



# Safety by Design in Hydrogen Projects

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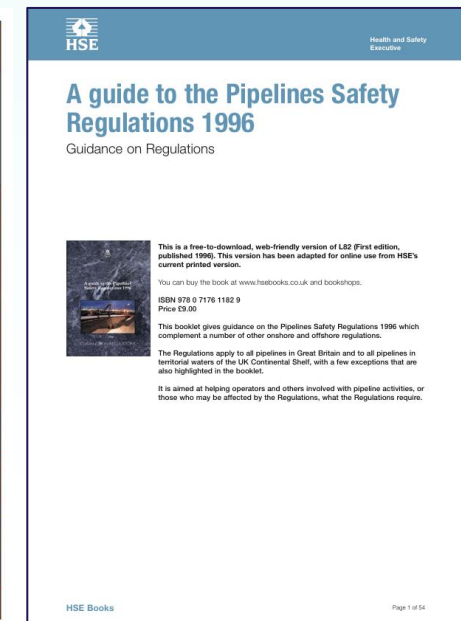
# About Kent

- Global integrated services provider for the energy industries.
- Covering engineering, projects and consulting across the full lifecycle.
- Over 50 years of experience with hydrogen-related projects worldwide.
- Kent Safety Team supports our engineering design projects and provides specialist safety consulting and advice to our energy clients.

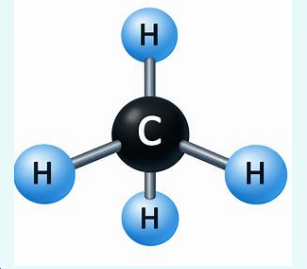


# About Hydrogen

- Hydrogen is flammable and explosive.
- Uncontrolled releases have the potential to cause significant harm to people.
- Hydrogen is treated as a **dangerous fluid** under the Pipelines Safety Regulations.
- Hydrogen is classified as a **dangerous substance** under the COMAH Regulations:
  - 5 tonnes (lower tier threshold)
  - 50 tonnes (upper tier threshold)
- Hazard Substances Consent is required for 2 tonnes.



# Hydrogen vs Natural Gas



- Hydrogen has unique properties that significantly impact risk to people.
- Compared to natural gas:
  - Hydrogen is a very small molecule – **leaks are much more likely.**
  - Hydrogen has a larger flammable range – **larger flammable clouds.**
  - Hydrogen has a very low ignition energy – **much easier to ignite.**
  - Hydrogen has higher flame velocity – **more severe explosions.**
  - Hydrogen burns with a near invisible flame in daylight and gives off low radiant heat – **hydrogen fires are more difficult to detect.**

# What this means for the energy transition

- New technologies in hydrogen production bring new/different hazards.
- Gaps and differences in industry technical standards for hydrogen production.
- Lack of extensive historical data of hydrogen production means more uncertainty in risk assessment.
- Newcomers less familiar with management of major accident hazards.

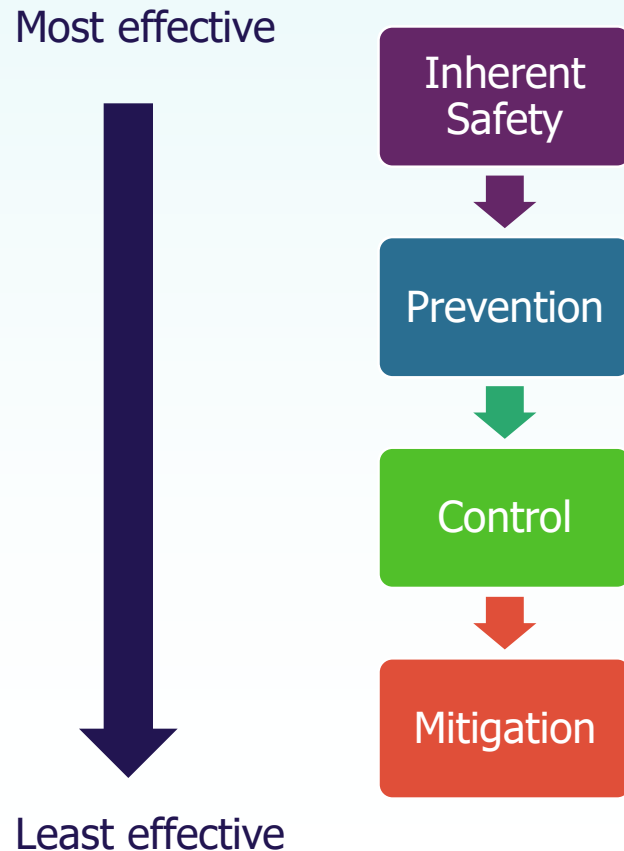
# Ensuring safety by design

- By considering safety as early as possible in a development project, and for key decisions such as site selection and layout.
- Through application of standard design risk management processes:



# Ensuring safety by design

- By applying a hierarchy of risk reduction, focussing on inherent safety and prevention first.



## Inherent safety and prevention measures:

- Site selection away from public populations.
- Separate inventories from each other.
- Minimise inventories.
- Minimise pressures.
- Use suitable materials.
- Reduce leak points (e.g. welds rather than flanges).

## Control and mitigation measures:

- Ventilation, gas detection, pressure relief, automatic shutdown

# Final point

- Our primary objective is to ensure safety of our hydrogen projects...
- ...but managing safety by design can also help de-risk other areas:
  - Planning and consenting – minimise issues relating to safety aspects.
  - Design cost – help make the design process as efficient and cost effective as possible.