

Written Testimony of John S. Bresland
U.S. Chemical Safety Board
Before the U.S. House of Representatives Committee on Education and Labor
Subcommittee on Workforce Protections
Hearing on “Examining the Tragic Explosion at the Kleen Energy Power Plant
in Middletown, Connecticut”
June 28, 2010

Good morning Chairman Woolsey and distinguished members of Congress. I am John Bresland, board member of the U.S. Chemical Safety Board. Thank you for convening this important field hearing of the House Education and Labor Committee and for inviting me to appear before you.

My statement today is on my own behalf and does not necessarily reflect the views of the other board members. This week we are welcoming two new members to the Chemical Safety Board: Dr. Rafael Moure-Eraso, who will serve as the new chair, and Mr. Mark Griffon. Dr. Moure and Mr. Griffon were confirmed by the Senate just last Wednesday evening.

The Chemical Safety Board or CSB is an independent, non-regulatory federal agency that investigates major industrial accidents involving hazardous substances. We were established in 1998 and have investigated approximately 70 industrial fires, explosions and toxic gas releases across the country. These include the West Pharmaceutical explosion of 2003, the BP Texas City refinery explosion of 2005, and the Imperial Sugar explosion of 2008. Most recently, we have been called in to investigate the causes of the explosion and fire at the Deepwater Horizon oil rig in the Gulf of Mexico.

For the past four-and-a-half months, the CSB has conducted an intensive investigation of the root causes of the February 7, 2010, accident at the Kleen Energy power plant under construction here in Middletown. That investigation began less than 24 hours after the explosion and has involved a large number of our personnel.

I myself observed portions of the site on the Tuesday immediately following the explosion (Figure 1). It was a scene of devastation and of tragedy. For us, it was one of the most challenging investigations we have ever conducted.

Our team has interviewed more than 90 witnesses, has gathered large numbers of documents from all the parties involved, and has painstakingly examined the site and key pieces of evidence. We have also conducted an exhaustive review of applicable federal and state regulations, codes, and standards governing the gas power industry and the work activities underway on the morning of the explosion.

CSB Investigation of Kleen Energy Explosion Reveals Significant Gap in Current Standards

Madam Chairman, the CSB team has uncovered what we believe is a significant gap in these standards – a gap that threatens the continued safety of workers at facilities that handle flammable natural gas.

CSB investigators have determined that no specific federal workplace safety standards prohibit intentional, planned releases of natural gas into workplaces, as occurred here on February 7. We also

determined that there are safe, feasible, economical alternatives to the unsafe gas-handling practices that caused this accident.

The tragedy that took six lives and injured many others at Kleen Energy was not the first explosion involving natural gas that the CSB has investigated. On June 9, 2009, a similarly destructive accident occurred at the ConAgra Slim Jim meat processing plant in Garner, North Carolina (Figure 2). That explosion during what is known as “gas purging” of a process pipe killed four workers and injured 67 others. It substantially destroyed the facility, leading to a permanent shutdown that cost more than 600 jobs in the region.

A mere three days before the accident at Kleen Energy, on February 4, the CSB held a public meeting in North Carolina to present our preliminary findings on the ConAgra explosion and to issue urgent safety recommendations for changes to the National Fuel Gas Code to prevent the unsafe indoor venting of gas during purging operations.

At the hearing, accident victims spoke to the Board – none more poignantly than Debra Pettaway, who worked for ConAgra and whose only son, 33-year-old Lewis Watson, also worked at the Slim Jim plant and was killed in the explosion, leaving behind a wife and child. Ms. Pettaway implored the Board, “For the people that did die, please don't let them die for nothing.” Ms. Pettaway’s plea has, I believe, inspired our continuing work to promote the safer handling of fuel gases – the work that we plan to complete here today in Middletown.

Madam Chairman, I am here to testify that these deadly accidents in Connecticut and North Carolina were preventable. There are readily available alternative practices that will completely eliminate the hazard. It is my earnest hope that standards will be put in place that will require these safer practices in the future.

Natural Gas Blow Released Huge Volume of Flammable Gas at Kleen

The explosion at Kleen Energy occurred during what has been termed a “natural gas blow.” This was a procedure to clean out debris from large, newly constructed natural gas piping that provided fuel to the plant’s large electricity-generating gas turbines.

