3.F. Presentations and Notes from the Breakout Sessions

Residential Fuel Cells Breakout Session Flipcharts

Top Issues To Be Dealt With

- Standards for hydrogen piping
- Beta, gamma units or prototypes vs. code development (moving targets)
- Acceptance tests (hydrogen infrastructure)
- Installers – qualifications – code, certification, licensed. "One-stop installers."
- Standards, codes for fuel cells
- Education of consumers, codes officials, rural and urban building operators. Action items.
- Long-term (15-20 year) maintenance. ESCO could be a viable alternative. Incident handling?
- Certify components for field support
- Insurance/risk reduction
- Texas initiative
- Lessons from solar water heaters. Single incident. Qualifications. Manufacturer instructions
- Fire marshals [extension of building] – major issue
- NFPA 853 to address < 50 kW installation standard
- Hydrogen production and storage changing zoning
- Sensors, olfactory organ for deodorized gases.
- Sulfur traps
- Annual ratings for fuel cells (NIST, ASHRAE)

Other Items For Consideration

- Copper piping vs. stainless steel
- Listed for hydrogen? Materials – valves, piping.
- Action: ASTM to address B31.3
- Prototype units installed. Experimental units. Length of time/timeframe specified. Universities: self inspection. Broad application.
- Acceptance testing. Manufacturer installation instructions. IMC Section 924.

Installers

- OEMs – only ones allowed to certify installers.
- Licensing at national, state.
- Voluntary certification
- Stakeholders – OEMs, end-users, building people, contractors, banks, government.
- Government financed. Training/certification system.
- Certified or voluntary?

Education (Joe Galdo, Anne-Marie Borbely, DOE/PNNL)

- Code officials, users, installers
- Stakeholders (identify)
- Awareness – exists – architects/engineers/end-users
- Marketing – cultivating customers
- "Turbotax" for Distributed Generation technologies

Long-Term Maintenance

- Definitions
- Hydrogen storage/production
- Insurance
- Texas initiative
- Sulfur traps
- Disposal
- 20 year maintenance
- Banks/insurance companies
- Resale of units

Discretionary (I.E., Less Critical) Items

- CE marking – self certification – not acceptable to code officials. Model bodies will accept 3rd party, non-biased entity with quality problems. (next three items included)
- Long-term maintenance, not code issue. When house is sold? Insurance? Lender? Lack of contractors? ESCO – one approach (PGE, Edison). Any incident?
- Fuel cells are appliances – codes and for educational purposes.
- Grid – I/C – utility. Transfer switch – backup generator. Identify stationary vs. portable. 1547 standard, standardize requirements and utility acceptance – Texas initiative.
- Adopt current codes – noted.
- Contact local AHJ on zoning/environmental requirements – early in the process. Size will impact – kW, volume, height
- Fuel cell education – downplay technical and emphasize value. Compare existing technology – furnace.
- Increase participation of end-users, consumer, A&Es, contractors on
    - Model code building
    - Standards – building.

  In ANSI, established process of participation.
- Code writers and manufacturers need to talk to each other
- Rural and urban codes implementation different, including fuel cells – 40,000 jurisdictions

- Hydrogen generator (reformer) standard in draft is available from CSA (Todd Strothers)
- ANSI standard addresses natural hazards impact on R-fuel cell. Z21.83 also addresses residual gases on shutdown.
- 1547 addresses reverse back feed
- Sulfur traps – manufacturers need to address
- Cincinnati, OH, September 16-20, 2001 model building codes, second half of code changes
- Emergency generator – not for fuel cell
- Component compatibility – gas codes address these

Other Observations

- Matched sets may not be an issue – more relevant to commercial size
- Indoor or outdoor units? – Z21.83 addresses outdoors, especially SOFC
- Emergency generators NFPA 110 – may include fuel cells, may exclude hospitals (NFPA 111?)
- ASME PTC 50 (performance test standard) – standardization of data report (performance, measurement)
- NES Protocol – to verify compliance with building codes
- ICBO – similar evaluation service (under development) (IMC 2000)
- IEEE 1547 (electrical) addresses installation commission
- Normal installations do not need testing lab unless installed outside requirements/instructions
- Use installation acceptance at other jurisdictions as a possible route
- Manufacturers should have customer feedback – duly noted
- Fuel, rather than fuel cell, is major concern
- HUD initiative to include energy-efficiency – including renewables, fuel cells, in new residential development (also DOE: Rebuild America). Specific segments address codes
    - PATH – Test technologies, performance
    - NAHBRC.org/PATH
    - Pathnet.org (includes fuel cells)
- Model building codes recognize spirit and intent – demonstrate equivalency in performance (particularly prototypes)

