

## Explosive Gas Mixtures

In the last few months there have been at least 2 fatal cylinder explosions at energy research facilities. Since I am not involved in the investigations, I cannot be absolutely sure as to the root cause. Given the severe damage that occurred and the descriptions of the events leading up to the incident, I suspect that a high pressure explosive gas mixture was involved. Even if these were not due to an explosive gas mixture, given the severe consequences, I believe that a safety alert is necessary to make others aware of the hazard.

An explosive gas mixture is when a flammable gas is mixed with an oxidizer gas. These can exist in a cylinder as a metastable mixture for long periods of time without reaction, even at high pressures. The most common trigger is the opening of the cylinder valve. The sudden pressurization of the cylinder valve outlet can create significant heat resulting from adiabatic compression of the mixture. If it is above the autoignition temperature of the mixture, it will ignite and the reaction wavefront will travel back into the cylinder. In the Semiconductor IC industry the most tragic example of this was the Gollub incident in 1988, nitrous oxide (oxidizer) somehow got mixed in a pure silane (flammable, pyrophoric) cylinder. This was shipped and handled numerous times around the US (Idaho, California, New Jersey) without incident until they tried to vent the cylinder at Gollub. The explosion killed 3 people, severely injured 1 and destroyed the building. A similar incident occurred at Osaka University in 1991 killing 2 graduate students.

Explosive gas mixtures can be created intentionally or by accident. The two recent fatal incidents were companies that are involved in alternate energy research, Membrane Technologies, Sept. 2, 2011 and Sylmar Energy, Oct 15, 2011. Both involved cylinders that were filled with a flammable gas. In the case of the Sylmar incident, DOT took the unusual step of suspending the shipment of the TyLar cylinders due to the extreme hazard (see below).

By law cylinders cannot be filled without the authorization of the owner. When they are, a detailed safety review of the procedures and design must be conducted as well as formal training of the operators. If a cylinder is suspected of containing an explosive gas mixture at high pressure, **call for assistance**. Very few ER teams are capable of safely handling or disposing of these mixtures.

As noted in the news article below, this is not the first time that the TyLar gas cylinders have been involved in an explosion.

  
Eugene Ngai

## Controlled Explosions Shake Sylmar

Previous accidents at two of the company's facilities left one person dead and two others injured.

By [Scott Weber](#)

| Sunday, Oct 16, 2011 | Updated 5:42 PM PST



At a Sylmar energy plant, a blast August 9 occurred when two men were reportedly transferring hydrogen from one cylinder to another.



**Chemically Speaking LLC**  
**Safety Alert**

Officials intentionally detonated three tanks thought to contain a volatile mix of gases at a Sylmar energy plant Sunday. The operation was prompted by a previous explosion and fire at Rainbow of Hope, an alternative-energy startup company that was attempting to create energy by breaking the molecular bond between hydrogen and oxygen from water molecules. [A blast August 9 at the plant occurred](#) when two men were reportedly transferring hydrogen from one cylinder to another. Off duty firefighter Timothy B. Larson lost an arm and leg in that blast. Larson, as it turned out, was the son of the owner, Timothy A. Larson.

In a cruel twist, Timothy A. Larson's other son, Tyson, was killed in a similar accident in June 2010 at another business owned by the company in Simi Valley.

The powerful explosion opened up the roof and threw a second man, William Stehl, co-owner of the company, into an alley. A joint statement issued by federal officials and the LAPD said the exact cause of last August's explosion remains under investigation and "numerous other cylindrical containers" were discovered at the extensively-damaged facility, the statement said.

Since the exact cause of the explosion is not fully understood, officials said the safest course of action was to evacuate the area and intentionally rupture the cylinders.

The operation was coordinated by a task force that included the LAPD bomb squad, city fire department, California Highway Patrol, and the U.S. Environmental Protection Agency.

The industrial park around the plant was evacuated and a section of the Foothill (210) Freeway was closed for a short time.

"It went perfect. Exactly as we planned it. There were no hitches," said Robert Wise, the EPA On Scene Coordinator.

The containers were thought to contain highly volatile tylar gas, a mixture of oxygen and hydrogen. But Wise said they turned out to be empty. As a precaution, Federal pollution scientists were monitoring the atmosphere for any residual effects.

Wise said there was a potential for a huge explosion if crews had not taken action.

"This material is friction-and-static-sensitive. And there's historical documentation of people opening valves of tanks of this stuff and it detonating," Wise said. "The problem with this place is they were running under the radar. They had no permits no licenses and they told people they were purifying water."

Most residents did not hear this morning's detonation, but vividly remember the August explosion.

"We heard like a little bit... Boom. So we woke up and my sister-in-law said 'what's that?' And I think 'that was an explosion again,'" said Claudia Carranza, a San Fernando Resident. "She's like, Oh my God."



## **U.S. Department of Transportation Issues First Ever Order to Stop Companies from Transporting Cylinders Filled With Experimental Gas**

WASHINGTON – The U.S. Department of Transportation’s Pipeline and Hazardous Materials Safety Administration (PHMSA) has declared several California based companies an imminent hazard, and ordered the companies to immediately cease all transportation of the experimental gas known as TyLar. The investigation, conducted by PHMSA, found a pattern of severe explosions resulting in at least one fatality, serious property damage, and injuries associated with TyLar.

“The safety of the American people is my top priority,” said U.S. Transportation Secretary Ray LaHood. “And when companies put the traveling public at risk by recklessly disregarding safety regulations, we will take action.”

Today’s action prohibits Strategic Sciences Inc., Realm Industries, Rainbow of Hope, and Timothy A. Larson from filling any cylinder with TyLar gas and from transporting those cylinders. PHMSA used its authority, which was granted under the Hazardous Materials Transportation Safety and Security Act, because investigators determined this experimental gas posed an imminent hazard to the public, health, property and the environment.

“The safety of our nation’s hazardous materials transportation system is a priority and the investigation into these incidents is ongoing,” said PHMSA Administrator Cynthia L. Quarterman. “It is our responsibility to ensure that hazardous materials are properly marked, packaged and shipped to U.S. households and businesses, and we take that responsibility very seriously.”

An explosion involving TyLar gas on August 9, in Sylmar, Calif., injured three people and resulted in substantial property damage to the production facility. An ongoing investigation, being conducted by PHMSA’s Western Field Operations Office and in collaboration with other law enforcement and safety agencies, indicates that an undeclared shipment of TyLar was placed into transportation in DOT approved 3AA cylinders as recently as August 8, the day before the catastrophic explosion.

Other explosions have also resulted from the transport of TyLar. On June 17, 2010, an explosion resulted in a fatality at a previous TyLar business location. On December 15, 2008, a TyLar facility suffered an explosion that caused property damage but no injuries. In addition, TyLar’s exact composition and properties have not been revealed.