The cleaning of natural gas piping is a necessary activity when putting new piping into service at gas power plants, because even small debris particles can cause damage to the turbines, which are very large and costly. The turbine manufacturers – including companies like Siemens and General Electric – require cleaning of the piping as a condition of the warranty on the turbines.

Although contractors involved in constructing the Kleen Energy plant had considered using high-pressure air to clean out the piping, it was eventually decided to use high-pressure natural gas for this purpose. Using natural gas, we determined, has generally been done as a matter of custom and convenience at new power generation facilities, since an abundant supply of high-pressure natural gas is readily available from nearby gas pipelines that are already connected into these plants.

Gas blows of this kind can result in vast releases of natural gas to the atmosphere. Figure 3 shows a gas blow conducted at Kleen Energy about a week prior to the accident; a geyser-like plume of gas and debris towers over the large plant.

Over a four-hour period on the morning of February 7, workers were conducting a series of 15 planned gas blows involving different sections of piping within the plant. The gas was supplied at a high pressure of approximately 650 pounds per square inch gauge (psig).

This gas was vented directly to the atmosphere, without being captured or combusted. The venting occurred through large, horizontal, open pipe ends that were less than 20 feet off the ground and were located in congested areas adjacent to the power generation building.

Our investigators obtained gas company records that show that some two million standard cubic feet of natural gas were released to the atmosphere during these gas blows on February 7. To put that into some perspective, that is more than two billion BTUs worth of gas – enough to fuel a typical American home every day for more than 25 years.

During the final ten minutes prior to the blast, approximately 480,000 cubic feet of gas were released. That is enough gas to fill a pro basketball arena with an explosive fuel-air mixture.

Workers Were Not Adequately Involved in Safety Planning

No safety meeting was held that morning among the workers involved in the gas blows. About 150 workers were present at the site. Although workers were evacuated from the area south of the power generation building, there was no effort to evacuate nonessential personnel from the building itself; however, a few workers evacuated themselves due to concern about the odor from the gas that was being released.

While efforts were made to eliminate or control ignition sources outside the building, some ignition sources were difficult or impossible to eliminate. In addition there were abundant ignition sources that remained inside, including electrical devices and welding equipment. We view that the formation of a flammable gas cloud was the fundamental hazard, and thus determining a specific ignition source has not been a major focus of our investigation.

At approximately 11:15 a.m. the gas found one of the numerous available ignition sources and exploded.

Two Previous Fires or Explosions Occurred During Natural Gas Blows at Power Plants

CSB investigators discovered that this was not the only explosion that has occurred during a natural gas blow at a power plant. In October 2001, a fire occurred during a natural gas blow at a First Energy power plant in Ohio. Flames reportedly shot 30-40 feet in the air following a sudden, unexpected ignition of the gas. In that case, operators were able to shut off the supply of gas within a period of seconds, before injuries or serious damage occurred.

The next occurrence was even more serious. On January 26, 2003, a similar explosion occurred at the Calpine Wolfskill Energy Center in Fairfield, California. This blast, which was actually photographed as it began (Figure 4), also happened during a gas blow to clean piping, using high-pressure (630 psig) natural gas.

The explosion was powerful enough to be heard 10 miles away. However, workers were 80 to 140 feet away from the location of the vent and were spared injury. Investigators from Calpine noted that one of the causes of the accident was that available alternative cleaning methods such as compressed air were not being used.

Perhaps because these previous accidents did not cause severe injuries or damage, they were not widely publicized or acted upon by the gas power industry, which has continued to use natural gas for pipe cleaning.

Natural Gas Blows Remain Common, Despite Safer Alternatives

Following the explosion at Kleen Energy, we enlisted the help of an industry organization called the Combined Cycle Users' Group to conduct a survey of gas power companies concerning their pipe cleaning practices. The survey confirmed that there are a number of alternatives to using natural gas blows for cleaning debris from pipes.

These alternatives include blowing with air, nitrogen, or steam, or using a cleaning device known as a "pig" which can be pushed through the piping. Although no method is completely free of any risks, using compressed air, for example, completely eliminates the catastrophic fire and explosion hazard associated with using natural gas. Other methods, such as using a cleaning pig with compressed air as the motive force, also eliminate the fire hazard.

