The Dangers of Homemade Hydrogen Fuel "The Orlando Experience"

Presented by:

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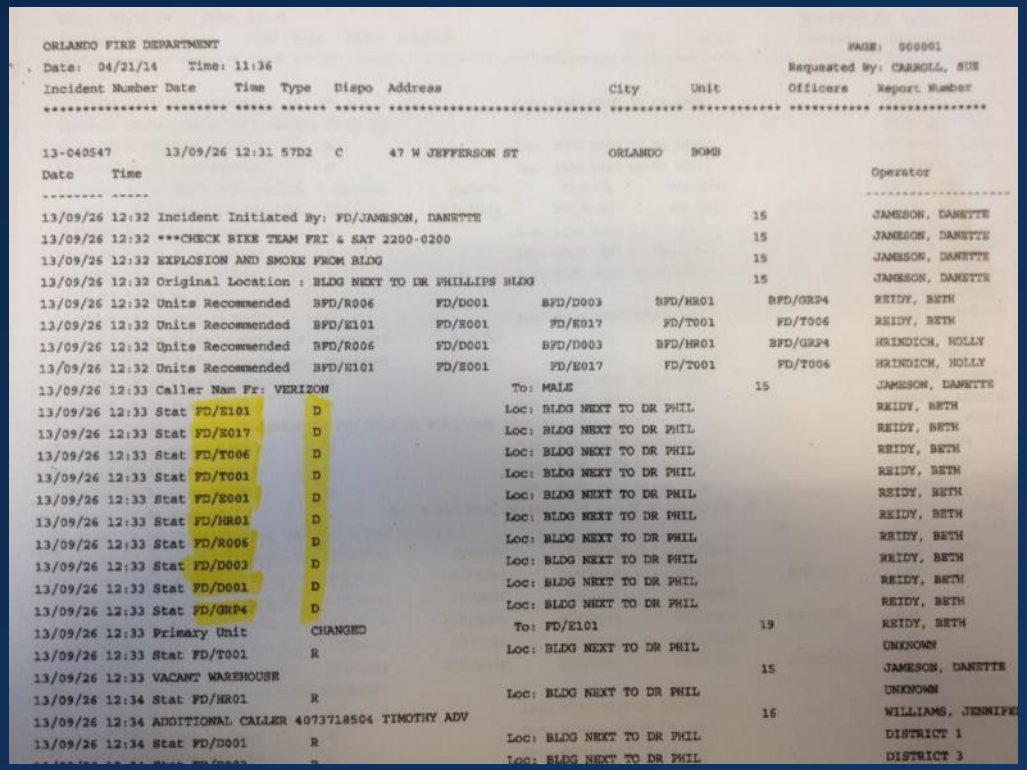
Retired District Chief, Orlando Fire Department (Hazmat Chief)

Objective is this Presentation

To provide the fire service and emergency response personnel with an overview of hydrogen based fuels, its related hazards, and the risk it can pose when involved in an emergency situation.

