NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Regulations, Codes, and Standards (RCS) Template for California Hydrogen Dispensing Stations

C. Rivkin, C. Blake, R. Burgess, W. Buttner, and M. Post

NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

Technical Report
NREL/TP-5600-56223
November 2012

Contract No. DE-AC36-08GO28308

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Regulations, Codes, and Standards (RCS) Template for California Hydrogen Dispensing Stations

C. Rivkin, C. Blake, R. Burgess, W. Buttner, and M. Post

Prepared under Task No. HT12.7310

National Renewable Energy Laboratory
15013 Denver West Parkway
Golden, Colorado 80401
303-275-3000 • www.nrel.gov

Technical Report
NREL/TP-5600-56223
November 2012

Contract No. DE-AC36-08GO28308

NOTICE

Available electronically at http://www.osti.gov/bridge

Available for a processing fee to U.S. Department of Energy
and its contractors, in paper, from:
U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831-0062
phone: 865.576.8401
fax: 865.576.5728
email: mailto:reports@adonis.osti.gov

Available for sale to the public, in paper, from:
U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
phone: 800.553.6847
fax: 703.605.6900
email: orders@ntis.fedworld.gov
online ordering: http://www.ntis.gov/help/ordermethods.aspx

Cover Photos: (left to right) PIX 16416, PIX 17423, PIX 16560, PIX 17613, PIX 17436, PIX 17721

Printed on paper containing at least 50% wastepaper, including 10% post consumer waste.

Executive Summary

The purpose of this report is to provide information on codes and standards that would help the design and construction and regulatory approval of hydrogen dispensing stations. Although this document is directed at California projects, many of the procedures and codes and standards requirements are similar in other parts of the United States. The California Environmental Quality Regulations are not in effect outside of California, but the Risk Management Plans required in California are part of a national program that has very similar requirements across the country.

Building hydrogen dispensing stations for hydrogen fuel cell vehicles is a critical piece of the infrastructure required to support the deployment of hydrogen fuel cell vehicles on a commercial scale. There are fewer than 50 publicly accessible [1] hydrogen dispensing stations in the United States as of April 2012 and all of these stations are prototype or developmental stations. They do not fuel at the volume of commercial liquid fuel stations. They are dissimilar to the common commercial gasoline retail dispensing stations that often contain convenience stores and other products sales such as propane as well as multiple dispensers and multiple dispenser islands. They also differ from existing retail stations in the relatively low number of vehicles they fuel.

The U.S. Department of Energy (DOE) Office of Energy Efficiency and Renewable Energy (EERE) Fuel Cell Technologies Program Safety, Codes and Standards (SCS) Project has as one of its objectives the accelerated deployment of hydrogen and fuel cell technologies. To achieve this objective the National Renewable Energy Laboratory (NREL) through direction and funding from EERE has developed a template for a commercial hydrogen dispensing stations to streamline the project development and permitting process for widespread deployment of hydrogen dispensing stations.

Table of Contents

1 Background and Purpose

Building hydrogen dispensing stations for hydrogen fuel cell vehicles is a critical piece of the infrastructure required to support the deployment of hydrogen fuel cell vehicles on a commercial scale. There are fewer than 100 hydrogen dispensing stations in the United States as of April 2012 and all of these stations are prototype or developmental stations. They are dissimilar to the common commercial gasoline retail dispensing stations that often contain convenience stores and other products sales such as propane as well as multiple dispensers and multiple dispenser islands. They also differ from existing retail station in the relatively low number of vehicles they fuel.

The U.S. Department of Energy (DOE) Office of Energy Efficiency and Renewable Energy (EERE) Fuel Cell Technologies Program Safety, Codes and Standards (SCS) Project has as one of its objectives the accelerated deployment of hydrogen and fuel cell technologies. To achieve this objective the National Renewable Energy Laboratory (NREL) through direction and funding from EERE has developed a template for a commercial hydrogen dispensing stations to streamline the project development and permitting process for widespread deployment of hydrogen dispensing stations.

This template defines the Regulations, Codes, and Standards (RCS) requirements for hydrogen dispensing stations and the administrative process involved in obtaining the required approvals to build and operate a station.

This template contains information on the permitting processes that most project applicants would encounter as well as the RCS that their applications would have to meet. This document should be helpful to both project developers and code officials. There are elements of this document that are specific to California but many of the requirements that a project would have to meet are similar in other locations in the United States. The California Fire Code [2] is based on the International Fire Code, which is widely used in the United States. Additionally, many code officials will require compliance with NFPA 2 Hydrogen Technologies Code (as well as some of the reference standards shown in this document), which would be the same requirements across the United States.

The California-specific portions of this document are the discussion of the California Environmental Quality Act (CEQA) [3] and the California Risk Management Plan [4] requirements, which are based on federal requirements that are in effect across the United States.

2 The Permitting Process

The permitting process is actually several processes typically involving multiple permits and agencies. The processes are in place to protect public safety, public health, and the environment. An example of the permits, agencies, and purposes for these multiple permitting process is shown in Table 1.

The permitting processes can be broken down into seven stages which help define the overall process and the timeline for completing all of the required components.

1. Preliminary project scoping
2. Station design
3. Approval process
4. Station/dispenser construction
5. Station/dispenser startup
6. Station/dispenser operation
7. Station/dispenser maintenance

The required permits address all of these phases but the permitting structure does not correlate on a one to one basis with the with the chronological steps required to build and operate a dispensing station. Tables 1 and 2 list elements of the permitting and approval processes. The difference between these tables is that there are regulatory agencies that typically issue a permit after the applicant has shown compliance with requirements and agencies that approve of an applicant's submission without issuing a permit.