Vehicular Fuel Cells Breakout Session Notes

TOPIC	VEHICULAR	PRIORITY H	PRIORITY M	PRIORITY L	ACTION	RESPONSIBLE PARTY
Research/Testing/ Documentation	▪ Basis for designation of a fuel cell as stationary, portable, or vehicular		X	X	IEC TC-105 Working Group #1 should handle this. Dave Conover will ocmmunicate with Kelvin Hecht and Steve Kazubski of the US TAG to ensure these three terms are addressed: Stationary Fuel Cell Portable Fuel Cell Vehicular / Mobile Fuel Cell	Dave Conover, Deputy Director of the US TAG for IEC TC-105. To be accomplished ASAP.
	▪ Safety related to hydrogen production	X			SAE has a Fuel Cell Standards Working Group on Safety, covering all aspects of vehicular safety for fuel cell vehicles, led by Glenn Scheffler.	
					On-Board Reformer design criteria is addressed by SSAE J2579 under the SAE Working Group. Jane Hock will convey this concern to the SAE Fuel Cell Standards Working Group at the next meeting on June 12.	SAE, Jane Hock
					Vehicle crash response is covered by SAE J2578 under the SAE Safety Working Group. Jane Hock will follow up.	SAE, Jane Hock
					List out safety issues associated with each scenario and I.D. who is is working on each one of them. SAE has developed a list of safety issues, available on their web site. NHA and ISO TC-197 are also working on these issues. SAE has liaison	Dave Howell

TOPIC	VEHICULAR	PRIORITY H	PRIORITY M	PRIORITY L	ACTION	RESPONSIBLE PARTY
					agreements with NHA and ISO Tc-197. ICC is also working on some of these issues. Dave Howell will work with PNGV to explore the task to compile a list of all these safety scenarios and keep it up to date.	
	▪ I.D. of necessary safety concerns for each type of fuel cell and how to address them			X	This list will be explored by Dave Howell of PNGV	Dave Howell
	▪ Ventilation needs for all parking garages		X		Being researched by ICC for Fuel Cell Safety Standards Work by Dr. Swain in Florida. Additional work on garages and tunnels may be necessary. DOT and NHTSA may need to be involved. Jane Hock will convey this concern to the SAE Fuel Cell Standards Working Group at the next SAE meeting on June 12, 2001.	ICC, Guy Tomberlein
	▪ How combustible liquids and flammable gases can co-exist in the same interior spaces or be stored on the same site		X		Same as above	ICC, Guy Tomberlein
	▪ Standardization of data		X		The following proposed SAE standards address these issues: Fuel Cell System Performance Testing Fuel Processor Subsystem System Performance Testing Fuel Cell Stack Subsystem Performance	SAE, Jane Hock ASME, Bob Wichert

TOPIC	VEHICULAR	PRIORITY H	PRIORITY M	PRIORITY L	ACTION	RESPONSIBLE PARTY
					Testing ASME PTC-50 also addresses fuel cell system efficiency performance. Jane Hock will bring this to the attention of SAE. Bob Wichert will bring this to the attention of ASME.	
	▪ Basis for the acceptability of fuel cell vehicle storage, fueling, and use within the current building infrastructure		X		ICC ad hoc hydrogen working group is addressing this issue.	ICC ad hoc hydrpgen working group.
	▪ *Need to address reforming on board or off site and issues associated with each*		X		See hydrogen production above	

TOPIC	VEHICULAR	PRIORITY H	PRIORITY M	PRIORITY L	ACTION	RESPONSIBLE PARTY
Education/Outreach and Service/Field Support	▪ Operational guidelines for consumers and distributors			X	Education/Training	SAE/Industry/OEM/Component Manufacturers
	▪ How to address hydrogen safety	X			Covered previously	
	▪ Servicing and maintenance protocols are being explored by SAE in cooperation with the Service Technicians Society (STS)	X			Covered by SAE	Covered by SAE
	▪ *Need to integrate fuel cell technology into airline support applications*	X			Covered by SAE.	SAE, Jane Hock
	▪ *Need to integrate fuel cell technology into portable power applications.*	X			Fuel Cell Manufacturers should work with various temporary power markets.	Manufacturers
	▪ *Need to identify regulatory barriers to fuel cell utilization.*	X			Fuel Cell Manufacturers should work on this issue.	Manufacturers
	▪ *Need to compete against gearhead mentality regarding IC engine competition*			X	Fuel Cell Manufacturers should educate appropriate audiences.	Manufacturers
	▪ *Need energy efficiency message to drive application of fuel cells*	X			Develop education package.	DOE, Fuel Cell Manufacturers, NGOs, Associations, EPA
	▪ *EMTs need help dealing with increased issues associated with use of fuel cells and related fuels*				Covered by SAE action item above.	SAE

TOPIC	VEHICULAR	PRIORITY H	PRIORITY M	PRIORITY L	ACTION	RESPONSIBLE PARTY
	▪ *Service technicians need to be educated, in place and certified*				Add qualified service technicians to operational guidelines above.	Manufacturers, SAE, Jane Hock
	▪ *Aircraft in process inspectors need to be trained in fuel cell technology*				Same as above.	Manufacturers, SAE
	▪ *Auto Inspectors / mobile platform inspectors*				Same as above.	Manufacturers, SAE
	▪ *What do commercial insurance carriers need?*				Being accomplished by SAE in cooperation with insurance liability industry.	SAE Working Group, Jane Hock

