



WHEN TRUST MATTERS

Assessing Hydrogen Safety – the story so far

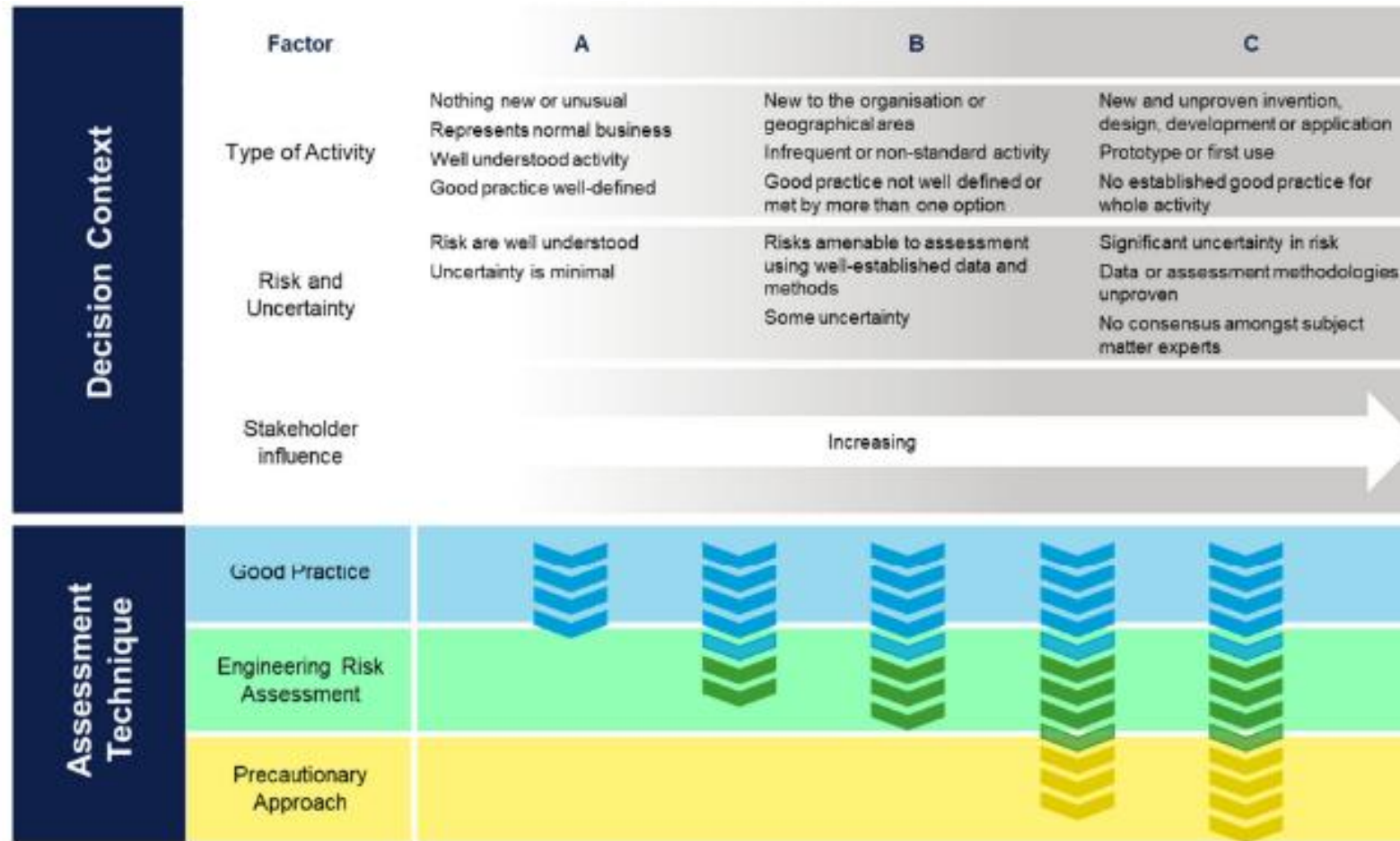
Jo-Anne Tomkins, Senior Principal Engineer

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Introduction



Assessing Hydrogen Safety



Oil and Gas UK, Guidance on Risk Related Decision Making, Issue 2, 2014

Quantitative Risk Assessment

- QRA is a formal method of quantifying risks
 - Usually fatalities, but can include injuries
 - Risk to individuals
 - Interest to the public
 - Criteria exist
 - Societal risk
 - Interest for policy decisions, as risks are low
 - Criteria exist for sites and transmission, but not distribution
 - Frequency of incidents
 - Fires and explosions
 - Could affect reputation and public acceptance
- Different tools used for sites, transmission pipes and distribution systems

