Inspecting Hydrogen Installations

U.S. DOE DE Road Show

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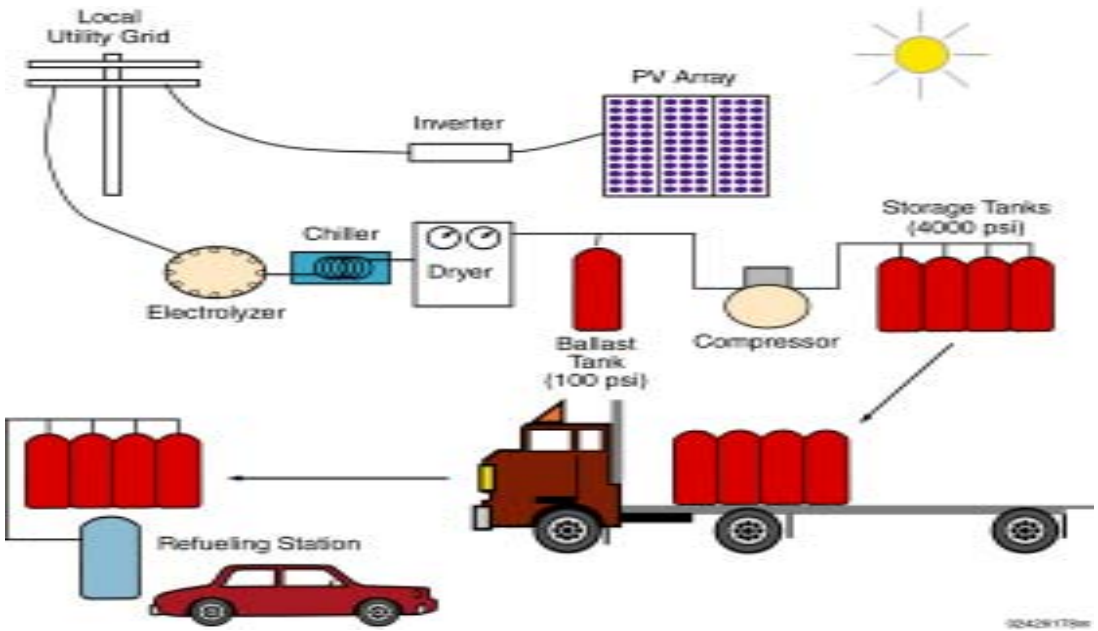
National Hydrogen Association

Hydrogen Fundamentals

- What is it?
- Where is it derived from?
- Why are we talking about it today?



Properties of Hydrogen

- Btu content
- Flash point
- Vaporization
- Dispersion
- Containerization

Hydrogen vs. Methane and Gasoline

Property	Hydrogen	Methane	Gasoline	Units
Molecular Weight	2.016	16.043	107	amu
Normal boiling point (nbp) temperature	20.268	111.632	310 to 478	K
Critical pressure	12.759	45.387	24.5 to 27	atm
Critical temperature	32.976	190.56	540 to 569	K
Density at critical point	0.0314	0.1604	0.23	g/cm3
Heat of fusion	58.23	58.47	161	J/g
Heat of vaporization	445.59	509.88	309	J/g
Heat of combustion (low)	119.93	50.02	44.5	kJ/g
Heat of combustion (high)	141.86	55.53	48	kJ/g
Energy of density	8.49	21.14	31.15	MJ/litre
NBP = Normal boiling point				
NTP – 1 atm and 20°C (293.5K)				

Hydrogen Production Today

- Industrial systems
  - Production
  - Transport
  - Storage
  - Use

Hydrogen and Power

- IC Engines
- Gas Turbines
- Fuel Cells

- This section is to explain that H2 can and will be used as a general fuel for a variety of applications, just like gasoline or diesel or natural gas.

Existing Standards

- Hydrogen Codes, Standards, and Regulations Matrix
  - by application
  - includes contact information
  - includes status
- NFPA

ICC Pending Changes

- International Fire Code
- International Mechanical Code
- International Fuel Gas Code
- International Residential Code

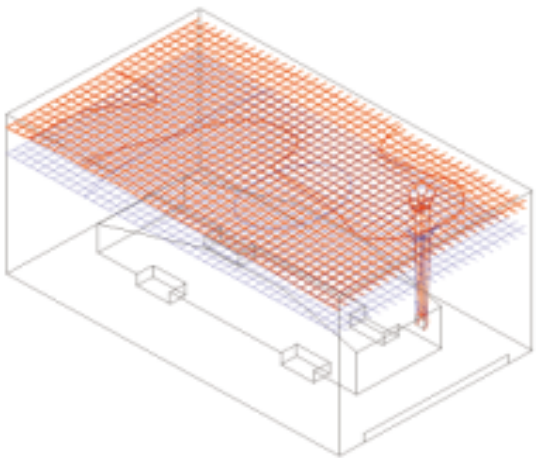


Figure C 1 - Unvented garage, 1 SCFM hydrogen leak for 20 minutes.
Blue: 0.82% hydrogen. Red: 4.1% hydrogen