These methods are practical and affordable and work as well if not better than natural gas. Many companies use these alternative techniques. Despite the availability of these alternative methods, we were disturbed to find that natural gas blows remain the most popular single technique, practiced by 37% of respondents in our survey. We even learned of several natural gas blows that were performed *after* the CSB's announcement at a news conference on February 25th that these operations were inherently unsafe and should be avoided.

General industry safety guidelines dating back for several decades emphasize the importance of eliminating process hazards to the greatest degree possible, rather than trying to control the hazards of inherently dangerous activities. This approach, often termed "inherent safety," recognizes that despite the best of intentions, efforts at controlling serious hazards are ultimately prone to failure over time. In the safety hierarchy, permanent elimination of a hazard is always preferable whenever it is possible to do so.

While not every natural gas blow leads to an explosion or to injuries, the activity is inherently dangerous and difficult to conduct in a way that reliably results in safe dispersion of the gas before it contacts an

ignition source. In fact, there are even indications that natural gas blows can self-ignite due to static electricity or impact sparks from metal debris.

Madam Chairman, the hazard of natural gas releases into workplaces is one that can and should be eliminated.

Current Regulations and Guidance Allow Natural Gas Blows

CSB investigators examined numerous standards, codes, and guidance from the U.S. Occupational Safety and Health Administration (OSHA), the National Fire Protection Association (NFPA), the American Society of Mechanical Engineers (ASME), the Electric Power Research Institute (EPRI), and the State of Connecticut. Yet we found nothing that specifically prohibits natural gas blows or mandates the use of feasible alternatives.

What we did find in our investigation was a series of exemptions governing the natural gas power industry. For example, we found that the National Fuel Gas Code (NFPA 54), which has been adopted by at least 35 states across the U.S., has a specific exemption for power plants and for piping above a pressure of 125 psig. We found that other NFPA documents that provide guidance for power plants, including NFPA 37 and NFPA 850, are silent on the issue of gas blows.

In addition we were told that industry representatives have resisted the development of NFPA or other consensus codes that would contain potential mandatory safety requirements for the power industry. NFPA 850, a document focused on fire protection in the electric power industry, has thus been designated a “recommended practice” rather than a code and it remains completely voluntary in all jurisdictions.

Urgent Safety Improvements Are Warranted

Madam Chairman, I would submit to you that the present patchwork of inadequate codes and voluntary practices does not protect America’s workers from the kind of explosions that killed six at Kleen Energy, killed four at ConAgra, and threatened many others with death or injury.

That’s why today, at our CSB public meeting later this evening, I intend to vote for and support new urgent safety recommendations calling for OSHA to enact new regulations to control this hazard, and I will encourage the other Board members to do the same.

The two accidents at Kleen Energy and ConAgra – and many others over the years – underscore the fact that OSHA currently has no regulatory standard for the safe handling of natural gas. In contrast, OSHA has specific regulatory standards for other flammable gases, including the liquefied petroleum gases propane and butane as well as acetylene and hydrogen.

Data gathered by our investigators demonstrate, however, that natural gas is far more widely used than the other common flammable gases. For example, natural gas use exceeds that of propane by a factor of 15 (Figure 5). Propane use is specifically regulated by OSHA; natural gas is not.

I will not seek to catalogue here all the accidents that have resulted from unsafe natural gas releases in industrial workplaces – they are both serious and numerous. Our draft urgent recommendations mention some of the most severe examples, including the catastrophic coal dust explosion that was ignited by an inadvertent gas release during the purging of a natural gas line at the Ford River Rouge power plant in Dearborn, Michigan, in 1999. That single accident killed six workers, injured dozens of others, and caused an estimated one billion dollars in property losses.

Other jurisdictions have gone further than federal OSHA. In California, state construction regulations prohibit work in an atmosphere where flammable gas exceeds 20% of the lower explosive limit (LEL). Similar regulations prohibit any work activity in an atmosphere above 20% of the LEL in a majority of Canadian provinces.

OSHA Should Develop Safety Standards for Natural Gas

The draft urgent recommendations that the CSB will consider tonight would call upon OSHA to enact new gas safety regulations that will:

- Prohibit the use of natural gas for pipe cleaning, the cause of the explosion at Kleen Energy
- Prohibit the venting or purging of fuel gas indoors, the cause of the explosion at ConAgra
- Prohibit any work activity where the flammable gas concentration exceeds a fixed, low percentage of the lower explosive limit
- Require that companies involve their workers *and* contractors in developing safe procedures and training for handling fuel gas

I believe OSHA should proceed with developing these regulations as quickly as possible, as a matter of considerable urgency. In the electrical generating sector alone, there are some 125 new gas-fired power plants planned for completion between 2010 and 2015 (Figure 6). These plants not only represent a major financial investment, but unless steps are taken to prevent unsafe gas blows, many workers may be placed in harm's way over the next five years.

