Hydrogen Hazards Assessment and Mitigation in Various Applications

26 to 28 August 2025
Woburn MA, US

Fires from intentionally ignited hydrogen (left) v. gasoline (right) fuel tanks

Instructor:
Dr. N. Albert Moussa, P.E.

BlazeTech
Bringing Science to Safety
Offering Fire Safety Courses since 1998

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Ubi fumus, ibi ignis

BlazeTech Corporation

Our services to the evolving hydrogen industry include safety assessments, testing, modeling and simulation, consulting, accident investigation and reconstruction, and expert witness. We have performed several assessments of the processing, handling, storage, and transportation of hydrogen in the chemical and transportation industries as well as its potential use in aviation. We have also conducted fire tests involving hydrogen and participated in national large-scale tests of the spill, dispersion, and ignition of cryogenic fuels. Our product ADORA is the premier Environmental and Safety offsite Consequence Analysis tool available for use by organizations involved with the assessment of the safety and environmental impacts of the accidental discharge of hazardous chemicals. We provide, also, customized training at client facilities expanding on any subject matter in this course.

Course Developer and Main Lecturer

Dr. N. Albert Moussa, Technical Director of BlazeTech, has over 40 years of experience in fire and explosion in a variety of applications. He authored one book on flammability and over 200 publications, presentations, and reports. In 1979, he participated in a national committee organized by the Electric Power Institute to assess the potential hazards of a hydrogen bubble suspected inside a nuclear reactor at the Three Mile Island power plant due to loss of coolant. In 1982, he compared the crash fire hazards of the Lockheed 400-passenger aircraft fueled by liquid hydrogen, versus liquid methane, gasoline, and jet A. He has since worked on safety assessments of components and entire systems involving gaseous and cryogenic hydrogen. Since 1998, he has taught professional courses on fire and has given invited lectures at several universities and the NTSB Training Center. His credentials include: William Lockwood Memorial Lecture Award, Engineer of the Year by the NE- AIAA Section, AIAA Distinguished Lecturer, Best Papers by SAE and ASEI, and several ASME citations. He served on national committees and was Associate Editor of an ASME Journal. He received his B.S. (with Honors) from Stanford U. and M.S./PhD from MIT, with both dissertations on fire.

Course Would Benefit:

Engineers, Designers, Program Managers, Transport Specialists, Regulatory Agents, Manufacturers, Fuel Cell Operators, Emergency responders, Hazard/Risk Analysists, Accident Investigators, and anyone responsible for hydrogen generation, handling, storage, and/or usage across industries such as power generation, data centers, transportation systems, chemical plants, industrial processing, heating systems, refueling stations/tank farms, and airports.

Course Objectives & Organization

Decarbonization will promote the use of hydrogen and introduce new technologies that pose safety challenges for the new users of hydrogen, thus the motivation for this course. Expect a comprehensive and unique treatment of practical fire, explosion, and dispersion hazards of hydrogen and how to mitigate against them. Using case studies on pressurized and liquified systems from the chemical industry, we will discuss initiating events, their evolution, systems survivability, design issues, protection methods and forensic implications, with the fundamentals introduced as needed. This approach is tailored to professionals who want to broaden and deepen their knowledge to enable handling new situations. The course is illustrated by videotapes and photographs of real events and well controlled and instrumented bench- and full-scale tests by FAA, NTSB, DOD, NASA and BlazeTech. Attendees will benefit from a grasp of:

- Hazards associated with the accidental discharge from pressurized and liquified hydrogen systems
- Scenario evolution including dispersion, fire and, explosion depending on local conditions
- Fundamentals differentiating H2 from other gases
- Hydrogen detection and protection methods
- Available simplified analyses for quick answers
- When to use such analyses vs. computer models
- What to ask from subject matter experts
- How to assess hazards from new technologies
- Discussion of testing and accident reconstruction
- Dynamic class and discussion of current issues

Attendees receive class notes containing a wealth of key data and a certificate of completion. Course is equivalent to three Continuing Education Credit Units.