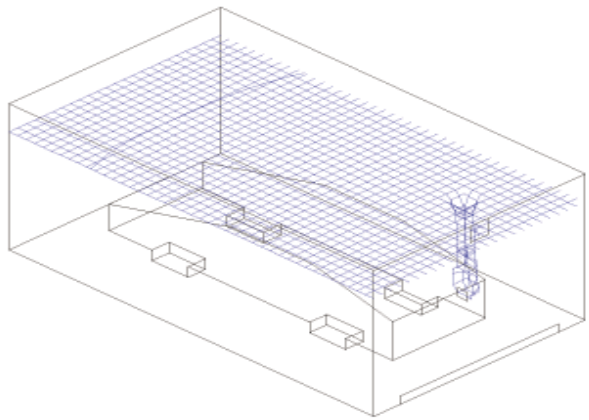


Figure C 2 - Vented garage, 1 SCFM hydrogen leak for 20 minutes.
Blue: 0.82% hydrogen. Red: 4.1% hydrogen

Hydrogen Dispersion in Residential Garages Diagrams Associated with IRC, IMC, & IFGC 2002 Proposals

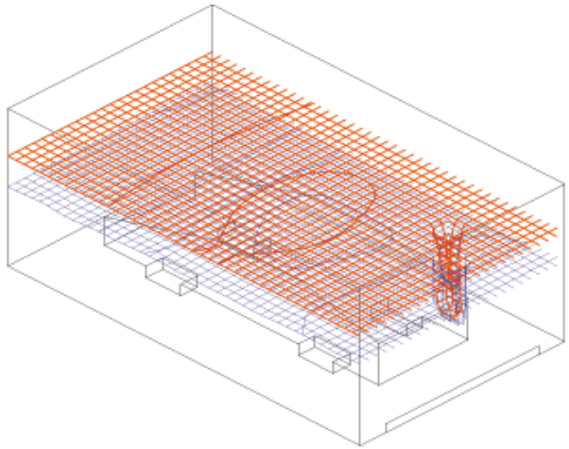


Figure C 3 - Unvented garage, 4 SCFM hydrogen leak for 20 minutes. Blue: 0.82% hydrogen. Red: 4.1% hydrogen

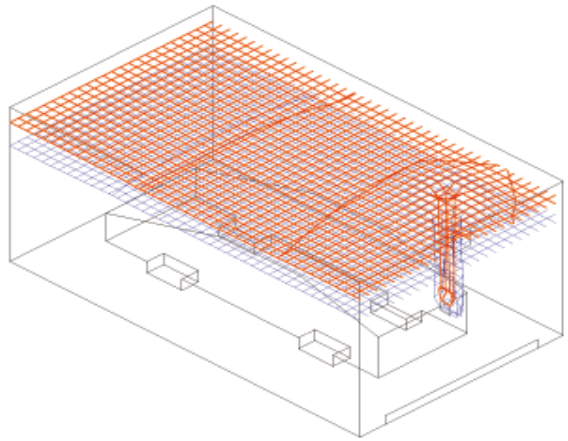


Figure C 4 - Vented garage, 4 SCFM hydrogen leak for 20 minutes. Blue: 0.82% hydrogen. Red: 4.1% hydrogen

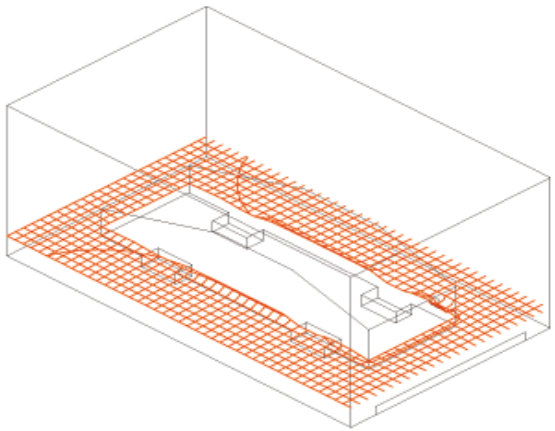


Figure C 5 - Unvented garage, 13 SCFM hydrogen leak for 20 minutes. Blue: 0.82% hydrogen. Red: 4.1% hydrogen