TOPIC	VEHICULAR	PRIORITY H	PRIORITY M	PRIORITY L	ACTION	RESPONSIBLE PARTY
Future codes and standards	▪ SAE has started a dialogue with the Performance Review Institute (PRI) for potential mobile unit certification				No action required	
	▪ *Producing and storage of hydrogen on site may change the building categorization to a hazardous production facility facility-need to review use group issues*				ICC is studying this issue ASAP.	ICC ad hoc hydrogen working group.
	▪ *SAE has relationship with transit standards consortium for standards for bus applications*				Continue relationship.	SAE, Transit Standards Forum
	▪ *Federal transit authority – bus standards on safety, but also performance*				Continue this work.	FTA
	▪ *Refueling stations may be a big issue (OEMS considering getting involved in distribution of fuel)*				Inform ICC of the possibility of dealerships becoming fueling stations for hydrogen or otherwise.	ICC, Guy Tomberlein
	▪ *SAE is doing a lot in codes and standards*				Continue this effort	SAE
	▪ *Need hydrogen infrastructure*				This is a market issue. DOE OPT (Carol Hammel) is assessing what needs to be done and developing a plan for what the infrastructure should be.	DOE (Carol Hammel), manufacturers, etc.

TOPIC	VEHICULAR	PRIORITY H	PRIORITY M	PRIORITY L	ACTION	RESPONSIBLE PARTY
	▪ *Need to address parking garages?*				See ICC item above.	
	▪ *What about tunnels? (DOT and NITSA need to address this)*				See ICC item above.	
	▪ *Will state vehicle inspectors need to inspect fuel cell related components?*				See educational item above.	
	▪ *What about passive ventilation of enclosed spaces for hydrogen safety?*				See ICC item above.	
	• *NFPA Building Codes*				Review NFPA Building, Mechanical, Electrical, Plumbing, and other new NFPA building codes to ensure proper coverage of fuel cells, consistent with work done for ICC Building Codes.	Manufacturers
	• *National Building Code of Canada, Administered by the National Research Council of Canada*				Review National Building Code of Canada to ensure proper coverage of fuel cells, consistent with work done for ICC Building Codes.	Manufacturers
	• *Utility Company or Federal refueling stations may not be required to follow building codes.*				Utility companies and Federal facilities will have to review their requirements	Utility companies and Federal facilities.

Vehicular Fuel Cells Breakout Session Presentation

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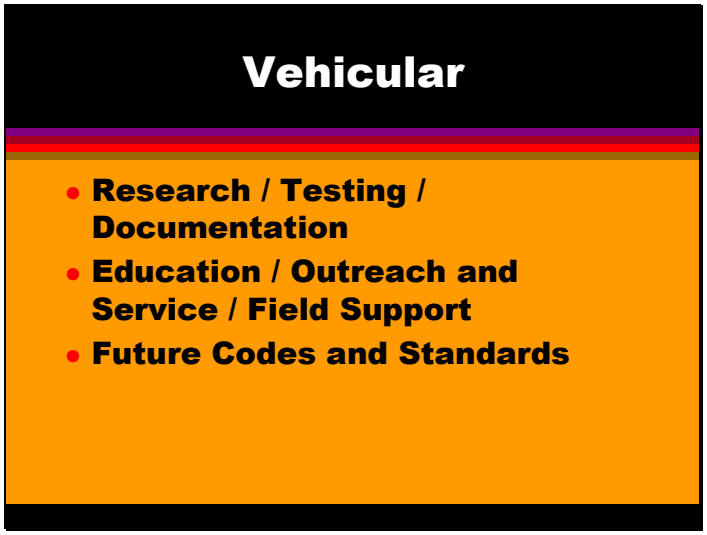

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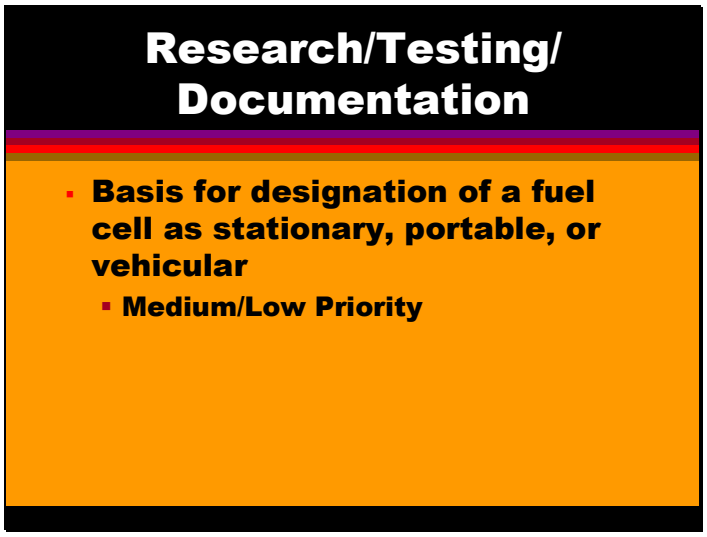

