Fuel Quality & Metering
Current Status and Future Needs

DOE Tank Safety Workshop

Sandia National Labs

April 29, 2010

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What does the Dept of Food & Agriculture have to do with Hydrogen??

The Division of Measurement Standards is the Weights and Measures arm of California

The Division of Measurement Standards is charged with enforcing the quality standards for Gasoline, Diesel, Motor Oil, Coolants, Brake Fluid, ATF, and Hydrogen (Petroleum Products Program)

The Division also has the responsibility to approve, prior to use, any commercial weighing, measuring, or counting device. This includes all Retail Motor Fuel devices (California Type Evaluation Program)

How did this ever happen??

In 2005 the California Legislature passed, and the Governor signed SB 76

Article 5.5. Standards for Hydrogen

13446. On or before January 1, 2008, the department, with the concurrence of the State Air Resources Board, shall establish specifications for hydrogen fuels for use in internal combustion engines and fuel cells in motor vehicles until a standards development organization accredited by the American National Standards Institute (ANSI) formally adopts standards for hydrogen fuels for use in internal combustion engines and fuel cells in motor vehicles. The department shall then adopt by reference the latest standards established by the ANSI-accredited standards development organization for hydrogen fuel for use in internal combustion engines and fuel cells in motor vehicles, except that no specification or standard shall be less stringent than is required by state law.

So there are quality specifications?

YES! They are found in the California Code of Regulations, Title 4, Division 9, Chapter 6, Article 8, Section 4181

4181. Specifications – Hydrogen Fuel Used in Fuel Cells and Internal Combustion Engines. Hydrogen fuel used in fuel cells and internal combustion engines shall meet the following requirements:

Hydrogen Fuel Index (minimum, %) 99.97
Total Gases (maximum, ppm v/v) 300
Water (maximum, ppm v/v) 5
Total Hydrocarbons (maximum, ppm v/v) 2
Oxygen (maximum, ppm v/v) 5
Helium (maximum, ppm v/v) 300
Nitrogen and Argon (maximum, ppm v/v) 100
Carbon dioxide (maximum, ppm v/v) 2
Carbon monoxide (maximum, ppm v/v) 0.2
Total Sulfur Compounds (maximum, ppm v/v) 0.004
Formaldehyde (maximum, ppm v/v) 0.01
Formic acid (maximum, ppm v/v) 0.2
Ammonia (maximum, ppm v/v) 0.1
Total Halogenated Compounds (maximum, ppm v/v) 0.05
Particulates Size (maximum, μm) 10
Particulate Concentration (maximum, μg/L @ NTP)

So how does the State enforce quality specifications?

In two words- We Don’t

Currently there is 1 approved ASTM method, with 13 work items in progress

None of the methods or work items have been validated by an inter-laboratory study

Very few analytical labs are set-up to analyze high-pressure, high-purity hydrogen

How about pumps & meters?

California is required to follow the tolerances found in NIST Handbook 44

This requirement is found in B&P Code, Division 5, Chapter 2, Section 12107

Tolerances for typical Retail Motor Fuel Dispensers are 0.3% for Type Approval, and 0.5% for Maintenance

These tolerances are followed by most states

States Not Following Handbook 44

- North Dakota

So how accurate does my hydrogen meter have to be?

Currently set at 1.5% for type approval, and 2.0% for maintenance

These are only interim codes, and are not intended to be enforced

These codes are adopted by the NCWM, where each state gets 1 vote

So how does the State enforce the pump & meter requirements?

Four Words – We Don't Know Yet

Currently we have identified 3 probable ways:

1) Gravimetric – Fill a tank & weigh it
2) PVT – Fill a tank and measure the PVT
3) Master Meter - Fill a tank using a NIST traceable meter

Is this a problem??

It could be, but isn't currently

Of all 21 hydrogen filling stations in CA, not one can sell to the public, because none have yet submitted a device for Type Approval

Fees are associated with submitting a device for approval

One approval = 1- 100-1000 dispensers

So what needs to happen next?