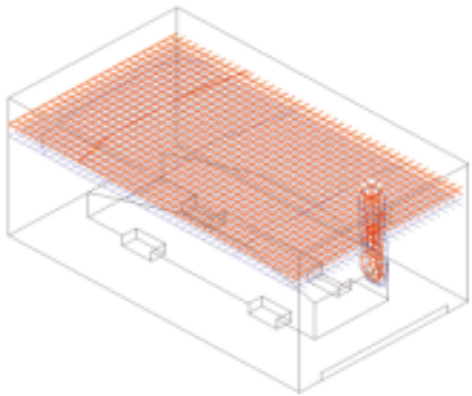
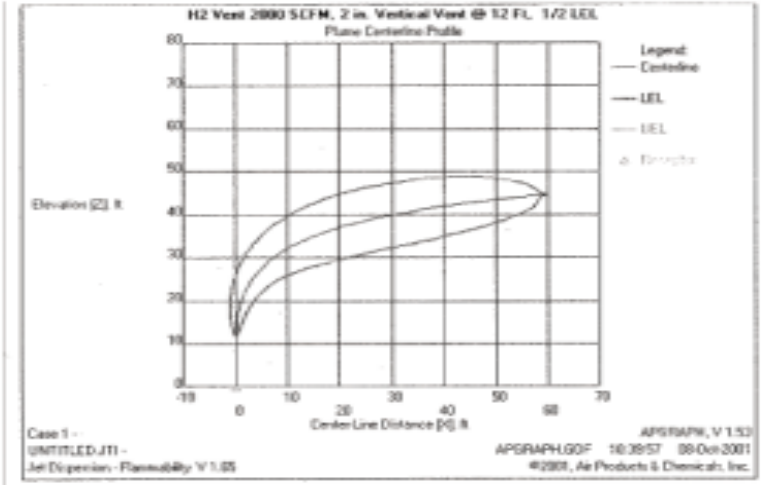
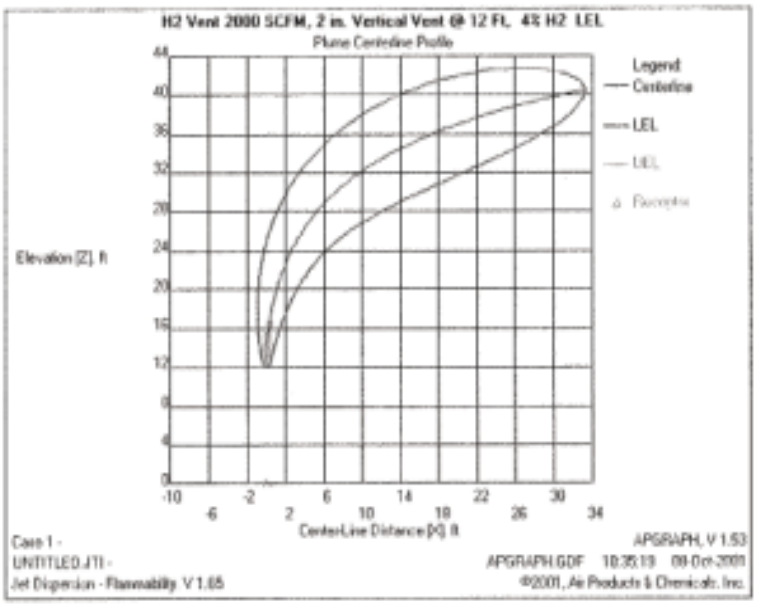
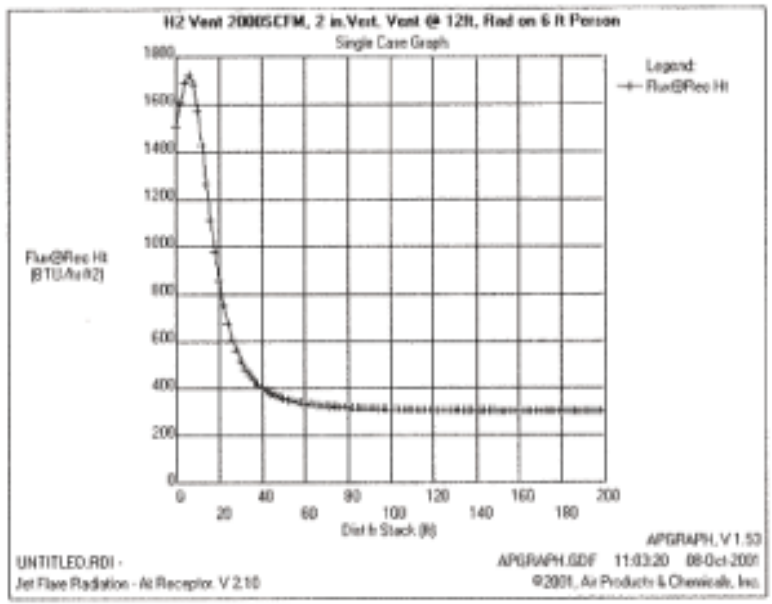


