

**National Hydrogen and Fuel Cell Codes and Standards Coordinating Committee  
(NHFCSCC)**

**Wednesday, November 10, 2021  
TIME: 2:00 – 3:00 pm (Eastern Standard Time)**

**Minutes**

**Attendees**

**Amy Ryan  
Bob Boyd  
Brian Ehrhart  
Carl Rivkin  
Chris LaFleur  
Christina Daniels  
Christine Watson**

**Connor Dolan  
Doug Olenick  
Eric Prause  
Jay Keller  
Jennifer Gangi  
Karen Quackenbush  
Kelvin Hecht**

**Norman Newhouse  
Owen Hopkins  
Ray Rahaman  
Rob Early  
Rudolf Coertze  
Ryan Murphy  
Sara Marxen**

**I. Welcome and Housekeeping Items**

- FCHEA's anti-trust guidelines – reviewed
- Meeting agenda - reviewed
- Previous meeting minutes – approved

**II. DOE/HQ Update**

**Brian Ehrhart**

Several announcements recently for awards for GM, Ford, and Daimler to demonstrate hydrogen-powered medium- and heavy-duty trucks.

An initiative through the Clean Energy Ministerial – the H2 Twin Cities was announced. The first phase ends at the end of the calendar year to identify as potential twin cities partners. This could apply to best practices as well as strengthening both cities commitment to clean energy and hydrogen.

**III. Codes & Standards Events and Fuel Cell Safety Information**

<http://www.hydrogenandfuelcellsafety.info/events/>

**Karen Quackenbush**

**Request:** technical resource updates for the Hydrogen and Fuel Cell Safety website. Any committee members who have materials they would like hosted on the website can send them to Karen Quackenbush ([kquackenbush@fchea.org](mailto:kquackenbush@fchea.org)) or Connor Dolan ([cdolan@fchea.org](mailto:cdolan@fchea.org)).

**IV. Global Technical Regulations**

**Ian MacIntire**

- IWG meeting was held October 12-15.
- A few Phase 2 issues remain unresolved on the IWG agenda (TPRD direction, extension of service life)
- Task forces are still resolving some minor issues

- Drafting task force has a goal to submit an informal document to GRSP by early December, however, this is a tight timeline
- A co-sponsors meeting will take place next week to consider a 6-month extension
- Next IWG meeting planned for the end of January

Task force 1 met yesterday to review TPRD.

Task force 3 is working diligently on fire testing.

All three task forces are wrapping up.

## V. Codes and Standards Organization Updates

### Institute of Electrical and Electronics Engineers

Mark Siira

FCHEA's stationary members are keenly interested in IEEE 1547 which is expected to be reopened next year. In the meantime, IEEE has issued 1547.9 as a guide of how the document applies to the industry. Our members reviewed the guide and found it to be quite informative.

IEEE 1547 is a large, comprehensive document which will be reviewed by the FCHEA Stationary Power Working Group.

### International Electrotechnical Commission IEC TC 105

Kelvin Hecht

- **IEC 62282-3-100**
  - Stationary fuel cell power systems – Safety 3<sup>rd</sup> edition
    - Steve Mauer - Convener
    - 1<sup>st</sup> meeting was held 10/14
    - 2<sup>nd</sup> meeting will be 12/08
- **IEC 62282-8-301**
  - Energy storage systems using fuel cell modules in reverse mode – Power to methane energy systems based on solid oxide cells reversible operation - Performance test methods
    - CD posted for comments
    - US TAG to meet 11/12 to coordinate comments

IEC TC 105 is seeking sponsorship for a meeting to be held in San Francisco, CA in conjunction with the broader IEC meeting. Alternately, conference space is being solicited for an outside meeting.

### International Standards Organization ISO/TC 197

Karen Quackenbush/Jay Keller

The plenary and strategic planning meetings will be held in early December on the 6<sup>th</sup> – 10<sup>th</sup>. Those needing access should contact Jay Keller.

The working groups are collaborating and proceeding forward. We expect to have updates on the working group activities following the plenary.

WG 22 – already working on first revision to the hoses document for gaseous hydrogen refueling stations have benefited greatly from the work at CSA on HGV 4.2.

WG 21 – compressors has not met this year, however, there have been many discussions with those engaged and we are working to develop the next working draft that will allow holding a new meeting. This new meeting would be held virtually.