Table 1. Hydrogen Dispensing Station Permitting/Potential Permits Required

Permit	Agency	Permit/Permit Scope
Construction	Building Department	Permit to Construct General/Address safety construction issues
Drainage	Engineering Department	Permit to Construct Drainage/Modification to sewer drainage
Site grading	Engineering Department	Permit to Construct Grading/Modification to site elevation
Electrical	Building/Electrical Department	Electrical Permit/Modification to electrical service
Demolition	Building Department	Construction Permit/Demolish structures required for dispenser construction
Food services	Health Department	Food sales
Air emission impacts	South Coast Air Quality Management District (SCAQMD)	Air Quality Permit or No impact declaration
Fire safety	Fire Department Plans Review Office	Fire Safety Permit/General fire code compliance
Water quality	Water Quality Management Agency	Liquid discharges to the environment

Table 2. Hydrogen Dispensing Station Approvals

Approval	Agency	Approval Scope
California Environmental Quality Act (CEQA) (see overview of CEQA attached at the end of this document)	Self enforcing although local AHJ has first opportunity to enforce	CEQA approval or finding of no significant impact/ environmental agency having jurisdiction
Zoning	Local zoning board	Zoning approval/allows construction and operation at defined location
California Accidental Release Prevention Program (CAL – ARP)	Local administering agency (for example county health or fire department) and U.S. EPA	Approved submission or finding of non-applicability/ requires an evaluation of the impact of the release of a regulated materials from the site and a plan in the event of a release

The Permit Applicant

The administrative process for reviewing and approving projects may vary from jurisdiction but there are common elements. These basic elements are as follows:

1. Presubmittal review and feedback (optional but highly recommended)
2. Review and feedback to applicant
3. Formal submission of application
4. Public meeting (on an as needed basis determined by both administrative law and the jurisdiction's determination as to whether public input should be solicited)
5. Make adjustments in the permit application (as needed) based on public input
6. Review of modified application and feedback to application
7. Resubmittal of modified application
8. Issuance of permit
9. Project construction
10. Site inspection to determine that project built as shown in final design plans
11. Periodic inspections to determine ongoing compliance.

The presubmittal review, although not typically required, is a critical step in this process. It is at the time that significant problems could be identified and potentially averted. Examples of problems that could be averted are:

1. Identification of problems at the proposed site that the applicant is not aware of
2. Identification of requirements the project must meet that the applicant had not evaluated in the draft application
3. Any history of issues with similar projects in the jurisdiction.

3 Permit Templates and Example Permit

Template 1 – Hydrogen Dispenser Added to Existing Fueling Station

For this template a single dispenser is added to an existing fueling station. In all California jurisdictions, the California Fire Code is the enforced fire code. The addition of a single dispenser still will trigger construction requirements. The dispenser will require at least the following elements:

- A dispensing platform
- Vehicle crash protection
- Electrical service
- Hydrogen storage or generation equipment or both for dispenser that has hydrogen generating and storage capability
- Lighting
- Compressors to compress the hydrogen to vehicle storage pressure
- Dispenser with fueling hose and nozzle
- Piping from the gaseous hydrogen storage system to the dispenser
- Fire protection system
- Maintenance system
- Unique construction requirements such as handicapped parking requirements.

Note that the citations associated with the code requirements are the International Fire Code's numbering system.

California Fire Code 2012 edition		
Item	Code citations	Compliance issues
General requirements	**2309.3.1.1 Outdoors.** Generation, compression, or storage equipment shall be allowed outdoors in accordance with Chapter 58.	Requiring the equipment be located outdoors will allow any releases to disperse and dilute rapidly
Dispensing platform	**2309.4.1 Dispensing systems.** Dispensing systems shall be equipped with an overpressure protection device set at 140 percent of the service pressure of the fueling nozzle it supplies.	This section gives a few general requirements for the dispenser-primarily gives the overpressure limit
Vehicle crash protection and fueling area	**2309.5.1 Protection from vehicles.** Guard posts or other *approved* means shall be provided to protect hydrogen storage systems and use areas subject to vehicular damage in accordance with Section 312. **2309.5.1.1 Vehicle fueling pad.** The vehicle shall be fueled on noncoated concrete or other *approved* paving material having a resistance not exceeding 1 megohm as determined by the methodology specified in EN 1081.	
Electrical service	**2309.2.3 Electrical equipment.** Electrical installations shall be in accordance with NFPA 70.	NFPA 2 will set electrical classification zones around dispensers
Hydrogen storage or generation equipment or both for dispenser that has hydrogen generating and storage capability	**2309.2 Equipment.** Equipment used for the generation, compression, storage or dispensing of hydrogen shall be designed for the specific application in accordance with Sections 2309.2.1 through 2309.2.3. **2309.2.1 Approved equipment.** Cylinders, containers and tanks; pressure relief devices, including pressure valves; hydrogen vaporizers; pressure regulators ; and piping used for gaseous hydrogen systems shall be designed and constructed in accordance with Chapters 53, 55 and 58.	Currently there are very few listed components for hydrogen dispensing systems. As a result of the absence of listed equipment, the system would have to go through the approval process by the AHJ. The AHJ may seek the assistance of a third party hydrogen safety expert to perform the review of the system and components.

