Safety of Hydrogen

Student Objective
The student:
- will be able to explain the current theory behind the Hindenburg disaster
- will analyze the safety of gasoline vs hydrogen

Key Words:
Hindenburg

Time:
1 class period

Materials:
- video of the Hindenburg disaster newsreel (see Internet Sites below–vidicom-tv link)
- PowerPoint presentation on the chemical causes of the Hindenburg disaster (see Internet Sites below–pbs.org)
- online or printed copy of *The True Story of Hydrogen and the Hindenburg Disaster* (see Internet Sites below)
- Slides of fuel leak simulation (see Internet Sites below–eere link)

Background Information

Many people believe hydrogen is dangerous, too dangerous to be used in society. Many use the Hindenburg disaster as one example, and the H-bomb and the first shuttle explosion as other examples. Some people know the H-bomb is made using tritium, an isotope of hydrogen. While the shuttle explosion was determined to be caused by an O-ring, it was only recently that additional information was obtained relative to the Hindenburg disaster. The new information is related to the "rocket fuel" that was painted on the airship.

The fuel leak simulation shows what happens when two cars, one filled with hydrogen and the other filled with gas, are ignited. In the gasoline car, the fuel line was punctured with a 1/16 inch diameter hole which enabled the gasoline to leaked out of the fuel line under the middle of the car. During the 3.5 minutes of videotaping, the vehicle leaked five pints of gasoline (approximately 70,000 BTU). During the video, the hydrogen vehicle leaked 3.4 pounds of hydrogen (approximately 175,000 BTU).

Procedure

1. Show the newsclip of the Hindenburg disaster (the vidicom-tv link in the Internet Sites section)
2. Ask the students to individually write down an answer to the following question. "Why did the Hindenburg crash?" After everyone has had time to answer the question write some of the responses on the board.
3. Show the slides from the PBS website.
4. Pass out copies of *The True Story of Hydrogen and the Hindenburg Disaster* (see Internet Sites below), or have the students access it online.
5. Discuss any points in the article that the students bring up.
6. Next, ask the students to individually write down an answer to the following question. "Which car would it probably be safer to be in, if the fuel tank is ruptured and ignited–a gasoline car or a hydrogen powered car? Why? After everyone has had time to answer the question, give the students a few minutes to discuss their answers.
7. Show the slides from the fuel leak simulation.
8. Lead a discussion on the safety of gasoline versus hydrogen powered cars, and the public misconception of the danger of hydrogen and the safety of gasoline.

Further Research

1. Lead a classroom discussion on public perception/misinformation–how it comes about, what factors contribute to it, and ways to get rectify the situation.
2. Explore the political/historical reasons that the scientific community came to the wrong conclusion concerning the cause of the Hindenburg disaster.
3. Research the comparative safety in the production stage of hydrogen and gasoline.
4. Which fuel, hydrogen or gasoline is the safest to transport and store?

Internet Sites

http://www.vidicom-tv.com/tohiburg.htm
A video of the Hindenburg disaster. Needs Quicktime 5.0.2 or better.

http://www.pbs.org/wnet/secrets/html/e3-chemistry.html
A slide show illustrating the cause of the Hindenburg disaster.

http://www.nlhs.com/hindenburg.htm
History and photographs of the Hindenburg

http://www.ch2bc.org/hindenburg.htm
International Clearinghouse for Hydrogen Commerce, *"The True Story of Hydrogen and the Hindenburg Disaster"* Discussion on the downing of the Hindenburg

http://www.eere.energy.gov/hydrogenandfuelcells/pdfs/30535be.pdf
Dr. Michael Swain's paper comparing two vehicle fuel leaks–gasoline and hydrogen.

http://evworld.com/view.cfm?section=article&storyid=482
Electric Vehicle World's news coverage of Dr. Swain's experiment

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Nature of Matter	**Standard 1**	**SC.A.1.4-**	**X**							
	Standard 2	**SC.A.2.4-**								
The Nature of Science	**Standard 1**	**SC.H.1.4-**		**X**	**X**					
	Standard 2	**SC.H.2.4-**								
	Standard 3	**SC.H.3.4**			**X**					

Benchmark SC.A.1.4.1 - The student knows that the electron configuration in atoms determines how a substance reacts and how much energy is involved in its reactions.

Benchmark SC.H.1.4.2 - The student knows that from time to time, major shifts occur in the scientific view of how the world works, but that more often the changes that take place in the body of scientific knowledge are small modifications of prior knowledge.

Benchmark SC.H.1.4.3 - The student understands that no matter how well one theory fits observations, a new theory might fit them as well or better, or might fit a wider range of observations, because in science, the testing, revising, and occasional discarding of theories, new and old, never ends and leads to an increasingly better understanding of how things work in the world, but not to absolute truth.

Benchmark SC.H.3.4.3 - The student knows that scientists can bring information, insights, and analytical skills to matters of public concern and help people understand the possible causes and effects of events.

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Hindenburg - The largest aircraft to ever fly, the Hindenburg was a gas-filled dirigible (zepplin, 'air-ship'), that crashed upon landing at Lakehurst New Jersey on May 6, 1937.