WG 23 – fittings circulated a Committee Draft in 2020 which passed ballot. There were 20 pages of comments submitted, including significant discussion on the scope of the document. An explanation of a committee internal ballot on the scope will be generated for agreement and resolution.

WG 24 – Working on a hydrogen fueling protocols. Work is broken into three task forces investigating fundamentals for a fueling protocol, communication for a protocol, and creation of a high-flow protocol.

*\* Interest was expressed for an aviation focused protocol as well for follow-up.*

WG 29 – Is starting up again to revisit the materials science table in the document. Also considering a liquid component to this activity.

### **National Fire Protection Association NFPA 2**

**Chris LaFleur**

NFPA 2 is still waiting for dates on the second draft meeting from NFPA. Expected to be held in early February. A Joint Storage task force has been meeting frequently on storage, specifically on liquid hydrogen storage. Several other task forces are active now.

NFPA 55 – the Committee held its second draft meeting last week. Work is continuing on activities such as venting. The storage task group presented its work on liquid hydrogen separation distances. Several CGA members have been working with Sandia on ways to improve the code. NFPA 55 accepted proposed change from NFPA 2 to adopt new distances.

There has been much work underway on how to make the scope of NFPA 55 more clear around the hydrogen requirements. We looked at how NFPA 55 handles other fuels. As hydrogen is becoming more of a fuel and less of an industrial gas we could have NFPA 55 treat hydrogen similarly to other fuels. A solution to this scope change will be submitted for the September meeting of the standards council of NFPA for their concurrence, after which a task group will be created to make changes needed.

### **International Codes Council (ICC)**

**Spencer Quong**

There are no updates for the fire code (and probably won't be for several months until the next version comes out.

### **Society of Automotive Engineers (SAE)**

**Mike Steele**

#### ***SAE Fuel Cell Standards Committee Documents***

<b>Task Force</b>	<b>Document</b>	<b>Title</b>	<b>Date</b>	<b>Status</b>
<b>Interface</b>	J2600_201510	Compressed Hydrogen Surface Vehicle Fueling Connection Devices	21-Oct-15	Revised - Action required

<b>Interface</b>	J2601_202005	Fueling Protocols for Light Duty Gaseous Hydrogen Surface Vehicles	29-May-20	Revised
<b>Interface</b>	J2601/2_201409	Fueling Protocol for Gaseous Hydrogen Powered Heavy Duty Vehicles	24-Sep-14	Issued - Action Required
<b>Interface</b>	J2601/3_201306	Fueling Protocol for Gaseous Hydrogen Powered Industrial Trucks	12-Jun-13	Issued - Action Required
<b>Interface</b>	TIR J2601/4	Ambient Temperature Refueling		Being developed
<b>Interface</b>	J2719_202003	Hydrogen Fuel Quality for Fuel Cell Vehicles	18-Mar-20	Revised
<b>Interface</b>	J2799_201912	Hydrogen Surface Vehicle to Station Communications Hardware and Software	13-Dec-19	Revised
<b>Interface</b>	TIR J3219	Hydrogen Fuel Quality Screening Test of Chemicals for Fuel Cell Vehicle		Being developed
<b>Safety</b>				
<b>Safety</b>	J1766_201401	Recommended Practice for Electric, Fuel Cell and Hybrid Electric Vehicle Crash Integrity Testing	10-Jan-14	Revised - Action required
<b>Safety</b>	J2578_201408	Recommended Practice for General Fuel Cell Vehicle Safety	26-Aug-14	Revised - Action required
<b>Safety</b>	J2579_201806	Standard for Fuel Systems in Fuel Cell and Other Hydrogen Vehicles	15-Jun-18	Revised
<b>Safety</b>	J2594_201611	Recommended Practice to Design for Recycling Proton Exchange Membrane (PEM) Fuel Cell Systems	15-Nov-16	Reaffirmed
<b>Safety</b>	J2990/1_201606	Gaseous Hydrogen and Fuel Cell Vehicle First and Second Responder Recommended Practice	3-Jun-16	Issued
<b>Safety</b>	J3089_201810	Characterization of On-Board Vehicular Hydrogen Sensors	43382	Issued
<b>Fuel Economy</b>				
<b>Fuel Economy</b>	TIR J3202	Recommended Practice for Measuring and Simulating Fuel Consumption and Range of Heavy Duty Fuel Cell Hybrid Road Vehicles Fueled by Compressed Gaseous Hydrogen		Being developed
<b>Fuel Economy</b>	J2572_201410	Recommended Practice for Measuring Fuel Consumption and Range of Fuel Cell and Hybrid Fuel Cell Vehicles Fuelled by Compressed Gaseous Hydrogen	16-Oct-14	Revised - Action required