	2309.2.2 Listed or approved equipment. Hoses, hose connections, compressors, hydrogen generators, dispensers, detection systems and electrical equipment used for hydrogen shall be *listed* or *approved* for use with hydrogen. Hydrogen motor-fueling connections shall be *listed* and *labeled* or *approved* for use with hydrogen. **2309.3.1.3 Gaseous hydrogen storage.** Storage of gaseous hydrogen shall be in accordance with Chapters 53 and 58. **2309.3.1.4 Liquefied hydrogen storage.** Storage of liquefied hydrogen shall be in accordance with Chapters 55 and 58.	The components most directly in contact with the individual performing the fueling operation are of particular concern. These components would include the dispenser nozzle and hose. A hose or nozzle failure could result in an injury to the individual performing the fueling operation. At a retail fueling facility, this individual could be any member of the public purchasing fuel or proximate to the fueling operation.
Lighting	Must meet NEC requirements	
Compressors to compress the hydrogen to vehicle storage pressure	**2309.2 Equipment.** Equipment used for the generation, compression, storage or dispensing of hydrogen shall be designed for the specific application in accordance with Sections 2309.2.1 through 2309.2.3. **2309.2.1 Approved equipment.** Cylinders, containers and tanks; pressure relief devices, including pressure valves; hydrogen vaporizers; pressure regulators; and piping used for gaseous hydrogen systems shall be designed and constructed in accordance with Chapters 53, 55 and 58. **2309.2.2 Listed or approved equipment.** Hoses, hose connections, compressors, hydrogen generators, dispensers, detection systems and electrical equipment used for hydrogen shall be *listed* or *approved* for use with hydrogen. Hydrogen motor-fueling connections shall be *listed* and *labeled* or *approved* for use with hydrogen.	The chapters referred to in this section specify requirements as follows: Chapter 53 Compressed Gases Chapter 55 Cryogenic Fluids Chapter 58 Flammable Gases and Flammable Cryogenic Fluids
Dispenser with fueling hose and nozzle	**2309.2 Equipment.** Equipment used for the generation, compression, storage or dispensing of hydrogen shall be	

	designed for the specific application in accordance with Sections 2309.2.1 through 2309.2.3. **2309.2.1 Approved equipment.** Cylinders, containers and tanks; pressure relief devices, including pressure valves; hydrogen vaporizers; pressure regulators; and piping used for gaseous hydrogen systems shall be designed and constructed in accordance with Chapters 53, 55 and 58. **2309.2.2 Listed or approved equipment.** Hoses, hose connections, compressors, hydrogen generators, dispensers, detection systems and electrical equipment used for hydrogen shall be *listed* or *approved* for use with hydrogen. Hydrogen motor-fueling connections shall be *listed* and *labeled* or *approved* for use with hydrogen.	
Piping from the gaseous hydrogen storage system to the dispenser	Piping shall be in accordance with ASME B31.12 hydrogen Pipelines and Piping **704.1.2 Piping systems.** Piping, tubing, valves and fittings conveying gaseous hydrogen shall be designed and installed in accordance with Sections 704.1.2.1 through 704.1.2.5.1, Chapter 27 of the *International Fire Code,* and ASME B31.3. Cast-iron pipe, valves and fittings shall not be used.	Cast iron pipe is particularly susceptible to hydrogen embrittlement and failure.
Fire protection system	**2309.3.1.5.2 Fire-extinguishing systems.** Fuel-dispensing areas under canopies shall be equipped throughout with an *approved automatic sprinkler system* in accordance with Section 903.3.1.1. The design of the sprinkler system shall not be less than that required for Extra Hazard Group 2 occupancies. Operation of the sprinkler system shall activate the emergency functions of Sections 2309.3.1.5.3 and 2309.3.1.5.4. **2309.3.1.5.3 Emergency discharge.** Operation of the *automatic sprinkler system* shall activate an automatic emergency discharge system, which will discharge the hydrogen gas from the equipment on the canopy top	Note that fuel dispensing that is not conducted under a canopy does not require the use of an approved automatic sprinkler system. However, there still may be a safety basis for install a sprinkler system. The AHJ may require manual release of the stored hydrogen. Also, the AHJ may allow for the use of manual release instead of the use of an automatic sprinkler system.

	through the vent pipe system. **2309.3.1.5.4 Emergency shutdown control.** Operation of the *automatic sprinkler system* shall activate the emergency shutdown control required by Section 2309.5.3.	
Maintenance system	**2309.3.1.2.1 Maintenance.** Gaseous hydrogen systems and detection devices shall be maintained in accordance with the manufacturer's instructions.	Maintenance is critical particularly for high pressure gas dispensing systems where detecting a system disturbance before it develops into a more serious problem.
Ignition control	**2309.3.1.2.2 Smoking.** Smoking shall be prohibited in hydrogen cutoff rooms. "No Smoking" signs shall be provided at all entrances to hydrogen cutoff rooms. **2309.3.1.2.3 Ignition source control.** Open flames, flame-producing devices and other sources of ignition shall be controlled in accordance with Chapter 58. **2309.3.1.2.4 Housekeeping.** Hydrogen cutoff room shall be kept free from combustible debris and storage.	Hydrogen has an ignition energy of XX which means that it can be easily ignited.
Emergency shutoff	**2309.5 Safety precautions.** Safety precautions at hydrogen motor fuel-dispensing and generation facilities shall be in accordance with Sections 2309.5.1 through 2309.5.3.1. **2309.5.2 Emergency shutoff valves.** A manual emergency shutoff valve shall be provided to shut down the flow of gas from the hydrogen supply to the piping system. **2309.5.2.1 Identification.** Manual emergency shutoff valves shall be identified and the location shall be clearly visible, accessible and indicated by means of a sign. **2309.5.3 Emergency shutdown controls.** In addition to the manual emergency shutoff valve required by Section 2309.5.2, a remotely located, manually activated emergency shutdown control shall be provided. An	Shutting down the gas flow in the event of an upset condition is critical. Until the gas flow is shut down fuel is being fed to a potential release point. The 75 foot distance will allow the activation of the emergency shutdown valve

