

LNG Liquefied Natural Gas

LOC Loss of containment

MR Mixed refrigerant

RPT Rapid phase transition

RTA Road traffic accident

QRA Quantitative Risk Assessment

QRM Qualitative Risk Matrix

T time

t tonne

tdu thermal dose units

tpd tonnes per day

VCE Vapour Cloud Explosion

# Table of Contents

[Disclaimer ii](#_Toc504579653)

[Publishable summary iii](#_Toc504579654)

[Key words iv](#_Toc504579655)

[Abbreviations iv](#_Toc504579656)

[Table of Contents v](#_Toc504579657)

[1 Background 6](#_Toc504579658)

[2 Introduction and Scope 7](#_Toc504579659)

[3 Discussion and Conclusions 8](#_Toc504579660)

[4 References 9](#_Toc504579661)

# Background

Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Aenean commodo ligula eget dolor. Aenean massa. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Donec quam felis, ultricies nec, pellentesque eu, pretium quis, sem. Nulla consequat massa quis enim. Donec pede justo, fringilla vel, aliquet nec, vulputate eget, arcu. In enim justo, rhoncus ut, imperdiet a, venenatis vitae, justo. Nullam dictum felis eu pede mollis pretium. Integer tincidunt. Cras dapibus. Vivamus elementum semper nisi. Aenean vulputate eleifend tellus. Aenean leo ligula, porttitor eu, consequat vitae, eleifend ac, enim. Aliquam lorem ante, dapibus in, viverra quis, feugiat a, tellus. Phasellus viverra nulla ut metus varius laoreet. Quisque rutrum. Aenean imperdiet. Etiam ultricies nisi vel augue. Curabitur ullamcorper ultricies nisi. Nam eget dui. Etiam rhoncus. Maecenas tempus, tellus eget condimentum rhoncus, sem quam semper libero, sit amet adipiscing sem neque sed ipsum. Nam quam nunc, blandit vel, luctus pulvinar, hendrerit id, lorem. Maecenas nec odio et ante tincidunt tempus. Donec vitae sapien ut libero venenatis faucibus. Nullam quis ante. Etiam sit amet orci eget eros faucibus tincidunt. Duis leo. Sed fringilla mauris sit amet nibh. Donec sodales sagittis magna. Sed consequat, leo eget bibendum sodales, augue velit cursus nunc,

# Introduction and Scope

# Discussion and Conclusions

# References