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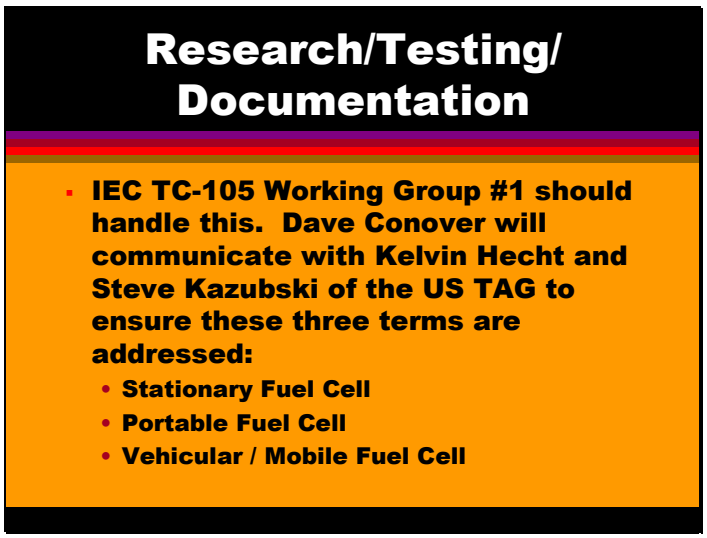

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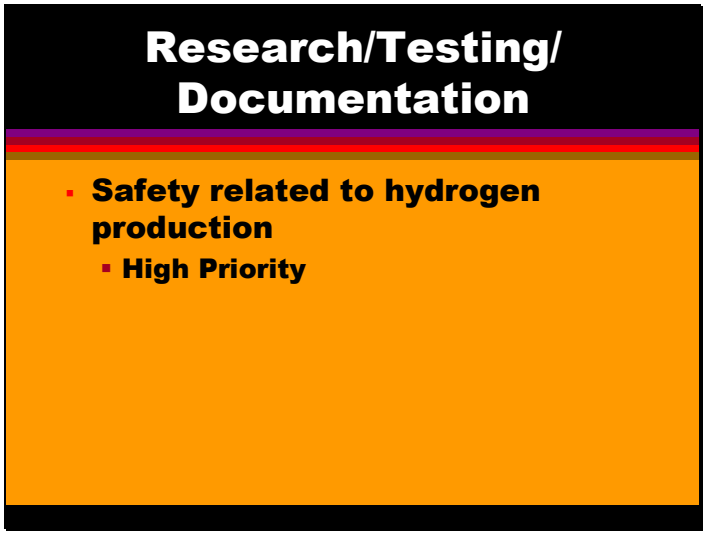

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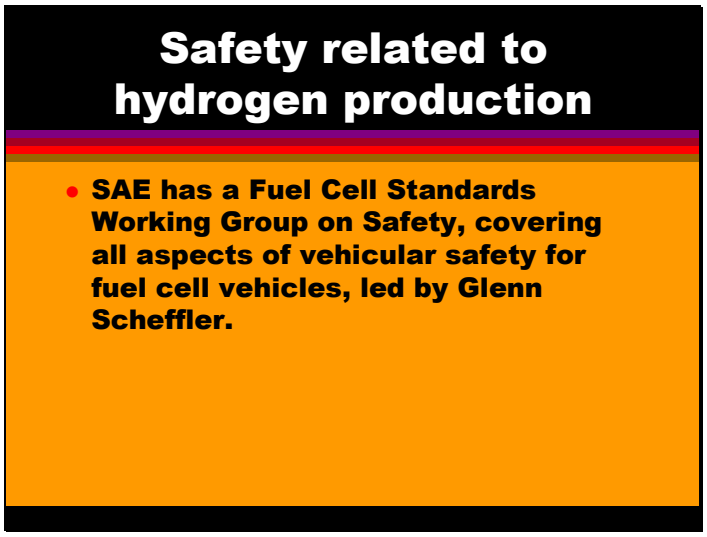

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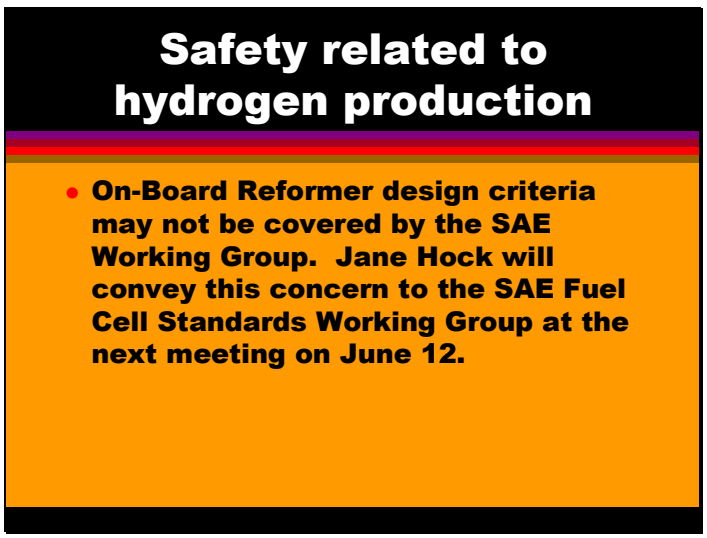