	emergency shutdown control shall be located within 75 feet (22 860 mm) of, but not less than 25 feet (7620 mm) from, dispensers and hydrogen generators. **2309.5.3.1 System requirements.** Activation of the emergency shutdown control shall automatically shut off the power supply to all hydrogen storage, compression and dispensing equipment; shut off natural gas or other fuel supply to the hydrogen generator; and close valves between the main supply and the compressor and between the storage containers and dispensing equipment	without unduly exposing the individual performing the shut down to the hazards associated with a hydrogen release.
Unique construction requirements	**2309.3.1.5 Canopy tops.** Gaseous hydrogen compression and storage equipment located on top of motor fuel-dispensing facility canopies shall be in accordance with Sections 2309.3.1.5.1 through 2309.3.1.5.5, Chapters 53 and 58 and the *International Fuel Gas Code*. **2309.3.1.5.1 Construction.** Canopies shall be constructed in accordance with the motor fuel-dispensing facility canopy requirements of Section 406.7 of the *International Building Code*. **2309.3.1.5.5 Signage.** *Approved* signage having 2- inch (51 mm) block letters shall be affixed at *approved* locations on the exterior of the canopy structure stating: CANOPY TOP HYDROGEN STORAGE. **2309.3.2 Canopies.** Dispensing equipment need not be separated from canopies of Type I or II construction that are constructed in a manner that prevents the accumulation of hydrogen gas and in accordance with Section 406.7 of the *International Building Code.*	This provision allows for canopy mounted equipment. Early installations employing canopy mounted equipment have proven to be very expensive in part because of the construction and material cost associated with supporting heavy equipment.

Template 2 – Stand Alone Hydrogen Dispensing Station

The initial deployment of hydrogen dispensing capability will more likely be single dispensers added to existing fueling facilities. As hydrogen dispensing deployment progresses, dedicated hydrogen fueling stations will be built. These stations will have additional components that a single dispenser station will not have. A station with a single dispenser will likely have a high pressure gas storage system to supply the dispenser. A stand-alone hydrogen dispensing station would likely have the following additional components:

a. Cryogenic liquefied hydrogen storage
b. Evaporation equipment to convert liquefied hydrogen to gaseous hydrogen
c. Bank of gaseous hydrogen storage tanks
d. A convenience store for selling cigarettes, alcohol, and other high profit margin items.

California Building Code		
	406.5.2.1 Canopies used to support gaseous hydrogen systems. Canopies that are used to shelter dispensing operations where flammable compressed gases are located on the roof of the canopy shall be in accordance with the following: 1. The canopy shall meet or exceed Type I construction Requirements. 2. Operations located under canopies shall be limited to refueling only. 3. The canopy shall be constructed in a manner that prevents the accumulation of hydrogen gas	
California Fire Code	The requirements shown previously would apply with the addition of cryogenic storage requirements found in	
Section 5806 Flammable Cryogenic Fluids		
Above Ground Tank Requirements	**5806.3 Above-ground tanks for liquid hydrogen.** Aboveground tanks for the storage of liquid hydrogen shall be in accordance with Sections 5806.3 through 5806.3.2.1. **5806.3.1 Construction of the inner vessel.** The inner vessel of storage tanks in liquid hydrogen service shall be designed and constructed in accordance with Section VIII, Division 1, of the ASME *Boiler and Pressure Vessel Code* and shall be vacuum jacketed in accordance with Section 5806.3.2. **5806.3.2 Construction of the vacuum jacket (outer vessel).** The vacuum jacket used as an outer vessel for storage tanks in liquid hydrogen service shall be of welded steel construction designed to withstand the maximum internal and external pressure to which it will be subjected under operating conditions to include conditions of emergency pressure relief of the annular space between the inner and outer vessel. The jacket shall be designed to withstand a minimum collapsing pressure differential of 30 psi (207 kPa). **5806.3.2.1 Vacuum-level monitoring.** A connection shall be	

	provided on the exterior of the vacuum jacket to allow measurement of the pressure within the annular space between the inner and outer vessel. The connection shall be fitted with a bellows-sealed or diaphragm-type valve equipped with a vacuum gauge tube that is shielded to protect against damage from impact.	
Underground Tanks	**5806.4 Underground tanks for liquid hydrogen.** Underground tanks for the storage of liquid hydrogen shall be in accordance with Sections 5806.4.1 through 5806.4.8.3. **5806.4.1 Construction.** Storage tanks for liquid hydrogen shall be designed and constructed in accordance with ASME *Boiler and Pressure Vessel Code* (Section VIII, Division 1) and shall be vacuum jacketed in accordance with Section 5806.4.8. **5806.4.2 Location.** Storage tanks shall be located outside in accordance with the following: 1. Tanks and associated equipment shall be located with respect to foundations and supports of other structures such that the loads carried by the latter cannot be transmitted to the tank. 2. The distance from any part of the tank to the nearest wall of a *basement*, pit, cellar or *lot line* shall not be less than 3 feet (914 mm). 3. A minimum distance of 1 foot (305 mm), shell to shell, shall be maintained between underground tanks. **5806.4.3 Depth, cover and fill.** The tank shall be buried such that the top of the vacuum jacket is covered with a minimum of 1 foot (305 mm) of earth and with concrete a minimum of 4 inches (102 mm) thick placed over the earthen cover. The concrete shall extend a minimum of 1 foot (305 mm) horizontally beyond the footprint of the tank in all directions. Underground tanks shall be set on firm foundations constructed in accordance with the *International Building Code* and surrounded with at least 6 inches (152 mm) of noncorrosive inert material, such as sand. **Exception:** The vertical extension of the vacuum jacket as required for service connections.	