Dispatch

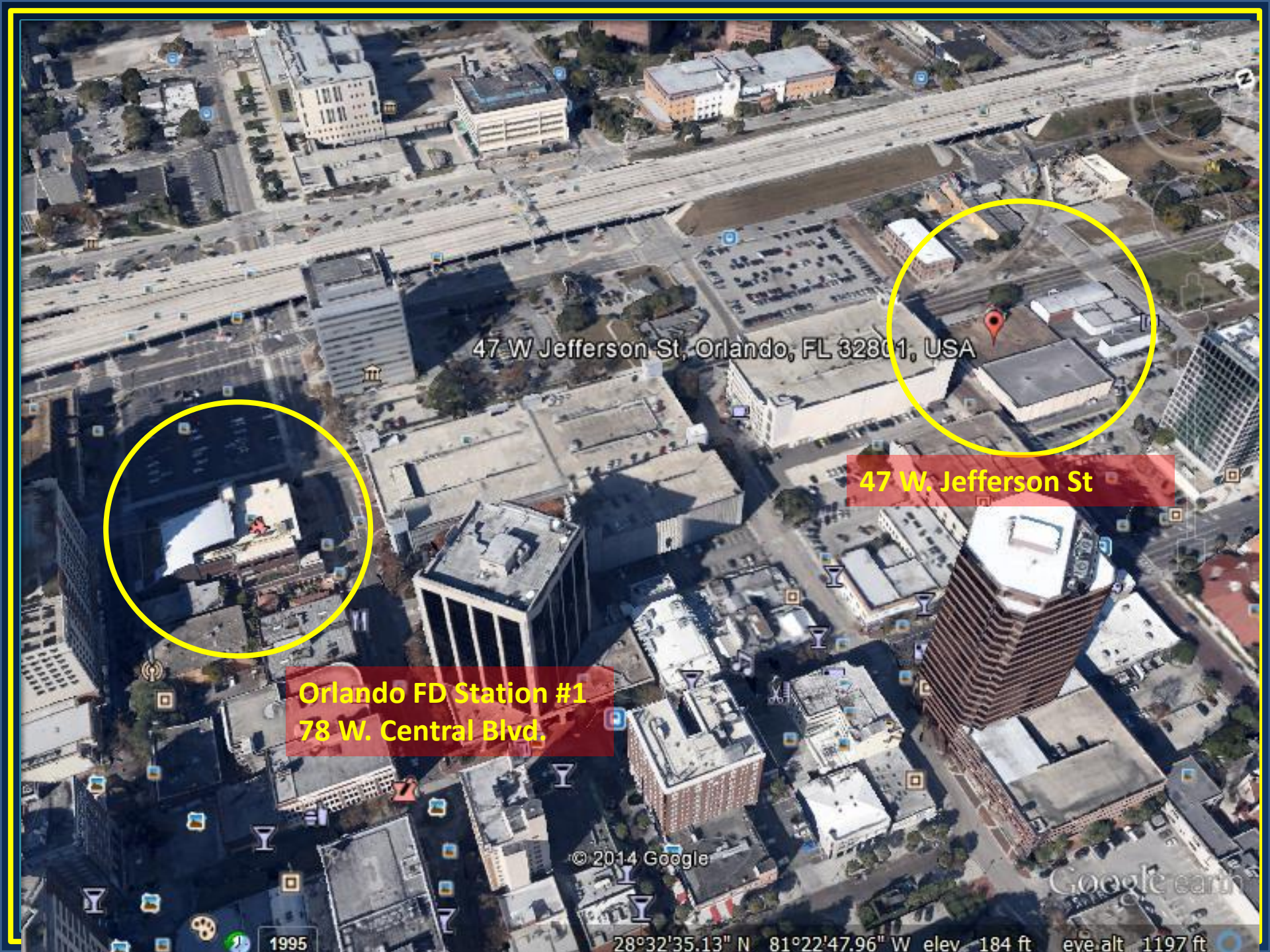
- September 26, 2013 at 1232
- **Explosion and Smoke from a Building,** 47 W. Jefferson St
- Engines 101, 17, 1
- Towers 6, 1
- Heavy Rescue 1
- Rescue 6
- District 1, 3



ORLANDO FIRE DEPARTMENT — PAGE: 000001
Date: 04/21/14 Time: 11:36 — Requested By: CARROLL, SUE

Incident Number	Date	Time	Type	Dispo	Address	City	Unit	Officers	Report Number
13-040547	13/09/26	12:31	57D2	C	47 W JEFFERSON ST	ORLANDO	BOMB		