Comparison between Natural Gas and Hydrogen

Similarities

- Release frequencies
 - Some exceptions
- Below ground dispersion behaviour
- Fire severity
- Human behaviour, response to leaks
- Flame visibility (in practical situations)

Differences

- Outflow rate
 - Mass or volumetric outflow
- Above ground dispersion further for hydrogen
- Flammable concentration range
 - Similar LFL but much higher UFL for H₂
- Ignition probability higher for hydrogen
- Explosion consequences could be worse for hydrogen (but not always)
 - Detonation possible
 - Effects outside source building
 - Unconfined explosions in open air
- Hydrogen does not produce CO

Overview of CONIFER Model – Development

Years	Model Development
1995 to 1999	‘Predictive model’ for cast iron mains >12” developed
2000	Mains Replacement Prioritisation Scheme (MRPS) implemented
2002 to 2005	Model for PE mains developed
2010 to 2014	Series of updates for natural gas mains
2015	Model used to define building proximity distances in IGEM/TD/3
2018 to 2020	H21 Phase 1, CONIFER developed for hydrogen (upstream of ECV)
2020 to 2022	H21 Phase 2, CONIFER model extended to downstream of ECV
2022 to 2023	Hydrogen Villages
2023 to 2024	Hydrogen MOBs QRA (domestic / single commercial storey)
2023 to 2024	GB Wide QRA – extended to non-domestic buildings