	5806.4.4 Anchorage and security. Tanks and systems shall be secured against accidental dislodgement in accordance with this chapter. **5806.4.5 Venting of underground tanks.** Vent pipes for underground storage tanks shall be in accordance with Section 5503.3. **5806.4.6 Underground liquid hydrogen piping.** Underground liquid hydrogen piping shall be vacuum jacketed or protected by *approved* means and designed in accordance with Chapter 55. **5806.4.7 Overfill protection and prevention systems.** An *approved* means or method shall be provided to prevent the overfill of all storage tanks. **5806.4.8 Vacuum jacket construction.** The vacuum jacket shall be designed and constructed in accordance with Section VIII of ASME *Boiler and Pressure Vessel Code* and shall be designed to withstand the anticipated loading, including loading from vehicular traffic, where applicable. Portions of the vacuum jacket installed below grade shall be designed to withstand anticipated soil, seismic and hydrostatic loading. **5806.4.8.1 Material.** The vacuum jacket shall be constructed of stainless steel or other *approved* corrosion resistant material. **5806.4.8.2 Corrosion protection.** The vacuum jacket shall be protected by *approved* or *listed* corrosion-resistant materials or an engineered cathodic protection system. Where cathodic protection is utilized, an *approved* maintenance schedule shall be established. Exposed components shall be inspected at least twice a year. Maintenance and inspection events shall be recorded and those records shall be maintained on the premises for a minimum of three years and made available to the *fire code official* upon request. **5806.4.8.3 Vacuum-level monitoring.** An *approved* method shall be provided to indicate loss of vacuum within the vacuum jacket(s).	

Example Permit

Jurisdiction of _____, _____(state)

Building/ Fire Permit For Hydrogen Dispensing Installation

Compliance with the following permit will allow the construction and operation of a hydrogen dispensing installation in the _____ jurisdiction. This permit addresses the following situations:

1. The addition of a hydrogen dispensing and storage system to an existing fueling station
2. TBD

This permit contains a general reference to the California fire and Building Codes or equivalent codes used in the jurisdiction. All work and installed equipment will comply with the requirements of XXXX code used in the jurisdiction. The jurisdiction maintains the authority/responsibility to conduct any inspections deemed necessary to protect public safety.

Section 1 of the permit application requires basic identifying information be submitted.

Section 2 of the permit application identifies which code requirements need to be complied with depending on whether the dispenser is being added to an existing station or whether the dispenser is at a new stand alone station.

The technical installation requirements address the following specific elements of station safety:

A. Approval/listing and labeling requirements

B. Piping code compliance

C. Storage vessel stamps/approval

Section 3 consists of a standard certification statement that could be modified as needed by the jurisdiction. By signing the certification statement the applicant agrees to comply with the standard permit conditions and other applicable requirements. This consent would give the jurisdiction the option of allowing the applicant to proceed with installation and operation of the dispensing equipment.

Section 4 of the document gives an example of a checklist the jurisdiction could develop to track key information on the application. The example under section 4 contains only a few items of the many that the jurisdiction might wish to track.

This permit package also includes a schematic drawing depicting a typical installation. The purpose of the schematic is only to show how the station equipment could be arranged and is not intended to convey any permit requirements.

Section 2: Sample Permit Structure

Topic	Permit Requirements
Siting	Do storage and dispenser systems meet separation distance requirements?
Mechanical	Is equipment listed or approved? -Valves -Pressure Relief Devices (PRDs) -Piping -Containers -Hoses -Nozzles
Electrical	Is equipment proximate to dispenser classified?
Maintenance	Have maintenance requirements been defined in permit application? Is there documentation required?
Emergency response	Are E-stops accessible? Do they have a plan? Are personnel trained? Is communications with the Fire Department and other emergency responders clearly defined?
Sensors	Do sensors detect releases or upset conditions? Is the information from sensors conveyed to the process equipment, operators, and Fire Department?

Section 3: Owner Responsibility Statement

I hereby certify that the electrical work described on this permit application shall be/has been installed in compliance with the conditions in this permit, NFPA 70, National Electric Code, and the Fire Code currently adopted and enforced within the jurisdiction of installation. By agreeing to the above requirements, the licensee or owner shall be permitted to construct and operate the charging station.

Signature of Owner Date

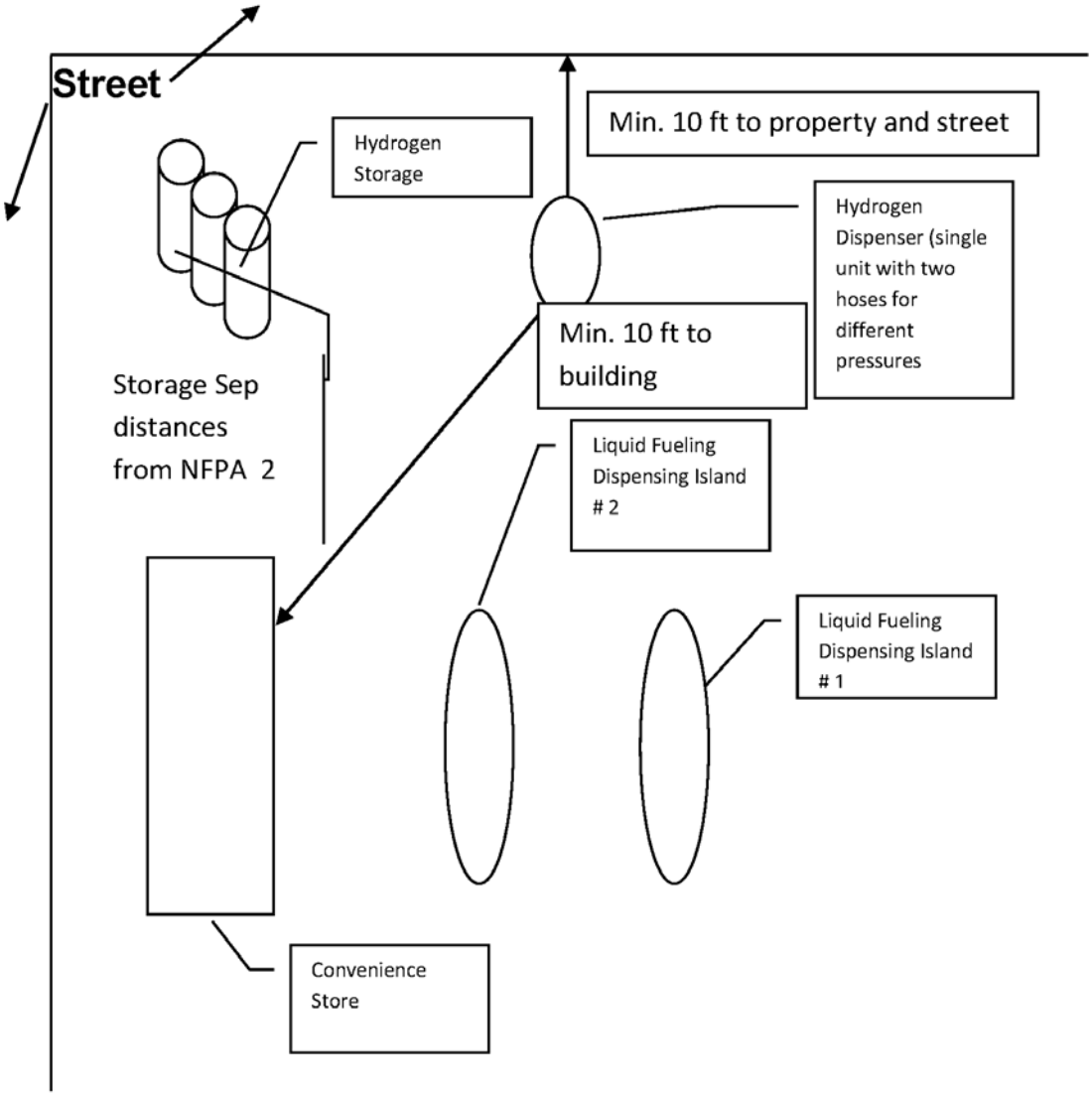
Section 4: Jurisdiction Checklist

Information each Jurisdiction would add to permit such as:

1. Unique requirements in the jurisdiction such as seismic requirements
2. Summary of California Risk Management Plan (RMP) analysis if subject to RMP
3. Summary of California Environmental Quality Act Compliance (CEQA) Analysis

This graphic illustrates the addition of a hydrogen dispenser to an existing fueling station.

Schematic of a Typical Hydrogen Dispensing Station with Single Dispenser



4 Listing of Codes and Standards for Hydrogen Technologies

Table 3 gives a listing of documents that are required by law in California and also lists codes and standards that may be relevant to a project and could be enforced by an Authority Having Jurisdiction (AHJ) based on specific safety considerations.

Table 3. Codes and Standards for Hydrogen Technologies

California codes and ICC codes adopted by the State of California and enforced as law in the State of California		
California Building Code333		
	406.5.2.1 Canopies used to support gaseous hydrogen systems. Canopies that are used to shelter dispensing operations where flammable compressed gases are located on the roof of the canopy shall be in accordance with the following: 1. The canopy shall meet or exceed Type I construction requirements. 2. Operations located under canopies shall be limited to refueling only. 3. The canopy shall be constructed in a manner that prevents the accumulation of hydrogen gas	
California Fire Code	See information shown previously.	
ICC Documents		
Code		Topic
International Building Code (IBC)		
International Fire Code (IFC)		
International Mechanical Code (IMC)		
International Fuel gas Code (IFGC)		
Key reference documents that are not directly adopted as law in the State of California		
NFPA 2 and Related Documents	NFPA 2 is a comprehensive hydrogen technologies code. It covers vehicle fueling and infrastructure as well as hydrogen storage. It will likely be referenced in the 2015 IFC and eventually referenced in the CFC.	
Code		Topic
NFPA 1 Uniform Fire Code (UFC)	The NFPA 1 UFC is used in roughly 25% of the states- primarily in the Northeastern portion of the US.	
NFPA 2 Hydrogen Technologies Code	NFPA 2 covers almost all aspects of hydrogen technologies infrastructure including hydrogen dispensing and vehicle maintenance. The first edition was promulgated in 2011 and included extract materials from NFPA 55, NFPA 853, and NFPA 52.	