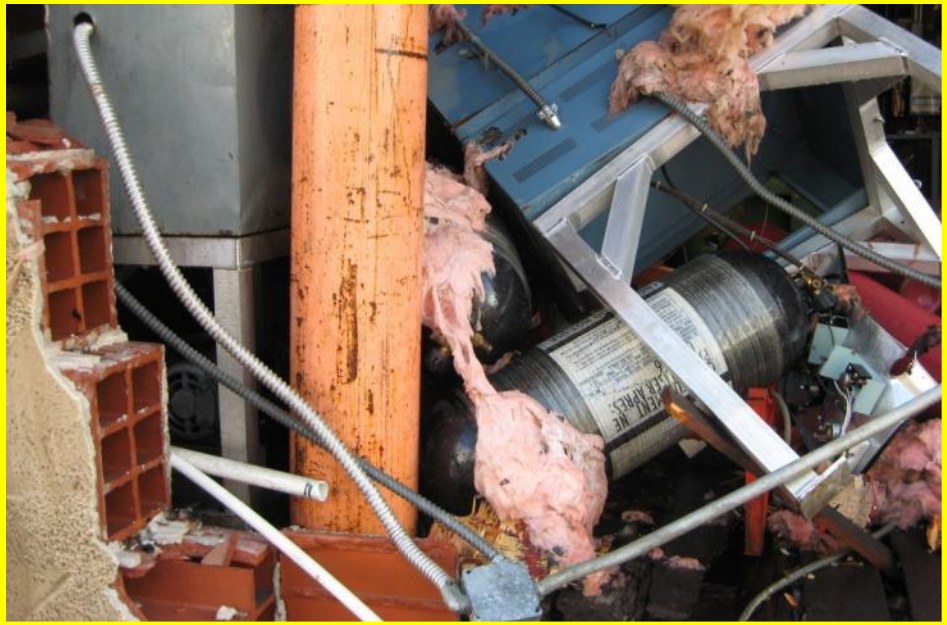
Date	Time				Operator
13/09/26	12:32	Incident Initiated By: FD/JAMESON, DANETTE		15	JAMESON, DANETTE
13/09/26	12:32	***CHECK BIKE TEAM FRI & SAT 2200-0200		15	JAMESON, DANETTE
13/09/26	12:32	EXPLOSION AND SMOKE FROM BLDG		15	JAMESON, DANETTE
13/09/26	12:32	Original Location : BLDG NEXT TO DR PHILLIPS BLDG		15	JAMESON, DANETTE
13/09/26	12:32	Units Recommended	BFD/R006 FD/D001 BFD/D003 BFD/HR01 BFD/GRP4		REIDY, BETH
13/09/26	12:32	Units Recommended	BFD/E101 FD/R001 FD/E017 FD/T001 FD/T006		REIDY, BETH
13/09/26	12:32	Units Recommended	BFD/R006 FD/D001 BFD/D003 BFD/HR01 BFD/GRP4		HRINDICH, HOLLY
13/09/26	12:32	Units Recommended	BFD/E101 FD/E001 FD/E017 FD/T001 FD/T006		HRINDICH, HOLLY
13/09/26	12:33	Caller Nam Fr: VERIZON	To: MALE	15	JAMESON, DANETTE
13/09/26	12:33	Stat FD/E101 D	Loc: BLDG NEXT TO DR PHIL		REIDY, BETH
13/09/26	12:33	Stat FD/E017 D	Loc: BLDG NEXT TO DR PHIL		REIDY, BETH
13/09/26	12:33	Stat FD/T006 D	Loc: BLDG NEXT TO DR PHIL		REIDY, BETH
13/09/26	12:33	Stat FD/T001 D	Loc: BLDG NEXT TO DR PHIL		REIDY, BETH
13/09/26	12:33	Stat FD/E001 D	Loc: BLDG NEXT TO DR PHIL		REIDY, BETH
13/09/26	12:33	Stat FD/HR01 D	Loc: BLDG NEXT TO DR PHIL		REIDY, BETH
13/09/26	12:33	Stat FD/R006 D	Loc: BLDG NEXT TO DR PHIL		REIDY, BETH
13/09/26	12:33	Stat FD/D003 D	Loc: BLDG NEXT TO DR PHIL		REIDY, BETH
13/09/26	12:33	Stat FD/D001 D	Loc: BLDG NEXT TO DR PHIL		REIDY, BETH
13/09/26	12:33	Stat FD/GRP4 D	Loc: BLDG NEXT TO DR PHIL		REIDY, BETH
13/09/26	12:33	Primary Unit CHANGED	To: FD/E101	19	REIDY, BETH
13/09/26	12:33	Stat FD/T001 R	Loc: BLDG NEXT TO DR PHIL		UNKNOWN
13/09/26	12:33	VACANT WAREHOUSE		15	JAMESON, DANETTE
13/09/26	12:34	Stat FD/HR01 R	Loc: BLDG NEXT TO DR PHIL		UNKNOWN
13/09/26	12:34	ADDITIONAL CALLER 4073718504 TIMOTHY ADV		16	WILLIAMS, JENNIFE
13/09/26	12:34	Stat FD/D001 R	Loc: BLDG NEXT TO DR PHIL		DISTRICT 1
			Loc: BLDG NEXT TO DR PHIL		DISTRICT 3


47 W Jefferson St, Orlando, FL 32801, USA
47 W. Jefferson St
Orlando FD Station #1
78 W. Central Blvd.
© 2014 Google
Google earth
1995
28°32'35.13" N 81°22'47.96" W elev 184 ft eye alt 1197 ft