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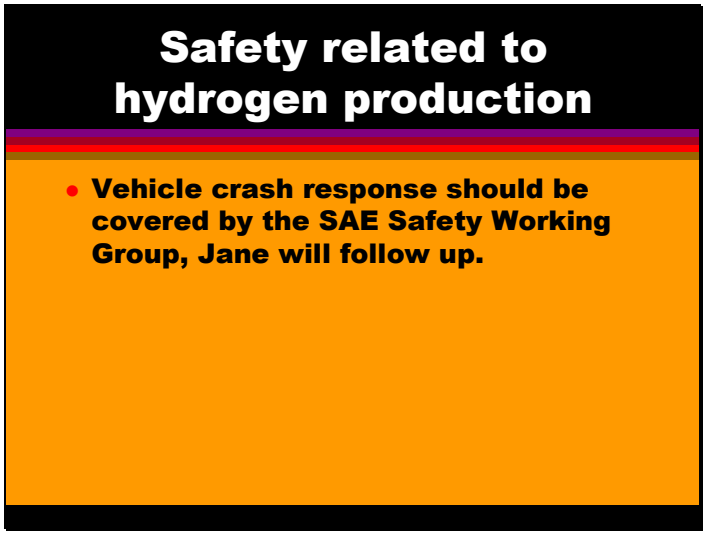

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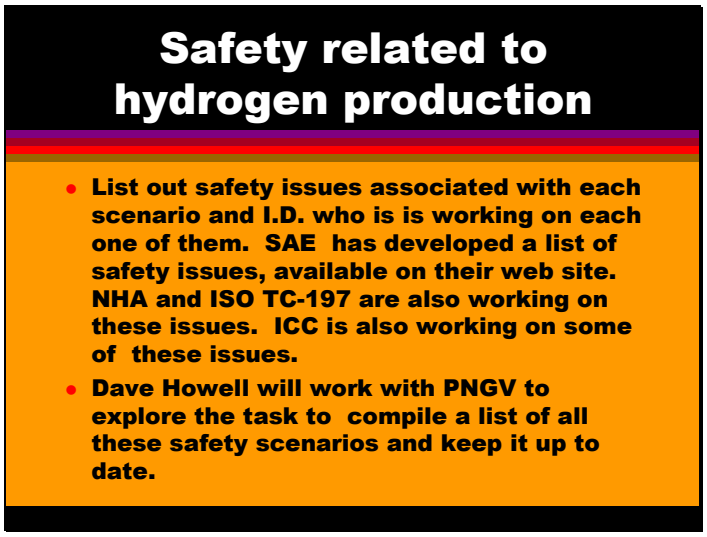

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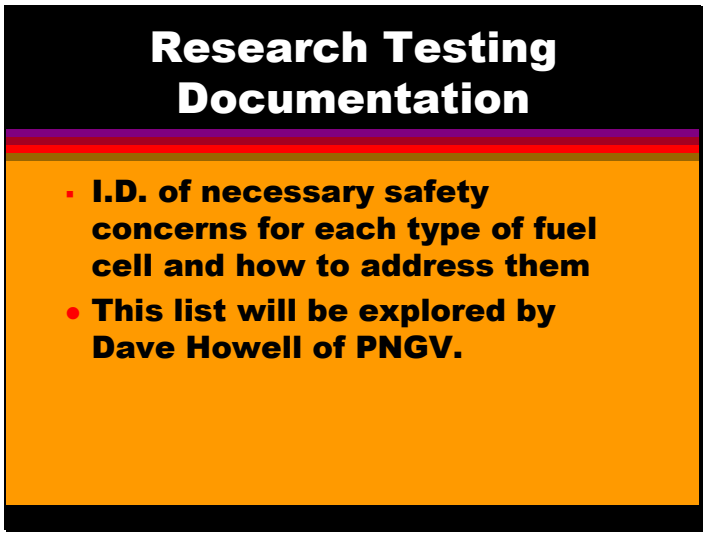

Slide 10

Research Testing Documentation

- **Ventilation needs for all parking garages.**
  - **Being researched by ICC for Fuel Cell Safety Standards Work by Dr. Swain in Florida. Additional work on garages and tunnels may be necessary. DOT and NHTSA may need to be involved.**

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Research Testing Documentation

- **How combustible liquids and flammable gases can co-exist in the same interior spaces or be stored on the same site.**
  - **Same as above.**

Slide 12

Research Testing Documentation

- **Standardization of data**
- **The following proposed SAE standards address these issues:**
  - **Fuel Cell System Performance Testing Fuel Processor Subsystem System Performance Testing**
  - **Fuel Cell Stack Subsystem Performance Testing**

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Research Testing Documentation

- **Standardization of data**
  - **ASME PTC-50 also addresses fuel cell system efficiency performance.**

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Research Testing Documentation

- **Standardization of data**
  - **Jane Hock will bring this to the attention of SAE.**
  - **Bob Wichert will bring this to the attention of ASME.**

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Research Testing Documentation

- **Basis for the acceptability of fuel cell vehicle storage, fueling, and use within the current building infrastructure.**
  - **ICC ad hoc hydrogen working group is addressing this issue.**

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Research Testing Documentation

- ***Need to address reforming on board or off site and issues associated with each***
  - **Same as hydrogen production, above.**

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Education/Outreach and Service/Field Support

- **Operational guidelines for consumers and distributors**
  - **Education & Training by OEMs, Component Manufacturers, SAE.**
- **How to address hydrogen safety**
  - **Covered above**

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Education/Outreach and Service/Field Support

- **Servicing and maintenance protocols are being explored by SAE in cooperation with the Service Technicians Society (STS)**
  - **Covered by SAE, Jane Hock**

