

Wrap-Up/The Road to NH₃ Fuel Certification

7th Annual Ammonia Fuel Conference

Detroit, MI – September 28, 2010

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Overview

- Re-cap of meeting
- News
- The NH₃ name game
- “Listing” of NH₃ fuel – An Update
- #1 Argument against NH₃

Conference Re-Cap

- Excellent attendance and participation (as usual, $\sim 1/2$ or so of participants signed up in the last 10 days)
- Federal government participation still low
- Herb London keynote underscored NH₃ Fuel as a (the?) game changer alternative to petroleum
- Wind to NH₃ (Reese) for fuel and fertilizer taking shape in Minnesota; economics still being studied
- Martin and Leithy presentations point to high value of NH₃ for large scale energy storage applications
- Syngest Biomass to NH₃ moving forward smoothly, predicted to produce NH₃ fuel cost competitive with gasoline
- Hawaii, North Dakota making progress with NH₃ Fuel
- NH₃ to have visible demonstration through Clinton Climate Initiative
- Considerable progress in ICE applications – near commercial?

What's in a Name? (NH₃ aka)

- Ammonia
 - Anhydrous Ammonia
 - NH₃
 - NH₃ Fuel
 - NFuel (Vrijenhoef)
 - Hydrofuel NH₃ (Vezina)
 - NiHY (Krementz)
 - N-Hydrogen-3 (Oswald)
 - Nitrogen Tri-hydride
 - Several others
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- Need to settle on 1 name – NH₃FA Board to consider

“Listing” of NH₃ Fuel

- Sec Chu and top DOE officials are aware of NH₃ Fuel
- Administrative or legislative approach?
- VanNess Feldman (Seattle lobbyist) working to assess situation (\$100K?)
- Support, or at least acknowledgement, from several Congressional offices (WA, MN, IA, Maine...)
- Exploring
 - “Input” to DOE
 - Amendment to federal energy legislation
- Likely will require a coalition effort

#1 Argument Against NH₃ Fuel

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- Yes – It's Safety (or rather, perceived toxicity)

Yes, NH₃ is an inhalation hazard, but...

■ Permissible Exposure Limit (OSHA, TWA)

NH₃ – 50 ppm

Benzene (1-2% of gasoline) – 1 ppm

Chlorine – 1 ppm

Carbon Monoxide – 50 ppm

Acetic Acid – 10 ppm

SO₂ – 5 ppm

NH₃ is hard to ignite and is not explosive

- Minimum Ignition Energy

NH₃ >> Gasoline > Methane > Hydrogen

- ANFO – Ammonium Nitrate (94%)/Fuel Oil (6%) (commercial explosive); NH₄NO₃ is made by combining NH₃ and Nitric Acid; ANFO Detonation – AN reacts with long chain HCs – NH₃ won't react similarly.

Occasionally NO_x is Thrown Out As a Curve Ball

- But...

NO_x is not a major problem with NH₃ ICEs –
better than gasoline

NH₃ is its own de-NO_x agent

Everything is Relative

- More people die by lightning strikes every year than by NH₃ releases (which largely occur in commercial refrigeration applications)
- More people died in a single NG pipeline explosion in San Bruno CA recently than died in the U.S. by NH₃ releases in several years

Thank You