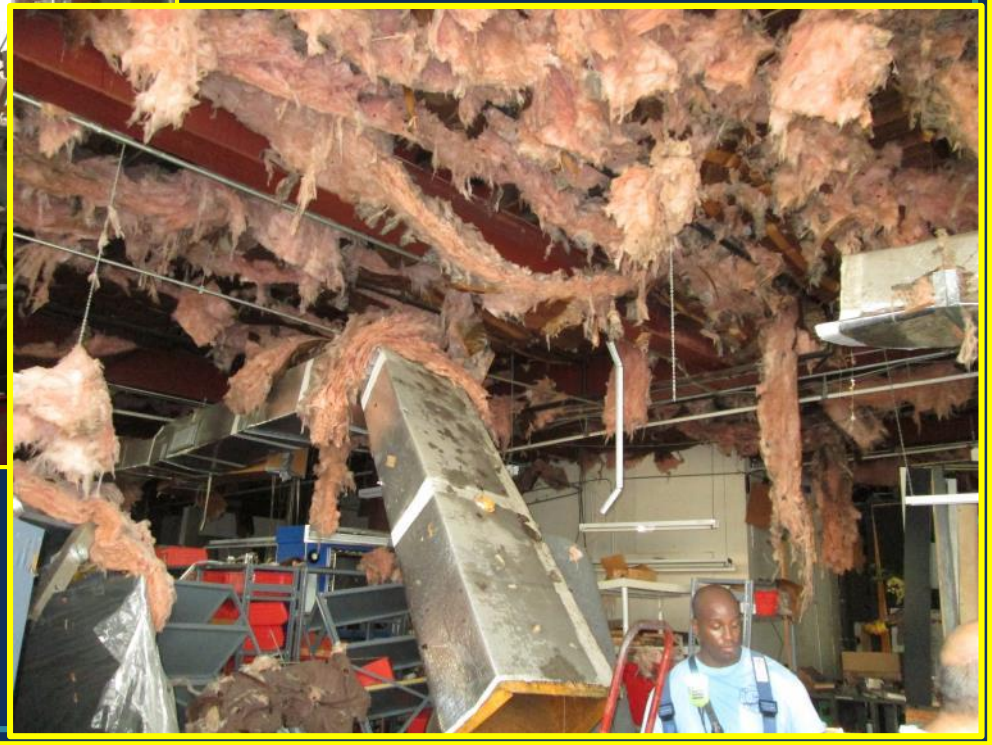
What Occurred

- An explosion ripped through a warehouse blowing out the rear wall and destroying the inside of the building
- No fire occurred
- All damage was due to the catastrophic failure of K size cylinder containing 2000psi of gas
- There were no occupants when the explosion occurred.

The air was filled with dust and dirt but NO smoke. A large portion of wall on Side C was blown out.



Damage Inside the Structure was Significant



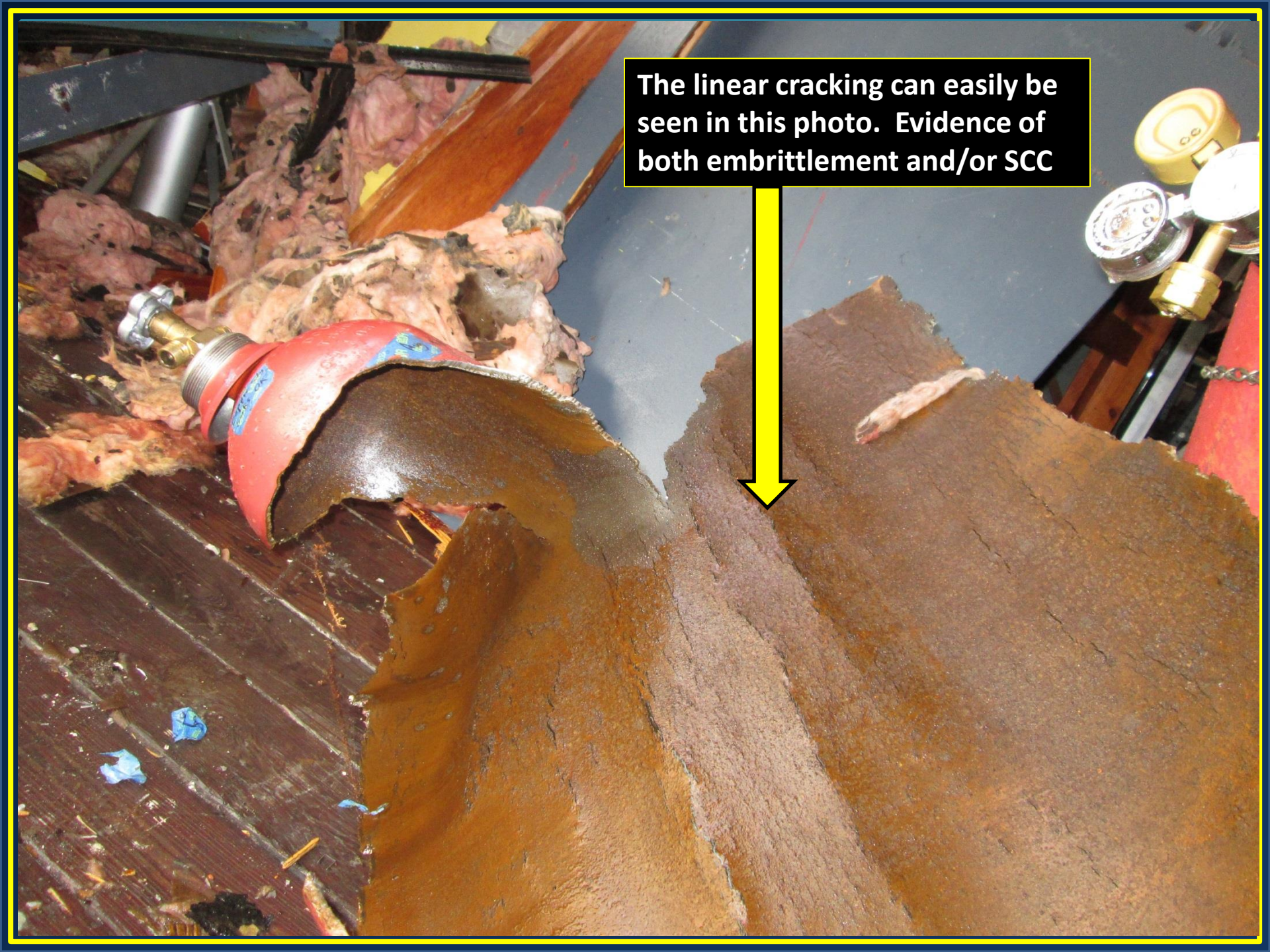
Large cylinders were thrown around the damaged area. In total there were 12 K/M cylinders found. 5 contained product.