Assessing (Hydrogen) Safety

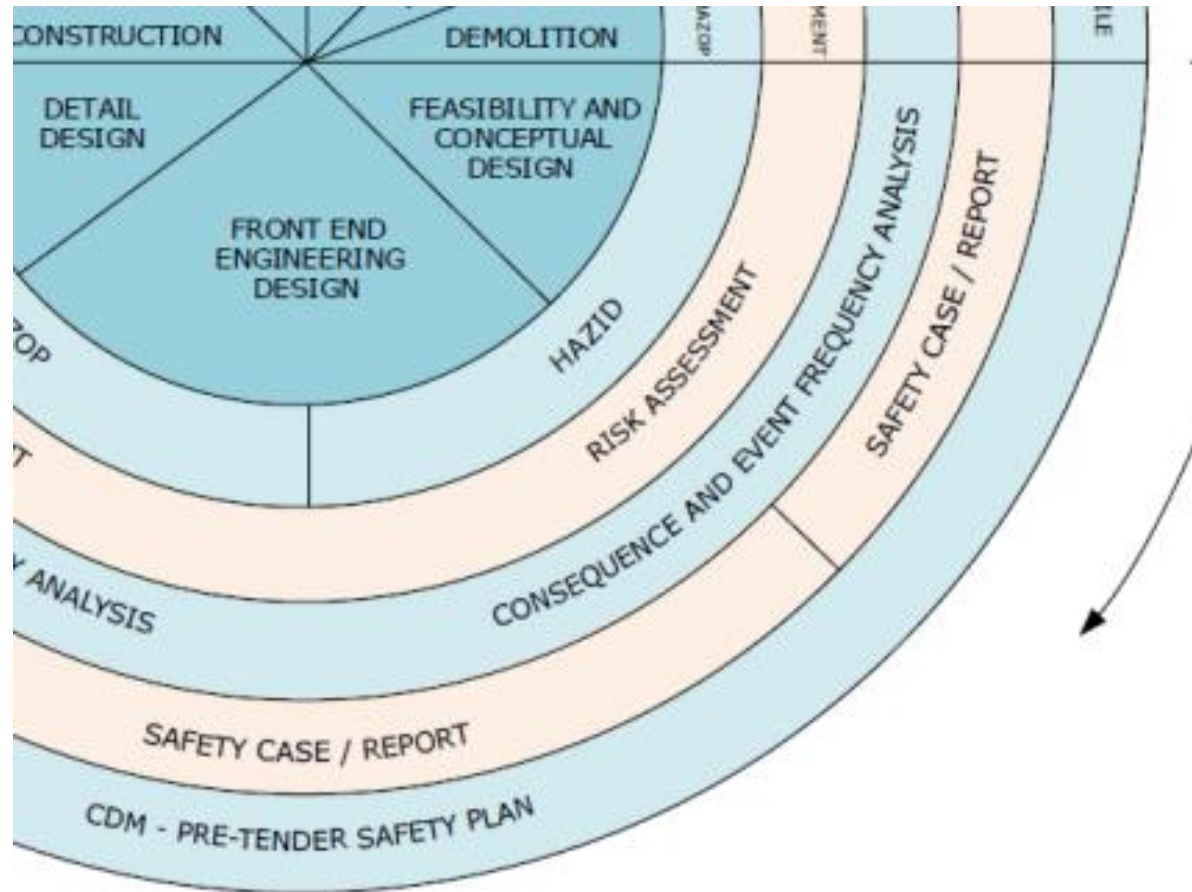


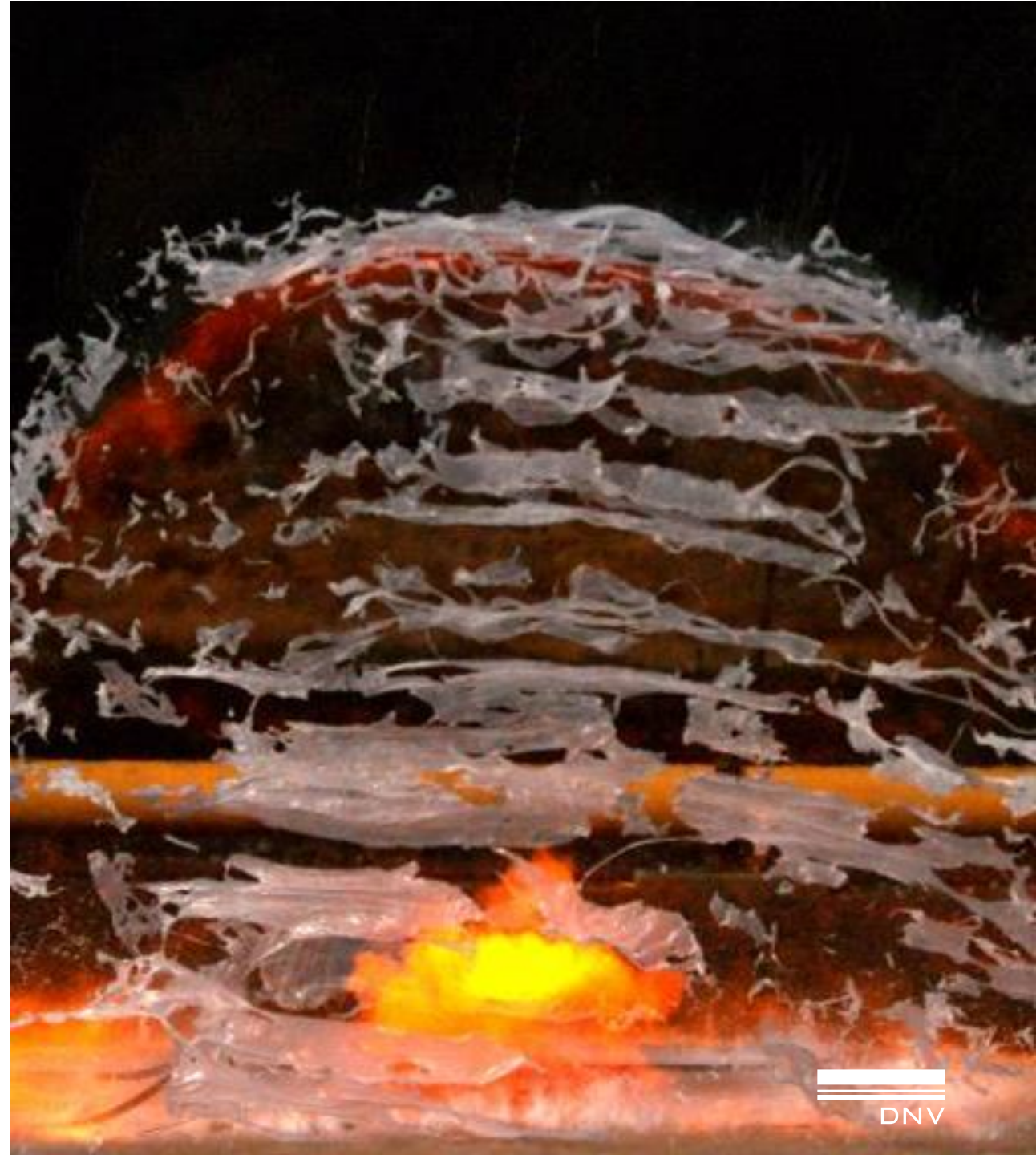
FIGURE 8 – LIFE CYCLE ACTIVITIES OF A PROJECT

Types of Safety Assessment

- Bespoke studies
- QRA
- Model development and validation
- Safety Case / Case for Safety
- Functionality assessment.
- Standards development
- Research and testing
- Materials testing
- Procedure development

What is left to do?

- Further rupture testing
- Dispersion validation
- Ignition probability
- Reliability
- Trials / further industrial projects
- Standards development and amendment
- Regulation change
- Policy decision (support)
- Removal of conservatisms from risk assessments
- Myth busting
- Gap assessment of compliance with current regulations



Thank you

Jo-Anne.Tomkins@dnv.com

www.dnv.com