Figure C 6 - Vented garage, 13 SCFM hydrogen leak for 20 minutes. Blue: 0.82% hydrogen. Red: 4.1% hydrogen

Safe-Vent Flame Radiator Diagram Associated with IFC 2002 Proposals







Inspecting a Hydrogen Installation

- Tools Available
- The Hydrogen Handbook for Building Code and Fire Safety Officials
- The Hydrogen Sourcebook

Inspecting a Hydrogen Installation

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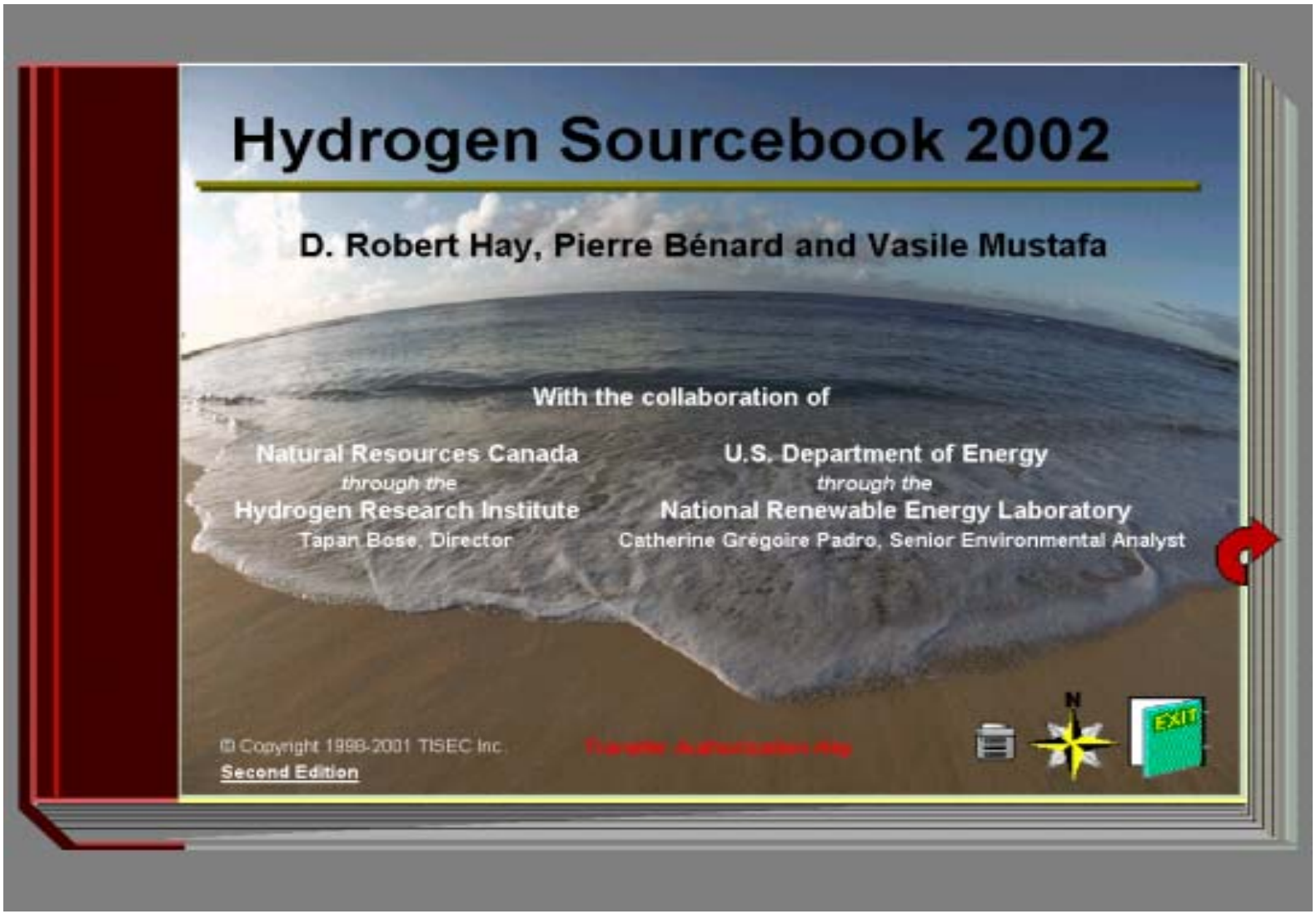

Inspecting a Hydrogen Installation

- Confinement
- Review Potential for Ignition
- Minimizing Consequences
- Review the Need for Detectors
- Safety Analysis
- Review Site-Specific Factors
- Personal Investigation

Detection

- Sensors vs. Odorants

For more information:

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