Safety Bulletin: # 1014

Fatal Natural Gas Explosion

three dead, six hospitalized, over $30 million in damage

A Virginia iron foundry, which manufactures transmissions and other automotive components, suffered a massive natural gas explosion in March of 2000. The result was three dead, six hospitalized and over $30 million in damages. The facility employed over 500 workers of which about 100 were inside the building when the explosion occurred. The blast could be heard 15 miles away in surrounding towns. The plant itself extends for several blocks. The damaged portion of the facility was leveled.

A representative from the local fire department said, *"We've got a massive pile of steel. We had a four-story building that basically collapsed down to two stories."* The explosion and fire was believed to have started in the plant's "core department", where metal is poured into molds to make transmission components and other auto parts. Three 25-foot sections of the building's east wall were sucked in by the blast, while other walls were blown out. A witness saw *"mass destruction in an area the size of a football field."*

QUICK FACTS

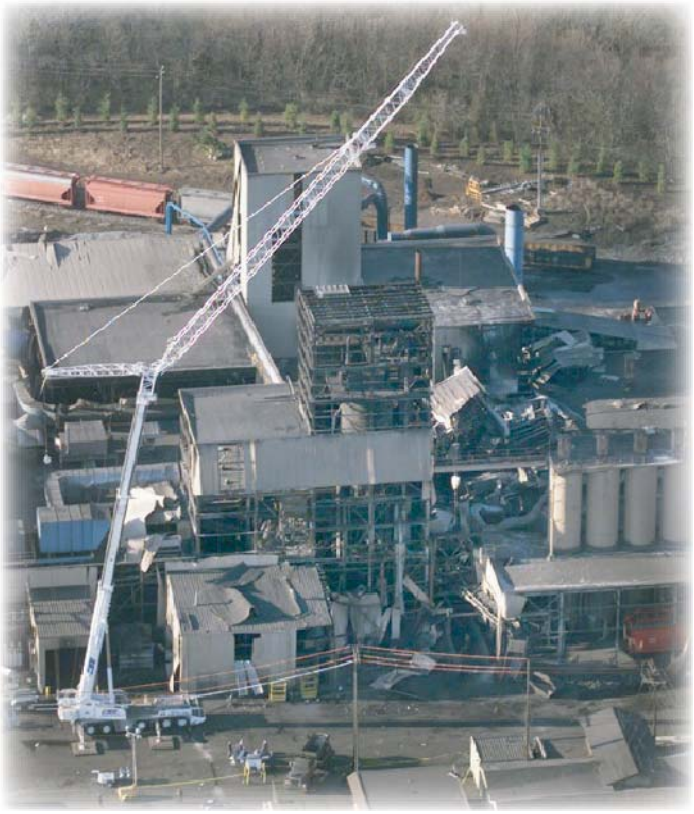
Location: *Iron Foundry in Virginia*
Date: *March of 2000*
Event: *Natural gas explosion*
Results: *Three dead, six hospitalized, over $30 million in damage.*

THE SCENARIO

Many employees tried to make their way to the exits and had to crawl and grope along, as the thick smoke blinded them. Those who tried to walk out were reduced to gagging until they found clearer air near the floor. One plant employee stated, *"I tried to yell but you couldn't get enough air to yell. It was totally dark, like being in a basement at midnight with the lights out."*

One man was killed immediately and two women were crushed beneath a four-story building. The death toll would have been higher except for the heroic actions of some individuals as they assisted the injured. One employee was rendered unconscious when the fireball knocked him off his feet and his co-workers brought him out of the plant.

The search for survivors was hampered, however, by the rupture of a large water main. This further complicated the effort to cool four ladles of molten iron to prevent more explosions.



THE CAUSE OF THE INCIDENT

The local police department, the Virginia State Police and the Bureau of Alcohol, Tobacco and Firearms worked together to investigate the explosion. Representatives of United Cities Gas Company assisted as well. The plant is served with both natural gas and propane. Experts believe that the incident was caused by a natural gas leak that built to an explosive level and then found a source of ignition.

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WERE THERE ANY WARNINGS?

There were several warnings which, if heeded, could have prevented this tragedy. Gas odors were again detected on Monday, even after a gas odor related evacuation occurred on Friday, just two days before the incident. *"They said it was just the wind blowing the smell of gas in from outside",* according to a witness. The earlier evacuation on Friday was necessary when 300 pounds of gas leaked from an outside tank through a pipe running into the core department.

If employees had been trained and the appropriate equipment used, this tragedy may have been prevented.

CONCLUSIONS

There is no such thing as a safe gas leak. Natural gas in air reaches its lower explosive limit at a concentration of only 4.3%. Even small leaks, over time, can accumulate in confined areas and support combustion with an ignition source.

Not all flammable industrial gasses have an odor detectable by the human nose. In the case of carbon rich gasses using carbon monoxide, (such as for heat treat carburizing applications), there may not be a detectable odor. Propane and natural gas use different odorants. The search for a propane leak is much different than a natural gas leak or a hydrogen leak given the atomic weights of each gas. Natural gas and hydrogen are lighter than air while propane is heavier. Propane will fall to the ground and flow like an invisible liquid. It will pool and accumulate in low spots.

Leak detection techniques can include the use of electronic combustible gas detectors and liquid leak indicating fluids. The use of LEL (lower explosive limit) meters will allow for concentrations to be identified. Combustible gas detectors usually only indicate the presence or the absence of hydrocarbon molecules.

In any case, the answer is always to error on the side of caution. Here are four tips if you smell an obvious natural gas or propane odor:

(1) Think first to evacuate personnel from the area.

(2) Do not turn on lights or operate equipment that may provide an ignition source. You may encounter an ignition source from automatic equipment that cycles on/off. If you do try to secure the fuel source make sure it is at a remote area. The act of shutting off a piece of equipment that is operating in a explosive atmosphere could allow its motor starter to de-energize. When the motor starter contacts separate, an ignition source could be present. Even electronic leak detection equipment can introduce a spark. Only use NEMA rated explosion proof leak detection equipment or communication devices.

(3) Ventilation is not always the answer. If you ventilate a fuel rich area in the presence of an ignition source you could dilute the atmosphere just enough to hit the upper range of the explosive limit (about 15% for natural gas). If you ventilate, you may be able to do so from a distance with all personnel evacuated.

(4) Make sure that first responders are not sent into obviously hazardous conditions with test equipment to screen for hazards. The act of investigating a severe gas leak could itself be very hazardous.

Reference Sources: Richmond Times Dispatch. www.timesdispatch.com and Roanoke Times. www.roanoke.com

Information about services to ensure your gas-fired equipment's safe operation can be obtained at **www.combustionsafety.com**