Orlando's Response Involved Monitoring the Environment and Releasing (Venting) the Gas from the Unaffected Cylinders

- During the release process the LEL reached 72% in the building.
- A fog line was established and the LEL dropped to 1-5%
- Ventilation, using a fog line, continued until the tanks were empty and the environment reached a 0% LEL.

Cylinder Failure

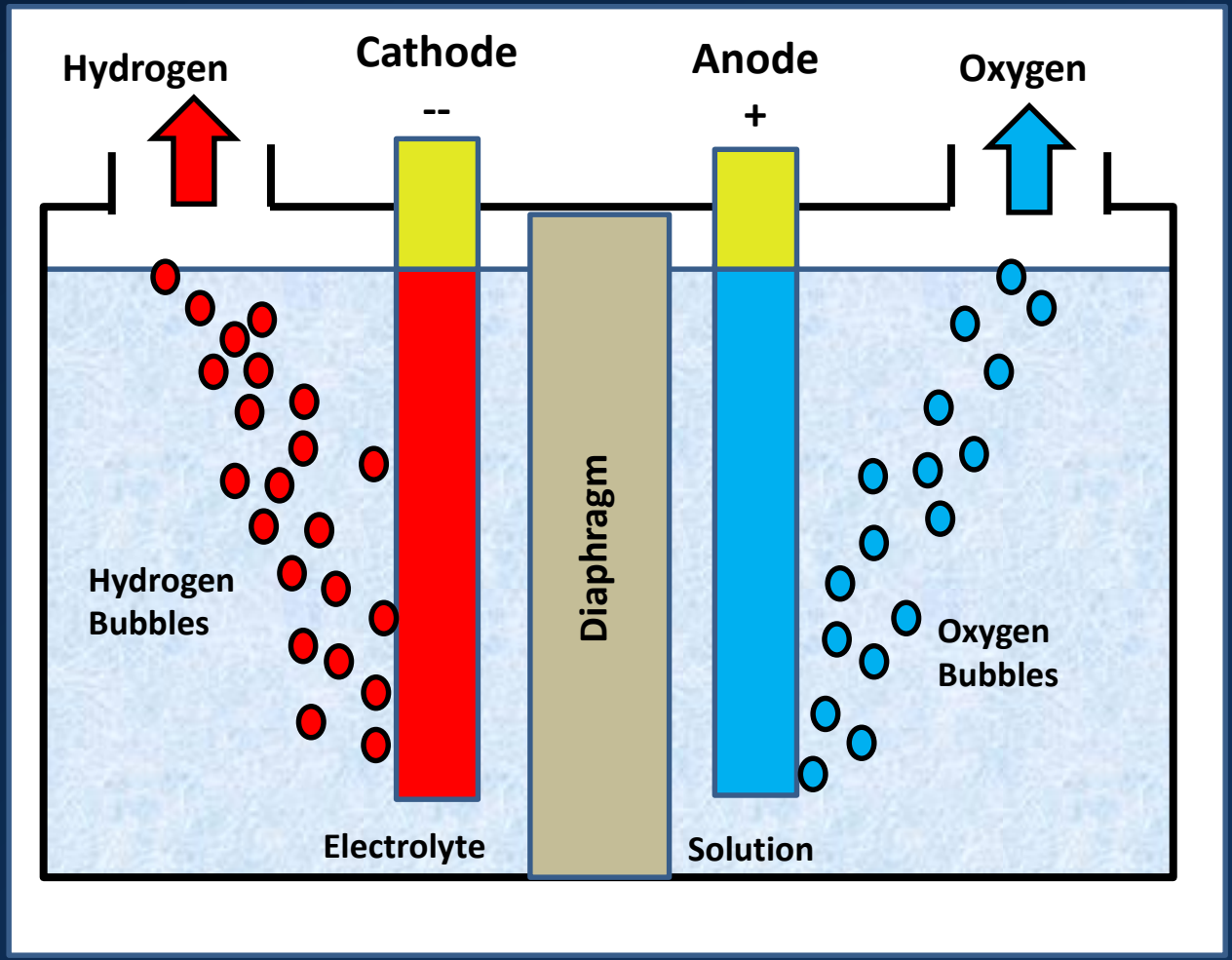
- The owner stated that he had several other cylinder failures but none were catastrophic.
- Failure occurred because the product was incompatible with the carbon steel cylinder
  - Stress Corrosion Cracking
  - Hydrogen Embrittlement