<b>Performance</b>	J2615_201110	Testing Performance of Fuel Cell Systems for Automotive Applications	20-Oct-11	Stabilized
<b>Performance</b>	J2616_201108	Testing Performance of the Fuel Processor Subsystem of an Automotive Fuel Cell System	12-Aug-11	Stabilized
<b>Performance</b>	J2617_201108	Recommended Practice for Testing Performance of PEM Fuel Cell Stack Sub-system for Automotive Applications	12-Aug-11	Stabilized
<b>Safety</b>	J2574_201109	Fuel Cell Vehicle Terminology	6-Sep-11	Stabilized
<b>Safety</b>	J2760_201106	Pressure Terminology Used in Fuel Cells and Other Hydrogen Vehicle Applications	1-Jun-11	Stabilized

## CSA

<b>Technical Committee Meetings</b>		
Fuel Cell Technical Committee (WebEx) – November 17, 2021 from 12:00 - 3:00 PM Eastern.		
<b>Active / Recently Published Projects</b>		
<b>TSC</b>	<b>Designation/Title</b>	<b>Status</b>
HGV 4.3	HGV 4.3, Test methods for hydrogen fueling parameter evaluation	This project is a revision of an existing standard, and will include content related to MC formula. The TSC completed review of comments, and the draft document is being prepped for Technical Committee Ballot.
HGV 4.2	HGV 4.2, Hoses for dispensing compressed gaseous hydrogen	This project is a revision of an existing standard, and will update to align with current hose technology, and remove requirements for on-board vehicle hoses (content will be transferred to HGV 3.1). The TSC completed review of comments, and the draft document is being prepped for Technical Committee Ballot.
HGV 5	HGV 5.2, Compact hydrogen fueling systems	This project is to develop a NEW standard for Compact Hydrogen Fueling Systems (HGV 5.2). The TSC completed content development. The draft will be available for public review in early November.
HGV 3	HGV 3.1, Onboard vehicle components for hydrogen gas vehicles	This project is a revision of an existing standard for technology updates, as well as inclusion of the on-board vehicle hose requirements (transferred from HGV 4.2). The draft will be available for public review in early November.
HGV 4.1	HGV 4.5, Priority and sequencing equipment for hydrogen vehicle fueling	This project is to develop a standard to REINSTATE an updated edition of a Priority and Sequencing standard. A seed document draft has been prepared and a kickoff meeting with the HGV 4.1 TSC is being scheduled for Fall 2021.
C22.2 No. 22734	Hydrogen generators using water electrolysis	The CSA technical subcommittee has initiated work on a binational adoption of ISO 22734. Contact Mark Duda ( <a href="mailto:mark.duda@csagroup.org">mark.duda@csagroup.org</a> ) with questions or for

additional information.

**Compressed Gas Association (CGA)**

**Rob Early**

Status of current and future publications:

