Assessing the changes in safety risk arising from the use of natural gas infrastructures for mixtures of hydrogen and natural gas

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Naturalhy project
safety work package
To identify and quantify the major factors influencing safety in the transportation, distribution, and delivery of hydrogen/natural gas mixtures by means of existing natural gas infrastructures.
Purpose

To provide information to allow risk assessments to be performed to assist decisions concerning:

• The amount of hydrogen that can be introduced into natural gas systems
• The conditions under which such systems should be operated, and
• The identification of vulnerable locations where modifications to a system may be required
Approach

• Introduction of hydrogen will require that:
  – risks remain below levels that are acceptable to the regulator
  – the concept is acceptable to the general public

• Identify appropriate information on hydrogen/natural gas mixtures (up to 50% H₂) to enable current risk assessment methodologies to be used to quantify the effect of:
  – changes in the amount of hydrogen
  – changes in the operating conditions (i.e. operating pressure)
  – the introduction of risk reduction measures
The main operational and gas utilisation activities will be studied

- Domestic and industrial utilisation
  - confined/vented explosions
- Transmission and distribution
  - pipeline rupture fires
- Operational sites (processing and storage)
  - jet fires
  - vapour cloud explosions
Domestic and industrial utilisation (confined/vented explosions)

- Gather information on leak frequency and ignition probability
- Undertake experiments on gas build-up and explosions in confined/vented enclosures. The data will be compared with data and predictive tools available for natural gas
- Particular emphasis will be placed on identifying conditions (if any) which might result in transition to detonation
Transmission and distribution (pipeline rupture fires)

- Undertake transmission pipeline fire experiments to study the important early stages of fireball development and the generation of overpressure
- The data generated will be compared with data and predictive tools available for natural gas
- Information gathered in this area is essential for land use planning, the classification of hazardous areas and the development of operational procedures
Transmission, distribution and operational sites (jet fires)

- Undertake high pressure jet fire experiments to study heat transfer to objects within and outside the flame envelope
- The data generated will be compared with data and predictions of tools developed for natural gas
Operational sites
(vapour cloud explosions)

- Undertake experiments involving high pressure gas releases into congested regions to study gas build-up and explosion. The data will be compared with data and the predictions of tools developed for natural gas.
- Particular emphasis will be placed on identifying conditions (if any) which might result in transition to detonation.
Risk assessment

• The information gathered in the work described in the previous slides will be incorporated into risk assessment methodologies pertinent to natural gas networks

• Risk assessments of selected sections of gas infrastructure carrying a hydrogen/natural gas mixture will be undertaken and the results compared with those obtained for natural gas
Assessment tool

Finally, the output from the Safety Work Package will be incorporated into the Assessment Tool, one of the main deliverables of the Naturalhy Project.
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