1. Introduction

- Previous hydrogen economies
- Hydrogen use in petrochemical industry
- H2 Colors: Green, Blue, Grey, Brown, Black
- Fuel cell and electrolyzer stacks

2. Exceptional Properties that Differentiate Hydrogen from Other Gases

- Thermodynamic diagrams
- Negative Joule-Thomson coefficient
- Thermophysical properties, thermophoresis
- Hydrogen embrittlement
- Cryogenic considerations
- Wide flammability limit, ease of ignition, and fast flame speed

3. Hydrogen Storage and Delivery

- Storage as compressed gas v. liquid
- Blending hydrogen/natural gas for pipelines
- Hydrogen production from methanol and NH3
- Fuel cell types and efficiencies
- Firing in conventional burners/engines

4. Accidental Release of Hydrogen

- Discharge flow rate at pressure and temp.
- Continuous leak v. instantaneous discharge
- Jet formation and mixing with surrounding air
- High pressure release; autoignition potential?
- Liquid spill produces a spreading/boiling pool
- Formation of initially dense cold vapors
- Air mixing yields buoyant/rising puff/plume

5. Fires in the Open

- Ignition of pool and jet and flames
- Effects of wind on flame tilting
- Thermal impacts on adjacent structures
- Will puff/plume disperse prior to ignition?
- Vapor cloud fire in delayed ignition scenario
- Domino events and fireballs

6. Fires Inside Structures

- Hydrogen leak detection methods
- Will dilution by ventilation preempt ignition?
- H2 enhances burning of other materials
- Vapors accumulate, air mix, can deflagrate?
- Deflagration flame speed vs. local conditions
- Pressure rise and structural failure?
- Protection methods

7. Explosions

- Conditions leading to detonation
- Deflagration transition to detonation, DDT?
- Overpressure and TNT equivalent yield
- Structural response

8. Hydrogen Safety Assessment in Transport

- Hydrogen v. lithium-ion batteries
- Lessons learned from current car fleet
- Applications to trucks, rails, and ships
- Safety protection during refueling
- Hydrogen usage on aircraft and air taxis
- Crash fire hazards of compressed gas and liquid hydrogen v. carbon-based fuels
- Hazard of release from a pipeline break
- Adaptation of lessons learned from hydrogen usage in space applications

9. Hydrogen Safety Assessment in Facilities

- Data centers, backup power, and airports
- Hazards from hydrogen production on site
- Hazards from uses in firing equipment
- Adaptation of lessons learned from hydrogen usage in chemical plants
- Adaptation of bulk delivery requirements of liquified gases to hydrogen
- NFPA 2, NFPA 55
- Hydrogen fire detection and suppression
- Hazard/ Risk Assessments

10. Closure

Course Schedule and Location

8:00 to 17:00 Tuesday-Thursday, 26 to 28 Aug. 2025
BlazeTech. 29 B Montvale Ave. Woburn, MA, or
local hotel nearby announced closer to course date

Fee and Registration

Fee: $3,500. To register, fill out form below.
Payments:
-Credit cards: fax to BlazeTech 781-759-0703
-Wire payments: contact us for details.
-Checks: mail to BlazeTech; discount $200 if check is received 2 months before course starts.
Registration is incomplete until payment is received. No walk-ins. We reserve the right to cancel course. **Participants must comply with US Federal & Massachusetts Health travel requirements, otherwise entrance is denied.**

Registration Form

Name: _____
Title/Position: _____
Company: _____
Address: _____
City, State, Zip: _____
Country: _____
Phone/Fax: _____
E-mail: _____
Specific Interest: _____

Payment: ☐ Check ☐ Credit Card ☐ Wire
Card #: _____
Expiration Date: _____ Amount: _____
3- or 4-Digits Security Code on card: _____
Name on Card: _____
Signature: _____Date:____
Billing Address for Card: _____
_____

How did you hear about the course?
☐ Colleague ☐ Website ☐ Email ☐ Other: