F-155 03/04
2209.3.2

Public Comment 2:

ICC AHC for Hydrogen Gas requests Approved as Modified by this Public Comment.

Modify proposal as follows:

1. Revise as follows:

2209.3.2 Location of dispensing operations and equipment. Generation, compression, storage and dispensing equipment shall be located ~~outdoors, above ground~~ in accordance with Sections 2209.3.2.1 through 2209.3.2.4.

~~**Exceptions:**~~

2209.3.2.1 Outdoors. Generation, compression, storage or dispensing equipment shall be allowed outdoors in accordance with Section 2209.3.1.

~~1.~~ **2209.3.2.2 Weather protection.** Generation, compression, storage or dispensing equipment shall be allowed ~~in buildings of Type I and II construction, as defined in the *International Building Code*, which are unenclosed for three quarters or more of the perimeter~~ under weather protection in accordance with the requirements of Section 2704.13 and constructed in a manner that prevents the accumulation of hydrogen gas.

~~2.~~ **2209.3.2.3 Indoors.** Generation, compression, storage and dispensing equipment shall be allowed indoors in accordance with Chapter 30 and as set forth in the *International Building Code* and *International Fuel Gas Code*.

2209.3.2.4 Liquefied hydrogen storage. Storage of liquefied hydrogen shall be in accordance with Chapter 32.

2209.3.3 Canopies. Dispensing equipment need not be separated from canopies of Types I or II construction that are constructed in accordance with Section 406.5 of the *International Building Code*, in a manner that would prevent the accumulation of hydrogen gas.

2. Add new text as follows:

3204.4 Underground tanks. Underground tanks for the storage of liquid hydrogen shall be in accordance with this section.

3204.4.1 Construction. Storage tanks for liquid hydrogen shall be designed and constructed in accordance with Section VIII of *ASME Boiler and Pressure Vessel Code* ~~(Section VIII, Division 1)~~ and shall be vacuum jacketed in accordance with Section 3204.6.

3204.4.2 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 feet (1525 mm), shell to shell, shall be maintained between underground tanks.

3204.4.3 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 of earth and with concrete a minimum of 4 inches (101mm) thick placed over the earthen cover. The concrete shall extend a minimum of one foot (0.3m) 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.

3204.4.4 Anchorage and security. Tanks and systems shall be secured against accidental dislodgement in accordance with this chapter.

3204.4.5 Venting of underground tanks. Vent pipes for underground storage tanks shall be in accordance with Sections 2209.5.4 and 3203.3.

3204.4.6 Underground liquid hydrogen piping. Underground liquid hydrogen piping shall be vacuum jacketed or protected by approved means and designed in accordance with this chapter.

3204.4.7 Overfill protection and prevention systems. An approved means or method shall be provided to prevent the overfill of all storage tanks.

3204.6 Vacuum jacket construction. The vacuum jacket shall be designed and constructed in accordance with Section VIII of *ASME Boiler and Pressure Vessel Code* ~~– CGA 341~~ and shall ~~include external loading due to backfill~~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 and hydrostatic loading.

3204.6.1 Material. The vacuum jacket shall be constructed of stainless steel or other approved corrosion-resistant material.

3204.6.2 Corrosion protection. The vacuum jacket shall be protected by an engineered cathodic protection system. A cathodic protection system maintenance schedule shall be provided and reconciled by the owner/operator. Exposed components shall be inspected at least twice a year.

3204.6.3 Vacuum level monitoring. An approved ~~monitoring~~ method shall be provided to indicate loss of vacuum ~~degradation~~ within the vacuum jacket(s). ~~The monitoring method shall provide for periodic~~

~~measurement of the vacuum level.~~

3. Revise as follows:

3205.1.2.4 Physical protection and support. ~~Above-ground~~ Piping systems shall be supported and protected from physical damage. Piping passing through walls shall be protected from mechanical damage.

~~4. Add new referenced standard to Chapter 45 as follows:~~

~~Compressed Gas Association~~

~~CGA 341-02 Standard for Insulated Cargo Tank Specifications for Nonflammable Cryogenic Fluids...3204.6~~

Commentor's Reason: The AHC has addressed and resolved the issues identified by the IFC Development Committee directly as modified by this public comment. The following discussion provides a brief explanation of each solution:

Specifically,

1) The AHC H2G states the proposed language in terms of required performance and continues to base its recommendations on one or more of the following factors during its open deliberations; namely, fire experience, industry representation, contemporary design practice research data, engineering fundamentals, and other available information. The activities of the AHC H2G can be reviewed at http://www.iccsafe.org/cs/cc/h2g/h2g.html

2) Reference to CGA 341 has been removed. The applicable provisions specific to the construction of the vacuum jacket are added directly to the code.

3) A concern was expressed with regard to the loading conditions to be anticipated during design. The AHC believes the revisions to Section 3204.6 address that concern, and are entirely consistent with similar provisions for the design and construction of below-grade vaults as is found in current IFC §3404.2.8.2 and F169-03/04 recommended for approval As Submitted.

4) Revisions to Section 3204.6.3 remove language (i.e., "periodic") subject to non-uniform interpretation and non-uniform enforcement.

Lastly, one of the charging statements tasked to the AHC for Hydrogen Gas when it was formed was to determine the adequacy of coverage in the International Codes for the storage, handling and use of hydrogen in the infrastructures, which support vehicular applications.

Thus, the greatest challenge envisioned by the DOE, the AHC, and industry was, and still is, in economizing the refueling station/convenience store footprint and site allocation requirements with the National existing motor fuel-dispensing infrastructure in mind. The requisite storage solution requires fresh and out of the box thinking, such as underground cryogenic liquid hydrogen as is suggested in this proposal. While helpful, the development of a sound code language through the focused deliberations of industry specialists and the open hearing process should not be predicated on the development of a standard for underground cryogenic liquid hydrogen storage.

The ICC AHC for Hydrogen Gas requests your support of F155-03/04 as modified by this public comment.

Public Hearing: Committee: AS AM D
Assembly: ASF DF