<b>Standard</b>	<b>Current edition</b>	<b>Status</b>
CGA G-5, <i>Hydrogen</i>	8 <sup>th</sup> (2017)	Deadline to submit proposed changes for next edition is 7/7/2022. <a href="https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=22-019">https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=22-019</a>
CGA G-5.3, <i>Commodity specification for hydrogen</i>	7 <sup>th</sup> (2017)	Deadline to submit proposed changes for next edition is 6/4/2022. <a href="https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=22-013">https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=22-013</a>
CGA G-5.4, <i>Standard for hydrogen piping systems at user locations</i>	6 <sup>th</sup> (2019)	Deadline to submit proposed changes for next edition is 12/22/2024. <a href="https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=24-54">https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=24-54</a>
CGA G-5.5, <i>Hydrogen vent systems</i>	3 <sup>rd</sup> (2014)	The 5 <sup>th</sup> edition has been published and can be found at <a href="https://portal.cganet.com/Publication/Details.aspx?id=G-5.5">https://portal.cganet.com/Publication/Details.aspx?id=G-5.5</a> Deadline to submit proposed changes for next edition is 03/04/2026. <a href="https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=26-3">https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=26-3</a> Heat radiation testing at Chart Industries in New Prague, MN date is planned for this fall. The goal is for the task force to review test results this fall.
CGA G-5.6, <i>Hydrogen pipeline systems</i>	1 <sup>st</sup> (2005 – reaffirmed 2013)	Deadline to submit proposed changes for next edition is 8/1/2022. <a href="https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=19-018">https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=19-018</a>
CGA H-1, <i>Service conditions for portable, reversible metal hydride systems</i>	2 <sup>nd</sup> (2011)	Deadline to submit proposed changes for next edition is 2/3/2022. <a href="https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=22-033">https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=22-033</a>
CGA H-2, <i>Guideline for classification and labeling of hydrogen storage systems with hydrogen absorbed in reversible metal hydrides</i>	2 <sup>nd</sup> (2018)	Deadline to submit proposed changes for next edition is 6/4/2022. <a href="https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=22-012">https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=22-012</a>



<b>Standard</b>	<b>Current edition</b>	<b>Status</b>
CGA H-3, <i>Standard for cryogenic hydrogen storage</i>	3 <sup>rd</sup> (2019)	Deadline to submit proposed changes for next edition is 12/1/2023. <a href="https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=23-036">https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=23-036</a>
CGA H-4, <i>Terminology associated with hydrogen fuel technologies</i>	3 <sup>rd</sup> (2020)	Deadline to submit proposed changes for next edition is 12/1/2024. <a href="https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=24-59">https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=24-59</a>
ANSI/CGA H-5, <i>Standard for bulk hydrogen supply systems</i>	3 <sup>rd</sup> (2020)	The deadline to submit proposed changes for the next edition is 2/26/2024. <a href="https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=24-010">https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=24-010</a>
CGA H-10, <i>Combustion safety for steam reformer operation</i>	2 <sup>nd</sup> (2018)	Deadline to submit proposed changes for next edition is 12/1/2023. <a href="https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=23-038">https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=23-038</a>
CGA H-11, <i>Safe start-up and shutdown practices for steam reformers</i>	2 <sup>nd</sup> (2020)	Deadline to submit proposed changes for next edition is 8/11/2025. <a href="https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=25-30">https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=25-30</a>
CGA H-12, <i>Mechanical integrity of syngas outlet systems</i>	1 <sup>st</sup> (2016)	Deadline to submit proposed changes for next edition is 3/1/2022. <a href="https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=21-016">https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=21-016</a>
CGA H-13, <i>Hydrogen pressure swing adsorber (PSA) mechanical integrity requirements</i>	1 <sup>st</sup> (2017)	Deadline to submit proposed changes for next edition is 8/1/2022. <a href="https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=22-027">https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=22-027</a>
CGA H-14, <i>HYCO plant gas leak detection and response practices</i>	1 <sup>st</sup> (2018)	Deadline to submit proposed changes for next edition is 12/8/2023. <a href="https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=23-045">https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=23-045</a>
CGA H-15, <i>Safe catalyst handling in HYCO plants</i>	1 <sup>st</sup> (2020)	Deadline to submit proposed changes for next edition is 9/1/2025. <a href="https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=25-59">https://portal.cganet.com/Publication/Workspace/Outline.aspx?work_id=25-59</a>
CGA H-XXX (TBD), <i>Small scale hydrogen production and delivery</i>	New publication not released yet	Task force has created the first draft that will then go to the CGA membership for review.
CGA P-28, <i>OSHA process safety management and EPA risk management plan guidance document for bulk liquid hydrogen</i>	4 <sup>th</sup> (2014)	The ad hoc committee reviewed and updated the draft of the 5 <sup>th</sup> edition on September 10. The draft will go to Standards Council for final balloting.