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Education/Outreach and Service/Field Support

- ***Need to integrate fuel cell technology into airline support applications***
  - **Covered by SAE, Jane Hock**

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Education/Outreach and Service/Field Support

- ***Need to integrate fuel cell technology into portable power applications.***
  - **Fuel Cell Manufacturers should work with various temporary power markets.**

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Education/Outreach and Service/Field Support

- ***Need to identify regulatory barriers to fuel cell utilization.***
  - **Fuel Cell Manufacturers should work on this issue.**
- ***Need to compete against gearhead mentality regarding IC engine competition***
  - **Fuel Cell Manufacturers should educate appropriate audiences.**

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Education/Outreach and Service/Field Support

- ***EMTs need help dealing with increased issues associated with use of fuel cells and related fuels.***
  - **Covered by SAE action item above.**

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Education/Outreach and Service/Field Support

- ***Service technicians need to be educated, in place and certified***
  - **Add to operational guidelines above.**
  - **Manufacturers, SAE, Jane Hock**

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Education/Outreach and Service/Field Support

- ***Aircraft in process inspectors need to be trained in fuel cell technology***
  - **Same as above**
- ***Auto Inspectors / mobile platform inspectors***
  - **Same as above**

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Education/Outreach and Service/Field Support

- ***What do commercial insurance carriers need?***
  - **Being accomplished by SAE in cooperation with insurance liability industry -- Jane Hock.**

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Education/Outreach and Service/Field Support

- ***Need energy efficiency message to drive application of fuel cells***
  - **DOE, Fuel Cell Manufacturers, NGOs, Associations, EPA to develop educational package**

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Future codes and standards

- **SAE has started a dialogue with the Performance Review Institute (PRI) for potential mobile unit certification**

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Future codes and standards

- ***Producing and storage of hydrogen on site may change the building categorization to a hazardous production facility facility-need to review use group issues***
  - **ICC is studying this issue ASAP.**

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Future codes and standards

- ***Refueling stations may be a big issue (OEMS considering getting involved in distribution of fuel)***
  - **Inform ICC of the possibility of dealerships becoming fueling stations for hydrogen or otherwise.**
  - **Guy Tomberlein**

Slide 30

Future codes and standards

- ***SAE is doing a lot in codes and standards***

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Future codes and standards

- ***SAE has relationship with transit standards consortium for standards for bus applications***
- ***Federal transit authority – bus standards on safety, but also performance***

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Future codes and standards

- ***SAE is doing a lot in codes and standards***
- ***Need hydrogen infrastructure***
  - **This is a market issue. DOE OPT (Carol Hammel) is assessing what needs to be done and developing a plan for what the infrastructure should be.**

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Future codes and standards

- ***Need to address parking garages?***
  - ***See ICC above***
- ***What about tunnels? (DOT and NITSA need to address this)***
  - ***See ICC item above***

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Future codes and standards

- ***Will state vehicle inspectors need to inspect fuel cell related components?***
  - ***See educational item above***
- ***What about passive ventilation of enclosed spaces for hydrogen safety?***
  - **See ICC item above**

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Future codes and standards

- ***NFPA Building Codes***
  - **Manufacturers to Review NFPA Building, Mechanical, Electrical, Plumbing, and other new NFPA building codes to ensure proper coverage of fuel cells, consistent with work done for ICC Building Codes.**

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Future codes and standards

- ***National Building Code of Canada, Administered by the National Research Council of Canada***
  - ***Manufacturers to* Review National Building Code of Canada to ensure proper coverage of fuel cells, consistent with work done for ICC Building Codes.**

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Future codes and standards

- ***Utility Company or Federal refueling stations may not be required to follow building codes.***
  - **Utility companies and Federal facilities will have to review their requirements**

Portable Fuel Cells Breakout Session Notes

Portable Fuel Cell Appliances (Definition)

1. A fuel cell generator of electricity, which is not fixed in place. A portable fuel cell appliance utilizes a cord and plug connection to a grid-isolated load and has an integral fuel supply.

- definition needed for battery substitutes.(remove cord and plug connection) May not be the case in scenarios.
- Micro fuel cells
- Fire Codes – Stockpiling fuel
- Quick disconnect to fuel tank ? OK but not to utility fuel line
- Action: expand definition scope to include non-cord connected products i.e laptop, flashlight (HJ, JG to address with the ICC Ad Hoc Hydrogen Comm. in Golden, CO 06/04-5)
- 18.1 Occupancy (Code)
- 18.2 Container (Standard)
- (Beth to verify)
- Add "non-reversible" to definition ?

2. Indoor use (Confined Spaces)
- -work is being done by CSA 3.01 to address oxygen depletion, hydrogen emissions
- limit power output/fuel supply of FC to intrinsic levels
- toxicity
- other indoor emissions issues i.e. MEOH, Propane etc…) Impact
- Confined Space (Boat, house, RV's, aircraft) what std. Will Apply (ask T.Strothers)
- Fuel storage technology (NaBH4, NH3…)
- H2 Gaseous fuel Detection – Will H2 be odorized ? detection.
- Actions: ID CSA limits (T.Strothers), FC Council determine issues other than home/garage, commercial bldgs (FC Council Portable Group) Requires research
- Make sure product stds insure full range of confined space issues including O2 depletion, H2 emissions, multiple appliance use.