Additional draft urgent recommendations will seek safety improvements from the NFPA, the American Society of Mechanical Engineers, the Electric Power Research Institute, the major gas turbine manufacturers, and the State of Connecticut and other states.

All these recommendations remain “draft” until they are voted on and approved by the full Board. I ask consent to have the 18 draft recommendations – together with more than 60 findings of fact that support the recommendations, included in the record of this morning's hearing.

If the Board approves the recommendations this evening, our intention is to conclude the CSB investigations of the explosions at Kleen Energy and ConAgra. We believe that the 18 urgent recommendations proposed today – together with the two urgent recommendations we issued on February 4 – address all of the principal root causes of these two tragic accidents. If adopted by the recipients, I have no doubt that future accidents will be avoided and lives will be saved as a result.

We need to put an end to the unsafe and potentially deadly practice of venting huge volumes of natural gas in the vicinity of workers and ignition sources. The CSB's draft recommendations represent a comprehensive, multi-layered strategy for doing just that.

Let me add, Madam Chairman, that we had an encouraging meeting just over a week ago with the OSHA Assistant Secretary, Dr. David Michaels, and his deputies to discuss the proposed recommendations. I know that Dr. Michaels and the other dedicated leaders and staff of OSHA are just as concerned about these recent fuel gas accidents as we are.

I hope that as you proceed with your work on this issue, you will consider providing OSHA with whatever specific fiscal resources, personnel, or statutory tools it may need to proceed quickly with the new recommended standards.

I thank you again, Madam Chair, for convening today's hearing and I thank you and the entire Connecticut Congressional delegation for your unwavering support of the CSB's investigation and our work to improve worker safety. I will be happy to answer any questions you may have.

