

Table 2. Summary of Permitting and Safety Experiences for IEA-HIA Annex 18 Projects

Location	Las Vegas, USA	Reykjavik, Iceland	Malmö, Sweden	Vancouver, Canada	Takasago, Japan	Beacon Farm, UK	Brescia, Italy	Ringkøbing County, Denmark	5 locations in France
Type of system	Combination fueling station and power plant	Vehicle fueling station	Vehicle fueling station / mixture with natural gas	Vehicle fueling station	Load-leveling power system	Domestic power system	Domestic power system	Hydrogen fuel cell vehicle and filling station	Residential fuel cells
Site description	Limited access parking lot	Publicly accessible Shell station	Publicly accessible bus depot	Fenced laboratory yard	Laboratory building	Garage	Gated estate	Factory floor	Buildings
Hydrogen storage	Compressed gas	Compressed gas (440 bar)	Compressed gas (395 bar)	Compressed gas (450 bar)	Metal hydride tanks	Compressed gas and MH	Compressed gas and MH	MH canisters on truck, Compressed gas in filling station (200 bar)	Natural gas reformer is part of the fuel cell package
Permitting agency	Las Vegas fire department	City	City	City, federal government	Company hazards group	Local fire marshal	Local fire brigade (Province of Como)		European Conformity standards:
Codes applied	Existing building and equipment codes; NFPA 50A for hydrogen storage separation distances	IEC 60079-10 for Electrolyzer; TÜV (Germany), Det Norsk Veritas (Denmark), NFPA 50A for hydrogen storage separation distances	Same as for natural gas since the mixture is considered natural gas	SAE J2600 for dispenser SAE J-2719 for fuel quality	Industrial Safety and Health Law, Hydrogen gas guidebook; High Pressure Safety Law; Electric Industry Law			CE certified	-Machinery 98/37/EC -Gas Appliances 90/396/EEC -Pressure Equipment 97/23/EC -Electro-Magnetic Compatibility 89/336/EEC -Explosive Atmosphere (ATEX) 94/9/EC -Low Voltage 73/23/EEC
Safety design	All H2 stored outside with appropriate separation distances	H2 stored outside; electrolyzer components split between hazardous and non-hazardous zones	H2 stored outside	H2 stored outside	Limited access to laboratory building; we must take action of ventilation, ventilation, and the dust removal to prevent the explosion or a fire	H2 storage outside; electrolyzer in separate space with ventilation access to open air	H2 production and storage in separate space with 15 m distance from house	Filling station outside; truck has hydrogen leakage sensors	
Comments	All systems subjected to detailed HAZOP review	“local fire department educated in response plans”	“good public acceptance due to existing familiarity with NG buses”		“Our system meets general regulations for safety, though there is no special regulation only for hydrogen systems in Japan.”	“with no proper guidelines, standards or regulations in place for the domestic use of hydrogen, so we had to devise our own”	“at first the fire brigade had a problem, but after a few months they agreed ...”	“Standardization is a subject that needs immediate attention, since this already puts restraints on products coming out to the market”	“In the absence of official regulations dealing especially with fuel cell technology, the above-mentioned directives were used.”