The linear cracking can easily be seen in this photo. Evidence of both embrittlement and/or SCC

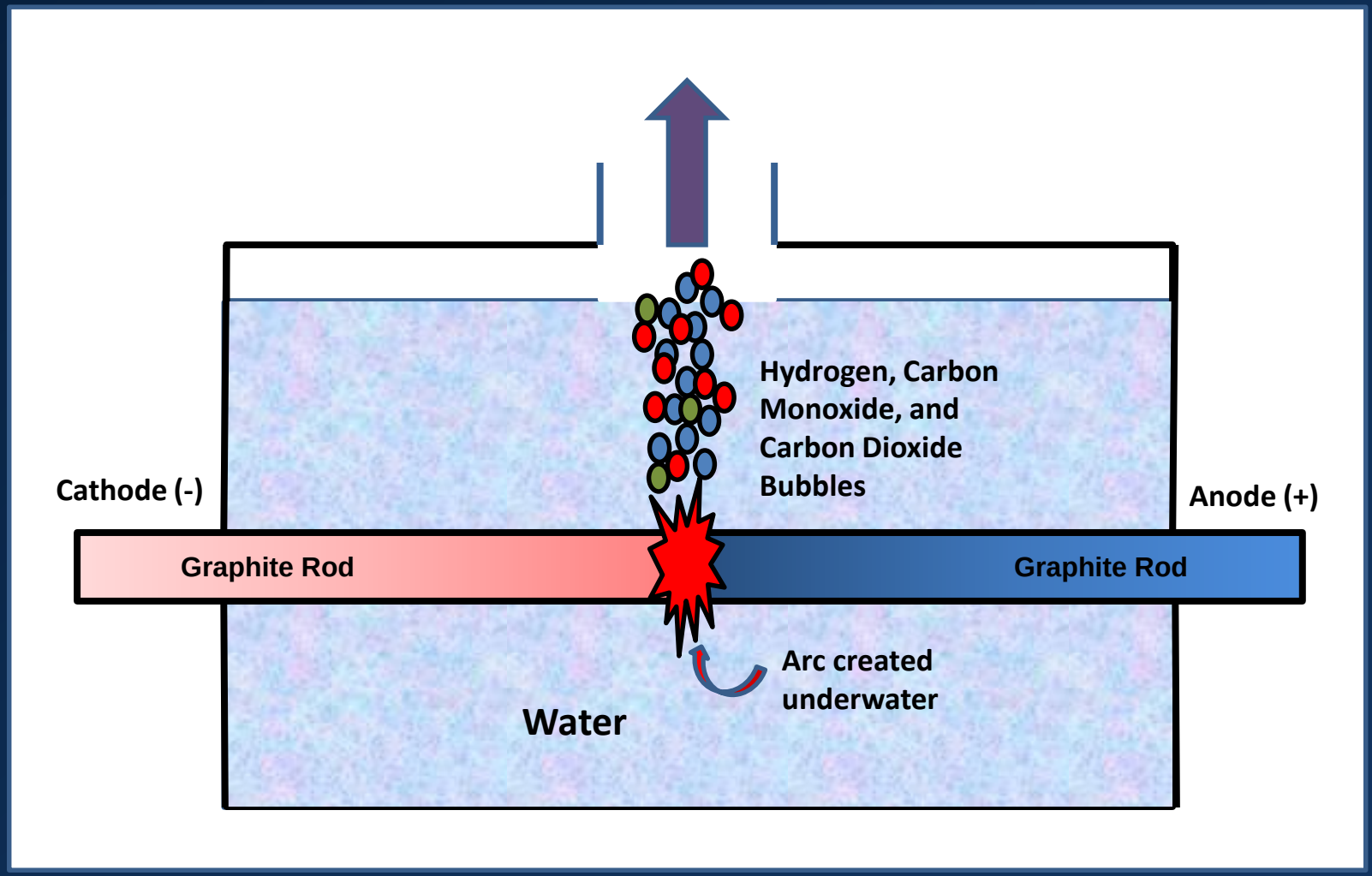
How is Hydrogen Fuel Made?