NFPA 70 National Electric Code (NEC)	The NEC sets requirements for the classified areas in the dispensing requirements.	
Standards Documents		
CSA Standards		
CSA America HGV 4.1 -2012 Final standard for Hydrogen Dispensing Systems	This document covers the complete dispensing system.	
CSA America HGV 4.2 -2012 Final standard for hoses for compressed hydrogen fuel stations, dispensers, and vehicle fuel systems	Standard for listing hoses for high pressure hydrogen dispensing.	
CSA America HGV 4.3 -20012 Final standard Fueling Station Parameter Safety	Standard for evaluating station performance as defined in SAE J2601.	
CSA America HGV 4.4 -20012 Final standard for breakaway devices for compressed hydrogen dispensing hoses and systems	Standard for evaluating devices to be used in conjunction with CSA 4.2.	
CSA America HGV 4.5 -20012 Final standard for priority and sequencing equipment for hydrogen vehicle fueling		
CSA America HGV 4.6 -2009 TIR for manually operated valves for use in gaseous hydrogen vehicle fueling stations		
CSA America HGV 4.7 -2009 TIR for automatic valves for use in gaseous hydrogen vehicle fueling stations		
CSA America HGV 4.10 -2008 TIR for performance of fittings for compressed hydrogen gas and hydrogen rich gas mixtures		
CSA Standards HPRD-1-2009 TIR for pressure relief devices for compressed hydrogen vehicle fuel containers		

UL Standards		
UL 2075 Standard for Safety Gas and Vapor Detectors and Sensors	These requirements cover toxic and combustible gas and vapor detectors and sensors intended to be portable or employed in indoor or outdoor locations in accordance with the National Electrical Code, NFPA 70. A gas detector and/or sensor and/or vapor detector, as covered by these requirements, consists of an assembly of electrical components coupled with a sensing means inside a chamber, or by separate components to detect toxic and/or combustible gases or vapors. The detector includes provision for the connection to a source of power and signaling circuits.	
CGA Standards		
H-1 Service Conditions for Portable, Reversible Metal Hydride Systems	http://www.cganet.com/customer/publication_detail.aspx?id=H-1	
H-2 Guidelines for the Classification and Labeling of Hydrogen Storage Systems with Hydrogen	http://www.cganet.com/customer/publication_detail.aspx?id=H-2	
H-3 Cryogenic Hydrogen Storage	http://www.cganet.com/customer/publication_detail.aspx?id=H-3	
H-4 Terminology Associated with Hydrogen Fuel Technologies	http://www.cganet.com/customer/publication_detail.aspx?id=H-4	
H-5 Installation Standards for Bulk Hydrogen Supply Systems		
CGA S-1.1 **Pressure Relief Device Standards-Part 1-Cylinders for Compressed Gases, Fourteenth Edition** Edition: 14th Compressed Gas Association / 01-Nov-2011 / 49 pages		
CGA S-1.2 **Pressure Relief Device Standards - Part 2 - Cargo and Portable Tanks for Compressed Gases** Edition: 9th Compressed Gas Association / 18-Mar-2009 / 35 pages		
CGA S-1.3-2008 **Pressure Relief Device Standards-Part 3-Stationary Storage Containers for Compressed Gases** The purpose of this standard is to complement the requirements of various regulations, codes, standards, or specifications applicable to storage containers for		

compressed gases. In case of conflict, the requirements of the regulations, codes, standards, or specifications of the authorities having jurisdiction over such containers shall apply. It is recommended that containers fabricated after December 31, 1995, use PRDs that meet the requirements of this edition of CGA S-1.3		
ASME Standards		
ASME B31.12 Hydrogen Piping and Pipelines	Code for the design of hydrogen piping systems that was developed from ASME B31.3- the code used extensively for industrial piping systems.	
ASME Boiler and Pressure Vessel Code (BPV)	Sets requirements for storage vessels including vessels used on vehicles- although its primary application is for fixed storage vessels.	
SAE Standards		
SAE J2579 Vehicle Fuel Systems	This standard covers the vehicle fuel storage system. Many of the requirements of this standard form the basis of the Global Technical Regulation (GTR) for fuel cell vehicles.	
SAE J2601 Fueling Protocol	The standard sets station performance requirements for hydrogen dispensing over a range of temperatures and pressures.	

5 California Environmental Quality Regulation (CEQA) Requirements

Summary of Key Requirements of the California Environmental Quality Act (CEQA)

Background. The CEQA Statute (Res. Code §21000 *et seq*) was promulgated in 1970 to protect the environment from the potential adverse impacts of projects. The act was implemented through the CEQA Guidelines which are regulations that explain and interpret the law. They are found in CCR Title 14 Chapter 3. Projects are generally construction projects but also include programs, such as a change in zoning requirements that would allow different types of construction that could result in an environmental impact. Figure 1 describes the process flow for compliance with the CEQA regulations.

Applicability. CEQA applies to projects undertaken by state and local agencies or a private entity for which they must receive some discretionary approval. For example, adding a piece of equipment that requires a permit from an Air Quality Management District would be considered discretionary approval.

Basic Requirements. Projects must be evaluated for significant environmental impacts and grouped into one of the following three categories:

1. The project has no significant environmental impacts
2. The project as initially proposed has significant environmental impacts but has been modified to eliminate those impacts. For example the project as initially proposed resulted in the discharge of a pollutant to the environment. The project was modified to eliminate the use of a materials that that would result in a discharge to the environment. Therefore, the project has no environmental impact.
3. The project will have a significant environmental impact and an Environmental Impact Report (EIR) has been produced describing measures taken to reduce impacts and the effects of the residual impacts.

Enforcement. CEQA is a self-executing statute which means that no one agency has responsibility for enforcing the statute.

Exemptions. There are both statutory exemptions and categorical exemption as defined by the Secretary of the Resources Agency.

1. A comprehensive list of statutory exemptions is found in Article 18 of the CEQA guidelines. Most of these exemptions are listed in Section 15282 of the Guidelines
2. Categorical exemptions are found in Article 19 of the CEQA Guidelines. Categorical exemptions are not absolute and there exceptions to these exemptions that are found in Section 15300.2 of the Guidelines.