<b>Standard</b>	<b>Current edition</b>	<b>Status</b>
<i>supply systems</i>		
CGA PS-31, <i>Position statement on cleanliness for proton exchange membranes hydrogen piping / components</i>	1 <sup>st</sup> (2007 – reaffirmed 2019)	Deadline to submit proposed changes for next edition is 6/12/2025. <a href="https://portal.cganet.com/Publication/Workspac e/Outline.aspx?work_id=25-16">https://portal.cganet.com/Publication/Workspac e/Outline.aspx?work_id=25-16</a>
CGA PS-33, <i>Position statement on the use of LPG or propane tanks as compressed hydrogen storage buffers</i>	1 <sup>st</sup> (2008 – reaffirmed 2020)	Deadline to submit proposed changes for next edition is 12/10/2026. <a href="https://portal.cganet.com/Publication/Workspac e/Outline.aspx?work_id=25-41">https://portal.cganet.com/Publication/Workspac e/Outline.aspx?work_id=25-41</a>
CGA PS-46, <i>Position statement on roofs over hydrogen storage systems</i>	1 <sup>st</sup> (2017)	Deadline to submit proposed changes for next edition is 3/6/2023. <a href="https://portal.cganet.com/Publication/Workspac e/Outline.aspx?work_id=23-012">https://portal.cganet.com/Publication/Workspac e/Outline.aspx?work_id=23-012</a>
CGA P-48, <i>Position statement on clarification of existing hydrogen setback distances and development of new hydrogen setback distances in NFPA 55</i>	1 <sup>st</sup> (2016)	Deadline to submit proposed changes for next edition is 2/12/2021. <a href="https://portal.cganet.com/Publication/Workspac e/Outline.aspx?work_id=21-062">https://portal.cganet.com/Publication/Workspac e/Outline.aspx?work_id=21-062</a>
CGA work item 21-126, <i>Hydrogen system siting and personnel exposures distances</i>		CGA will support the work on liquid hydrogen new setback distances proposed to NFPA 2 and NFPA 55 by Sandia. The NFPA 55 second draft web conference is scheduled for November 3-5. The NFPA 2 second draft meeting has not yet been scheduled.
CGA work item 21-127, <i>Transfer and unloading of hydrogen at near-consumer use points</i>	New publication not released yet	Develop new standard to update traditional hydrogen delivery practices for industrial users to improve practices for retail applications.
CGA work item 21-128, <i>Noise from hydrogen venting and hydrogen systems operations</i>	New publication not released yet	Develop new standard to reduce the noise from hydrogen system operations, including venting, particularly at retail applications where hydrogen system noise is greater than ambient noise

**American Society for Testing & Materials (ASTM)**

**Jennifer Hamilton**

Subcommittee meeting for D.03 for December 7<sup>th</sup>.

A hydrogen analyzer workshop is also upcoming.



Working through inquiries received and updates to the standards. If there are any revision items, they can be submitted between now and the next meeting, planned for next Spring.

## **VI. Discussion Topics**

### **Facilitating Deployment**

**All**

The Boston tunnel study is still underway within Sandia.

### **Center for Hydrogen Safety**

**Nick Barilo**

CHS has some upcoming meetings that is on the calendar reviewed earlier.

### **Regulatory Matrix Review and Comment**

**Karen Quackenbush**

Please direct any updates, questions, or comments to Karen Quackenbush by email at [kquackenbush@fchea.org](mailto:kquackenbush@fchea.org).

September 30, 2021 version was published and available online at <https://www.fchea.org/s/FCHEA-Regulatory-Matrix-Markup-September-30-2021.pdf>.

### **Permitting and Installation of Hydrogen Fueling Stations**

#### **California Station Implementation**

**Jennifer Hamilton**

The new CaFCP station map is online - <https://cafcp.org/stationmap>.

It shows the status of the retail stations (the same as what's on the Station Operational Status System- SOSS page: [m.cafcp.org](http://m.cafcp.org))

It also has new icons for the stations that are in various stages of development, including heavy duty.

Be sure to check out our by the numbers page: [https://cafcp.org/by\\_the\\_numbers](https://cafcp.org/by_the_numbers).

There is a new California hydrogen station opening being held today.

#### **California Div. of Measurement Standards/Fuel Quality / Metrology Christina Daniels**

Fueling in California has improved and we have begun resuming sample collection at a higher frequency. We continue to support station opening with the hydrogen fueling standard.

#### **Legal Metrology Standards Hydrogen Fuel Quality and Measurement**

**Juana Williams/Ralph Richter**

No update at this time.

## **VII. Open Discussion & Other Issues**

None at this time.

**VIII. Next Meeting** – Wednesday, December 15 2021 at 2:00 PM US Eastern.