- Electrolysis is a simple process of feeding electricity into electrolyte water using a positive (+) lead on one side and a negative (-) lead on the other.
- This produces oxygen at the positive lead and hydrogen at the negative
- The Orlando incident was NOT simple electrolysis
  - An arc welder was used with a positive and negative lead on graphite rods held close enough to produce an arc.
  - Arc technology produces primarily hydrogen, carbon monoxide, a small amount of carbon dioxide with very little oxygen.

Simple Electrolysis



Arc Technology



Hydrillium Generator

Aarons machine used two graphite rods powered by an arc welder. When the electrodes came in close proximity an arc was formed and the resulting gas contained about 60% hydrogen, 35% carbon monoxide, 2% carbon dioxide, and trace gases. This mixture has a flammable range of 7.6% to 63.4%.

A Little About the Owner

- The owner of the building is Aaron Fetcher
- He is an inventor and entrepreneur known for inventing and producing Whac-a-Mole and Rock-afire Explosion (from Chucky Cheese).
  - He is a scientist and inventor but not a chemist or physicist.

The Rock-afire Explosion

Why Was This Gas Being Produced?

- Aaron was using the gas for cooking. He called his gas Carbo-Hydrillium.
- Talked about using it (in the future) as an alternate fuel for welding, vehicle fuel, and household items, currently using natural gas or propane.
- Wanted a cheaper alternative than using fossil fuels.
- Although research indicates that producing hydrogen fuel cost more than producing fossil fuel.

Other Attempts to Make "Green Gas" Have Failed Resulting in Death and Injury.

I will highlight 3 incidents:

1. June 13, 2013 Kendal Washington (over-pressurized cylinder)
2. January 10, 2011 Whittier California (unknown chemical/physical properties)
3. June 17, 2010 (2008, 2011), Los Angeles (Sensitive and explosive)

June 13, 2013 Kendal Washington

- A man was seriously burned when he attempted to compress a mixture of hydrogen and oxygen into a 20 pound propane bottle.
- These bottles are not rated for high pressure.
- After the explosion, man was airlifted trauma hospital.

January 10, 2011 Whittier California

An explosion of an unidentified high-pressure tank severed a man's leg and injured a second person.

The explosion blew off the garage door.

Both victims were taken to a trauma center.

The Most Significant Event

- June 17, 2010, Los Angeles.
  - A company with a long history of accidents and incidents.
  - Named BGX Technologies, Rainbow of Hope, Realm Industries, and most recently Sylmar
    - Produced a gas called Tylar.
    - Tylar is a 2/1 hydrogen/oxygen mixture.
    - This is not new and inventors have attempted many times to produce this gas for consumer use, almost always with devastating results.

Sylmar after the most recent explosion (2011)

Hydrogen/Oxygen Mixtures are Called "Boom Gas" or "Brown Gas"

- The German Inventor who developed the electrolysis process named Brown Gas after himself. (BGX Technology…Brown Gas X??)
  - Extremely sensitive. Just the friction from opening the tank valve is enough to ignite the mixture.
  - If used to create a flame, the flame can backfire into the bottle and cause an explosion.