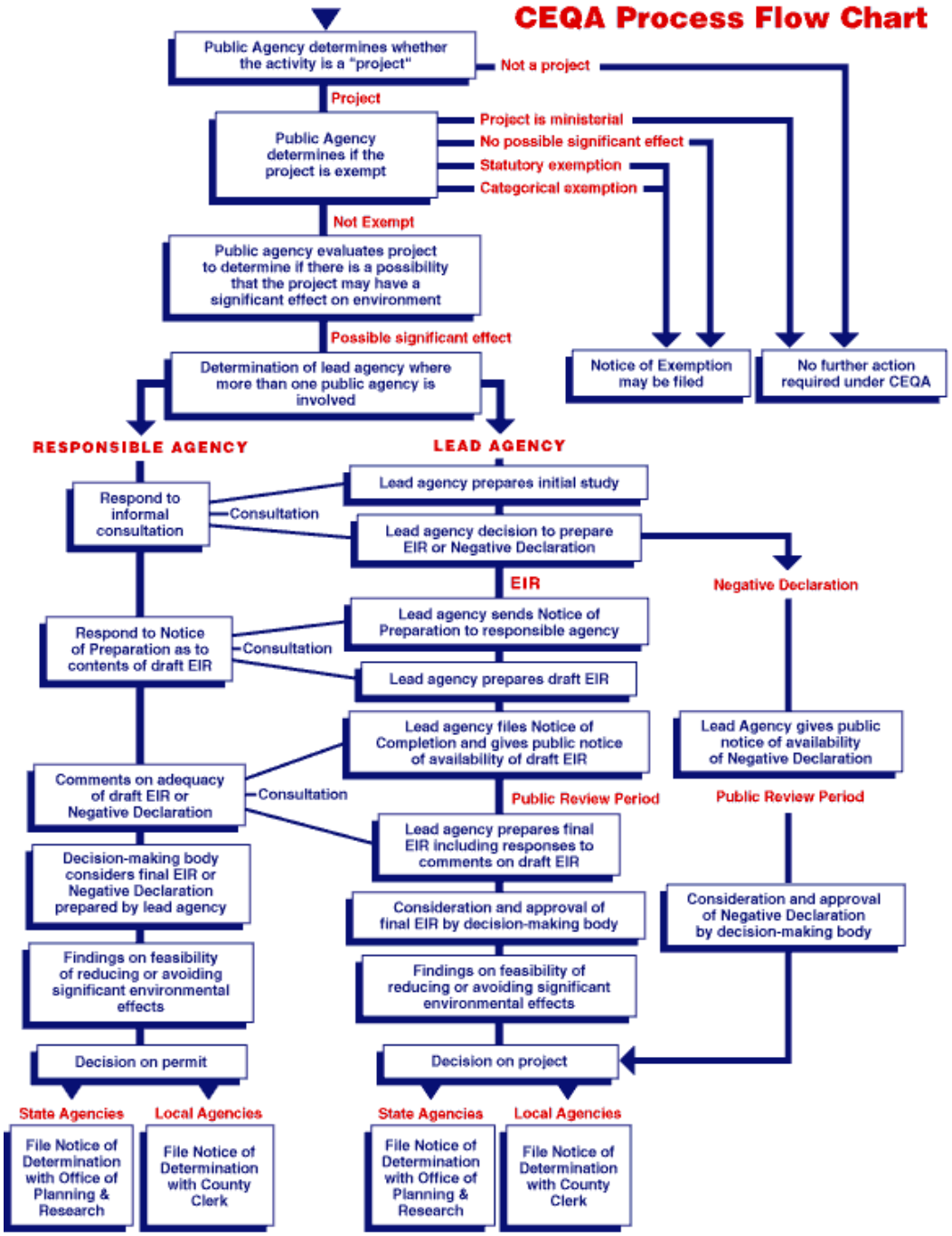


Figure 1. CEQA process flow chart

6 California Accidental Release Prevention Program (CAL-ARP) Requirements

California Accidental Release Prevention Program (CAL-ARP)

The CAL–ARP program is the Federal Risk Management Plan (RMP) regulations promulgated by the USEPA under with additional California requirements that include an expanded list of regulated materials.

The basic purpose of the program is to reduce the risk to the public of dangerous materials used in commercial activities by providing information to first responders so that they can safety resolve any incidents involving dangerous materials.

The basic requirements of the program are the preparation of document by a facility owner that includes at least the following elements:

- Regulated substances held onsite at the stationary source
- Offsite consequences of an accidental release of a regulated substance
- The accident history at the stationary source
- The emergency response program for the stationary source
- Coordination with local emergency responders
- Hazard review or process hazard analysis
- Operating procedures at the stationary source
- Training of the stationary source's personnel
- Maintenance and mechanical integrity of the stationary source's physical plant
- Incident investigation.

Organizations that meet the following criteria must submit a plan:

> An owner or operator of a stationary source that has more than a threshold quantity of a regulated substance (listed in Tables 1-3, Title 19 § 2770.5) in a process may have to complete and submit a risk management plan. Also, any facility the enforcing authority determines poses a significant risk, may be required to submit a plan under the due diligence clause in the regulations.

7 References

1. Hydrogen Fueling Station Locations, U.S. Department of Energy Office of Energy Efficiency and Renewable Energy Alternative Fuels Data Center, http://www.afdc.energy.gov/fuels/hydrogen_locations.html
2. California Fire Code text, http://osfm.fire.ca.gov/
3. California Environmental Quality Act text, http://ceres.ca.gov/ceqa/stat/
4. Regulation text of California Risk Management Plan Regulations, http://calarp.com/CalARP%20Regs.pdf