Quality

- Continue to work with SAE and ASTM to develop and adopt specifications and test methods
- Identify laboratories capable of analyzing hydrogen samples, strictly following ASTM test methods
- Funding of inter-laboratory studies to validate test methods

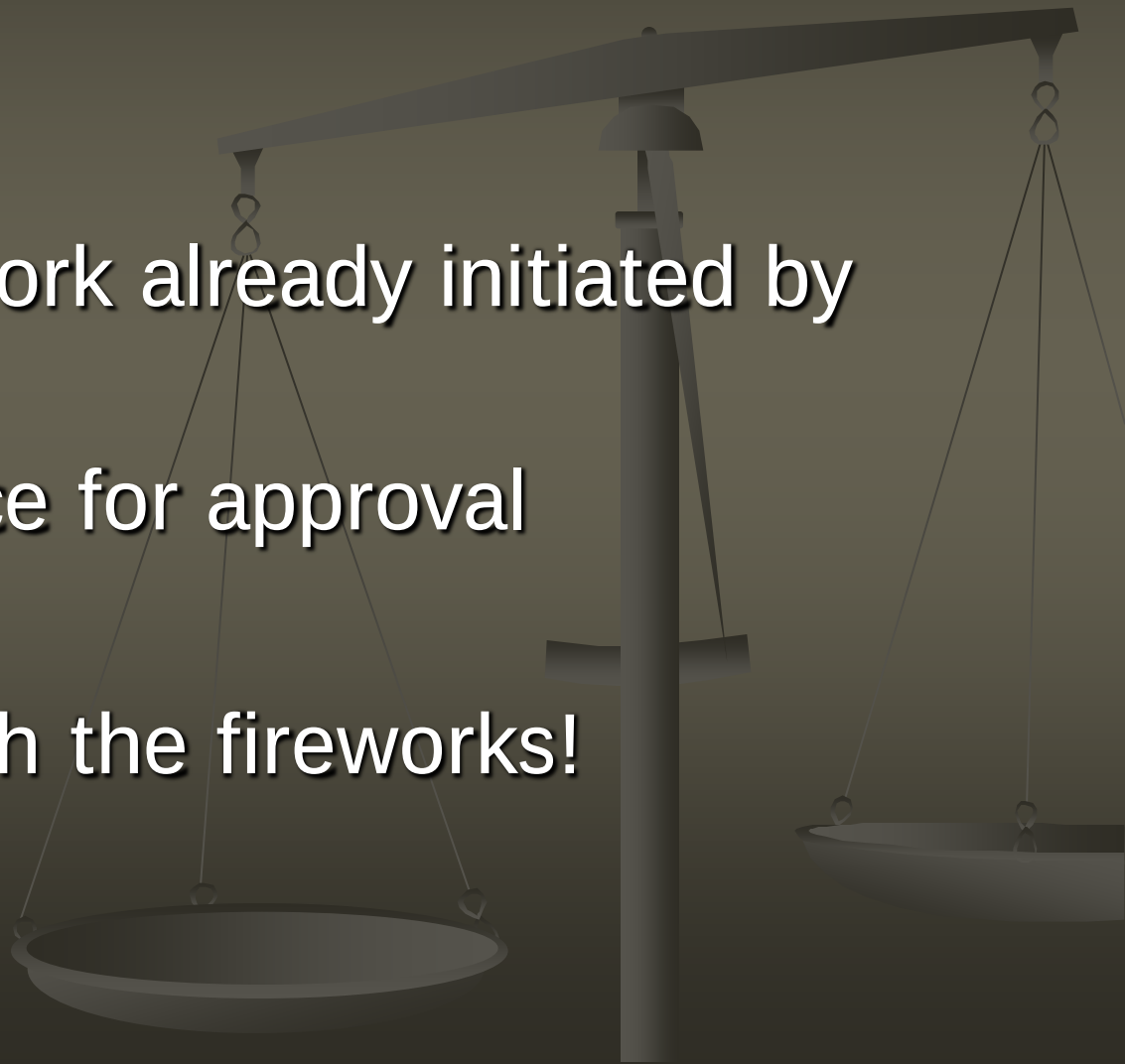
So what needs to happen next?

Type Approval

Continuation of work already initiated by CSA

Submittal of device for approval

Sit back and watch the fireworks!



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Questions ?