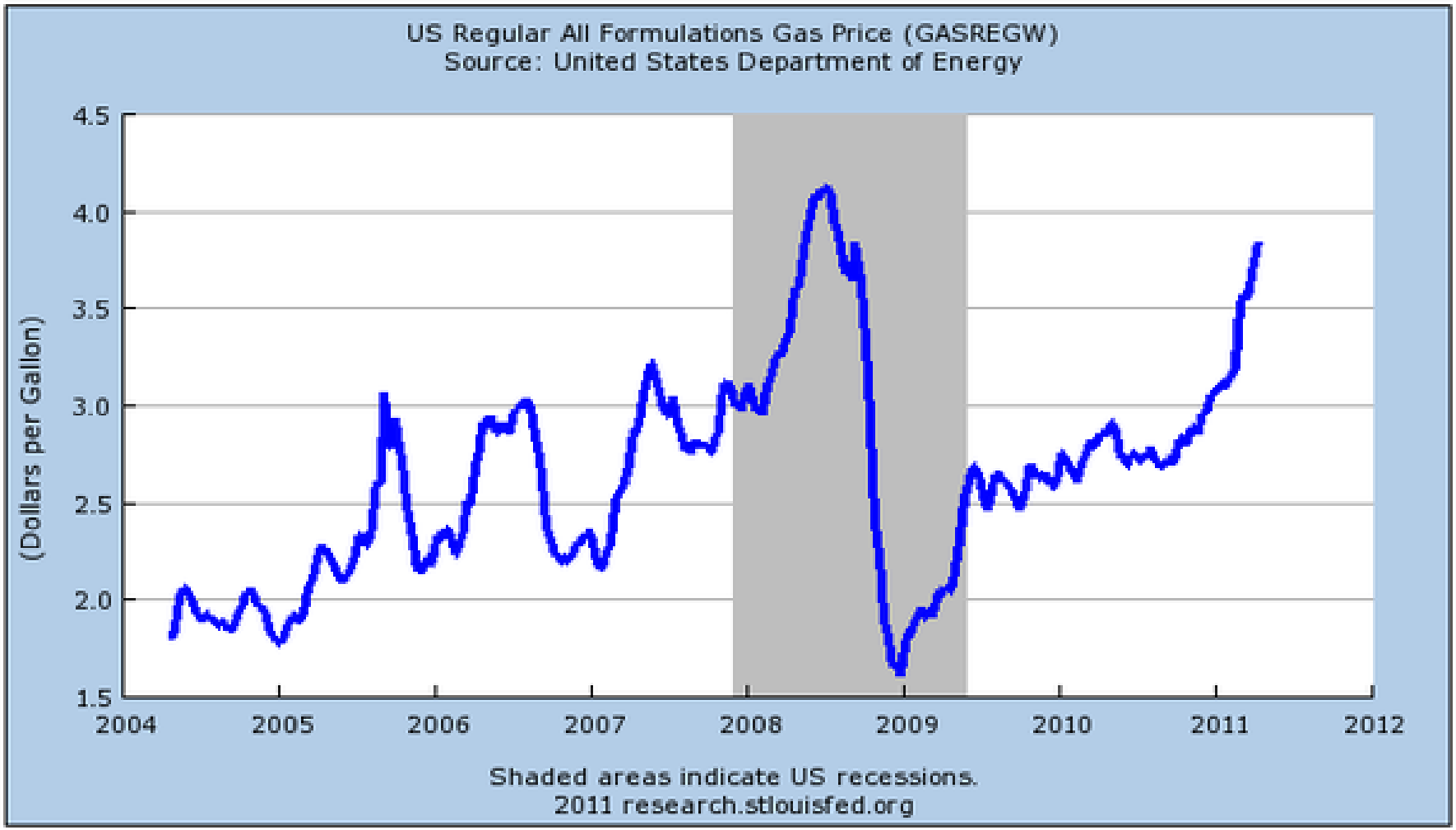
At Least 4 Explosions Occurred at Sylmar (and other associated companies)

- 2008 - 2 explosions occurred and were never reported. (these were discovered after an intense investigation by DHS).
- 2010 - explosion caused the death of the owner's son
- 2011 (14 months later)- detonation caused injuries to two employees. One victim, was the owners second son who lost his leg and part of an arm. He was an off-duty Los Angeles County Firefighter.

Why Has This Become Such a Big Issue?

- Price of hydrocarbon based (fossil) fuels is getting higher.
- Information on the internet is easily available but not always accurate.
- Not understanding chemical and physical properties of the chemical being produced.
- Those producing the chemical have little knowledge of chemistry or physics.

In 8 years gas prices have gone from $1.75 to nearly $4.00 per gallon



What is the Danger?

- These inventors are not breaking the law. Laws focus on transportation of compressed gases and not so much on the production.
- Incompatible cylinders.
- Over pressurizing non rated or under rated cylinders.
- Producing chemicals that are very sensitive.
- Producing poisonous/flammable/explosive chemicals.

Emergency Responder Precautions

- If an incident has occurred and there is an inventory of chemicals, exercise extreme caution. NEVER open a cylinder to sample or release the chemical!!
- In this type of event, control all utilities to the affected building (gas, electricity, water)
- Treat the scene as an active bomb scene and get professional advice before doing anything.

Questions????