3. Education/Consumer Awareness
- Literature, product search
- USFCC Working Group (Web Site)
- Educating Manufacturers
- Educating Regulators
- Educating Consumers
- Actions: Status report at FC 6

4. Interchangability fo Components
- Disposal/Recycling (Options and opportunities)
- MF lifetime ownership

- Product life cycle
- Study hazards
- Certification of replacement components (Stack?)
- Actions: Expand the scope of the CSA to include other FC technologies

5. Testing Protocols (Standards for operating range – performance
- Actions: Verify whether ASME PTC 50 covers portable (ask D.Conover/B.Wichert)
- Do we need performance standards ? (Ask the USFCC WG for portable)

6. Transport of fuel supply
- DOT
- Fuel type
- Actions: Update from portable WG for FC Summit 6 (RMES report)

7. Marking and labelling (misuse of appliance) – beyond standard (CSA) requirements. Product liability. Misuse of appliance.
- Actions: Review and participate in the development of CSA 3.01. Encourage CSA to action and identify gaps. Review CSA standard at FC Summit 6

8. Reversible FC appliances

Stationary/Commercial Fuel Cells Breakout Session Presentation

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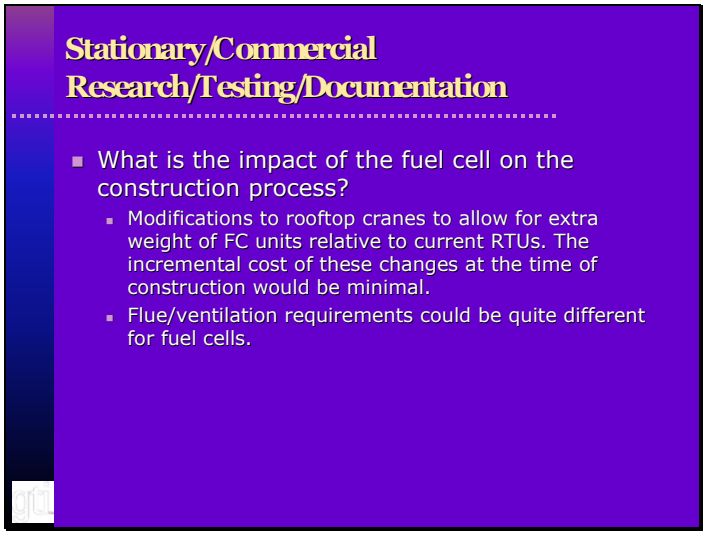

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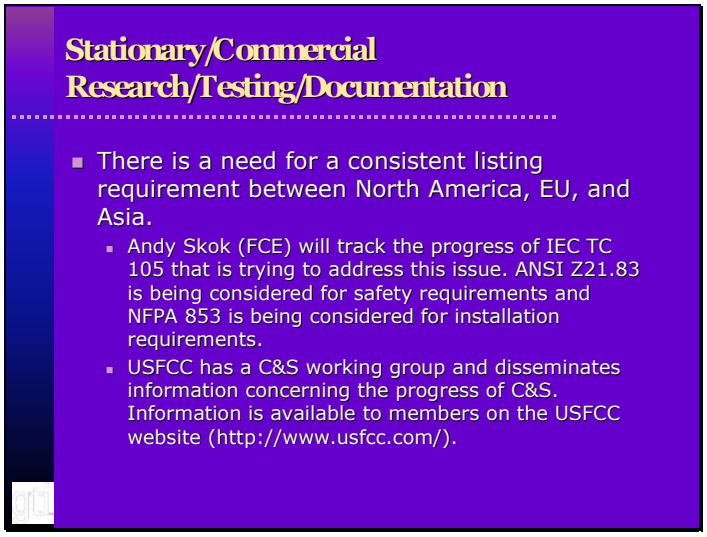

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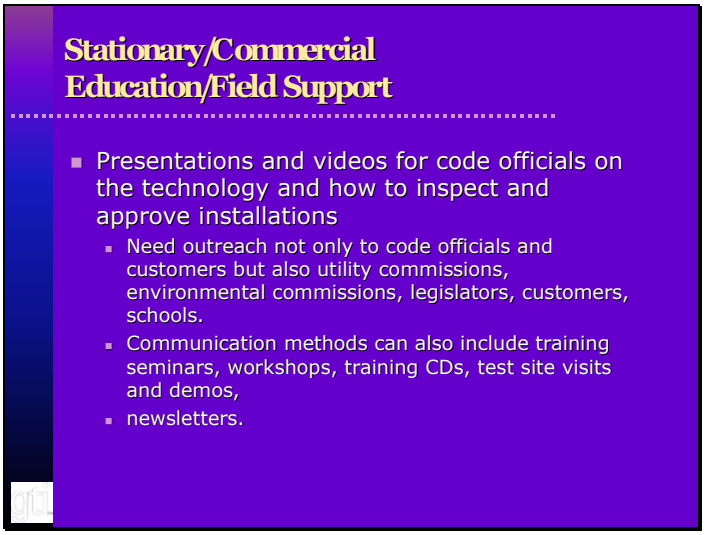

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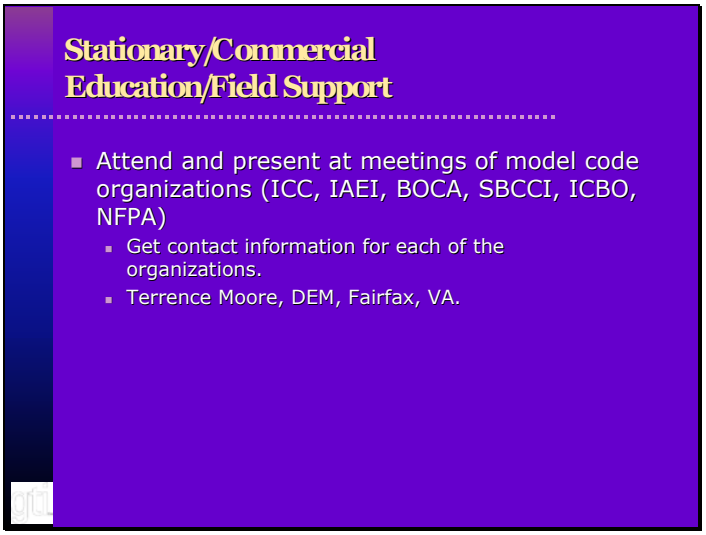

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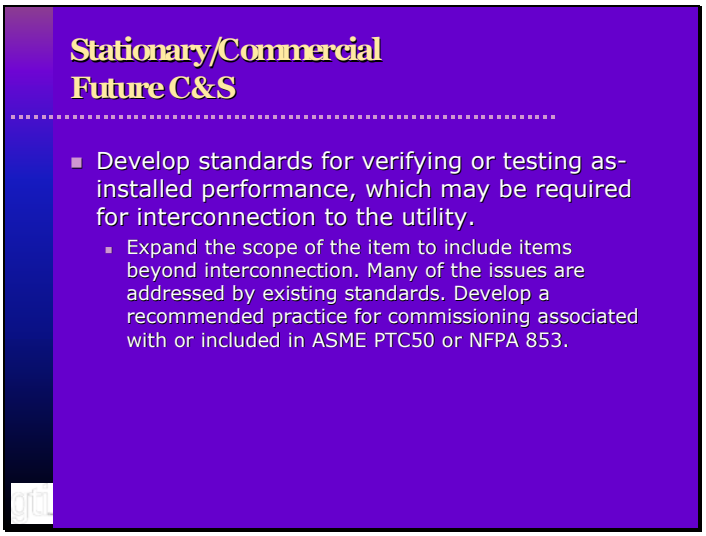

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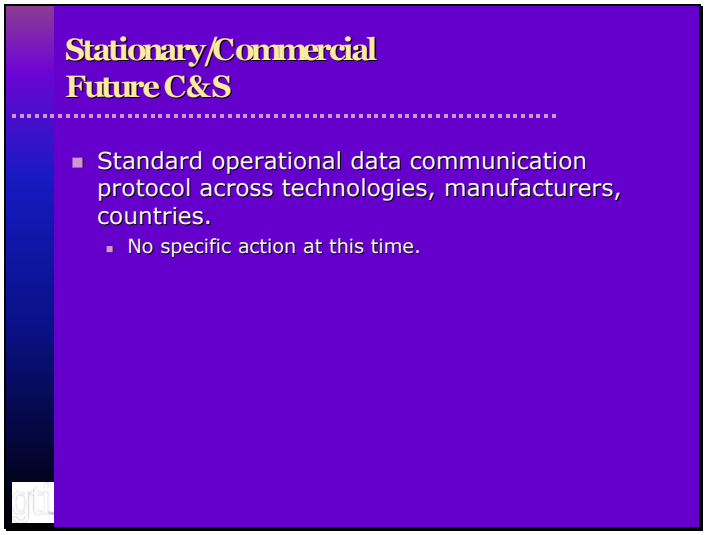

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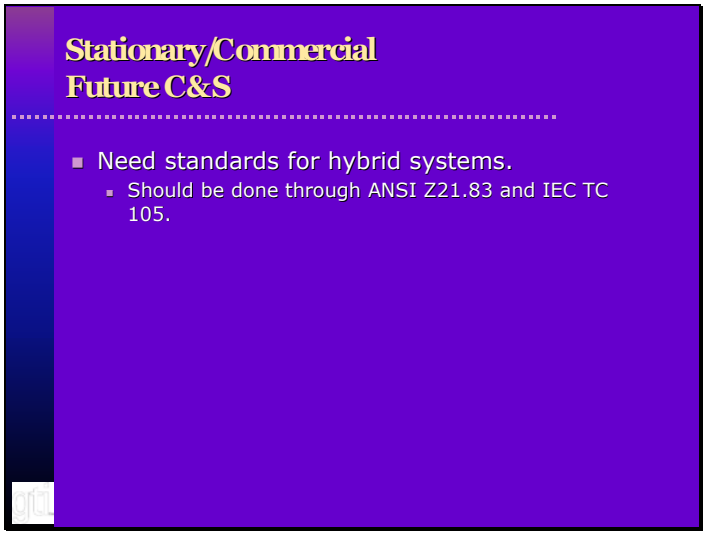

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