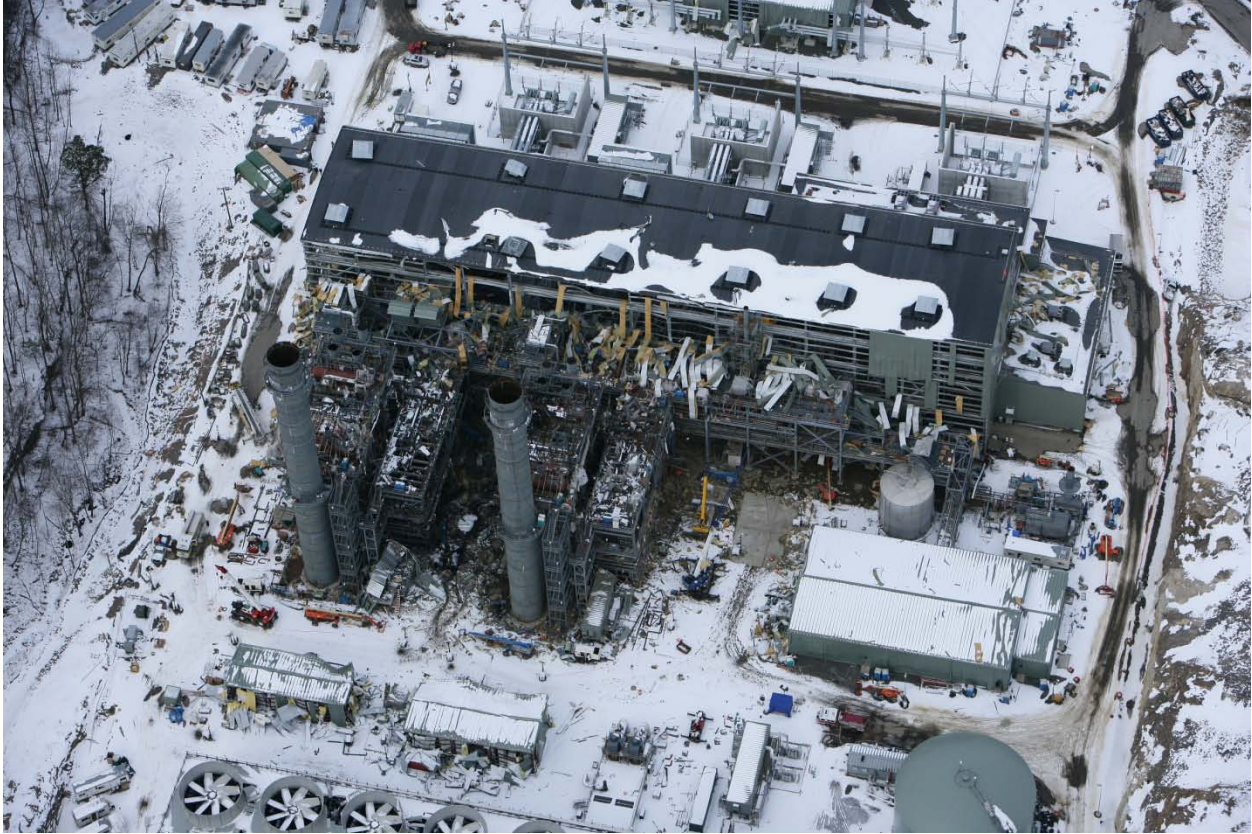


Figure 1. Aerial photograph taken shortly after the devastating gas explosion February 7, 2010, at the \$1 billion Kleen Energy power plant in Middletown, Connecticut.



Figure 2. ConAgra Slim Jim meat processing plant in Garner, North Carolina, following the natural gas explosion of June 9, 2009, which killed 4 workers, injured 67 others, and caused much of the building to collapse.



Figure 3. Natural gas blow conducted at the Kleen Energy plant a week prior to the explosion on February 7, 2010, showing plume of gas and debris hundreds of feet high.



Figure 4. Previous explosion during a natural gas blow on January 26, 2003, at a Calpine natural gas power plant in Fairfield, California. The explosion was heard 10 miles away.

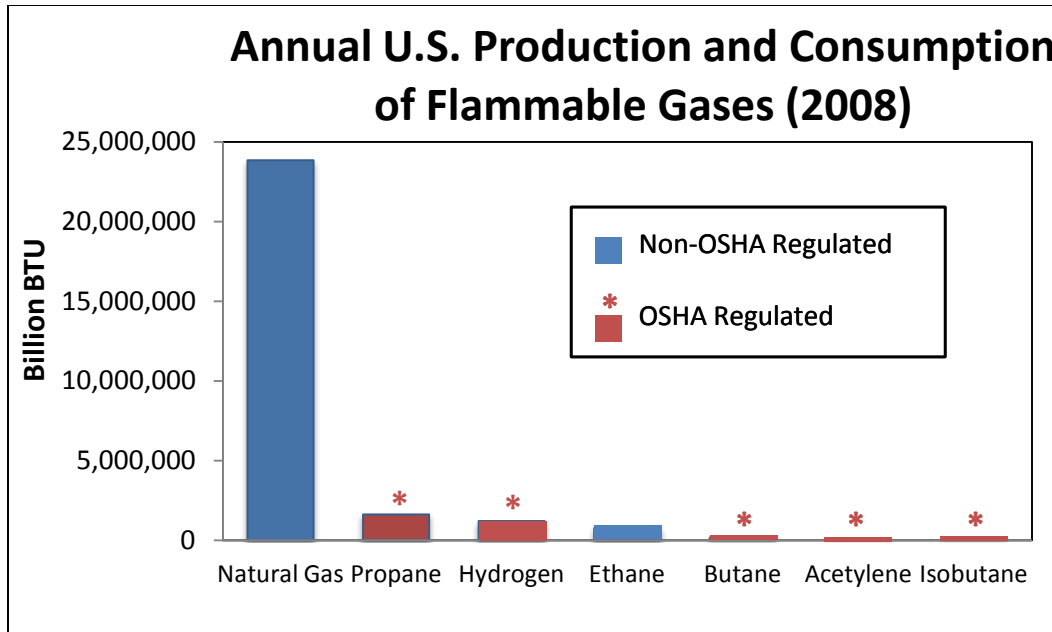


Figure 5. Graph showing annual U.S. consumption of various flammable gases. Although propane and other liquefied petroleum gases, hydrogen, and acetylene are regulated by specific OSHA safety standards, OSHA currently has no specific standard for the safety of natural gas (methane), which is by far the most common gas.

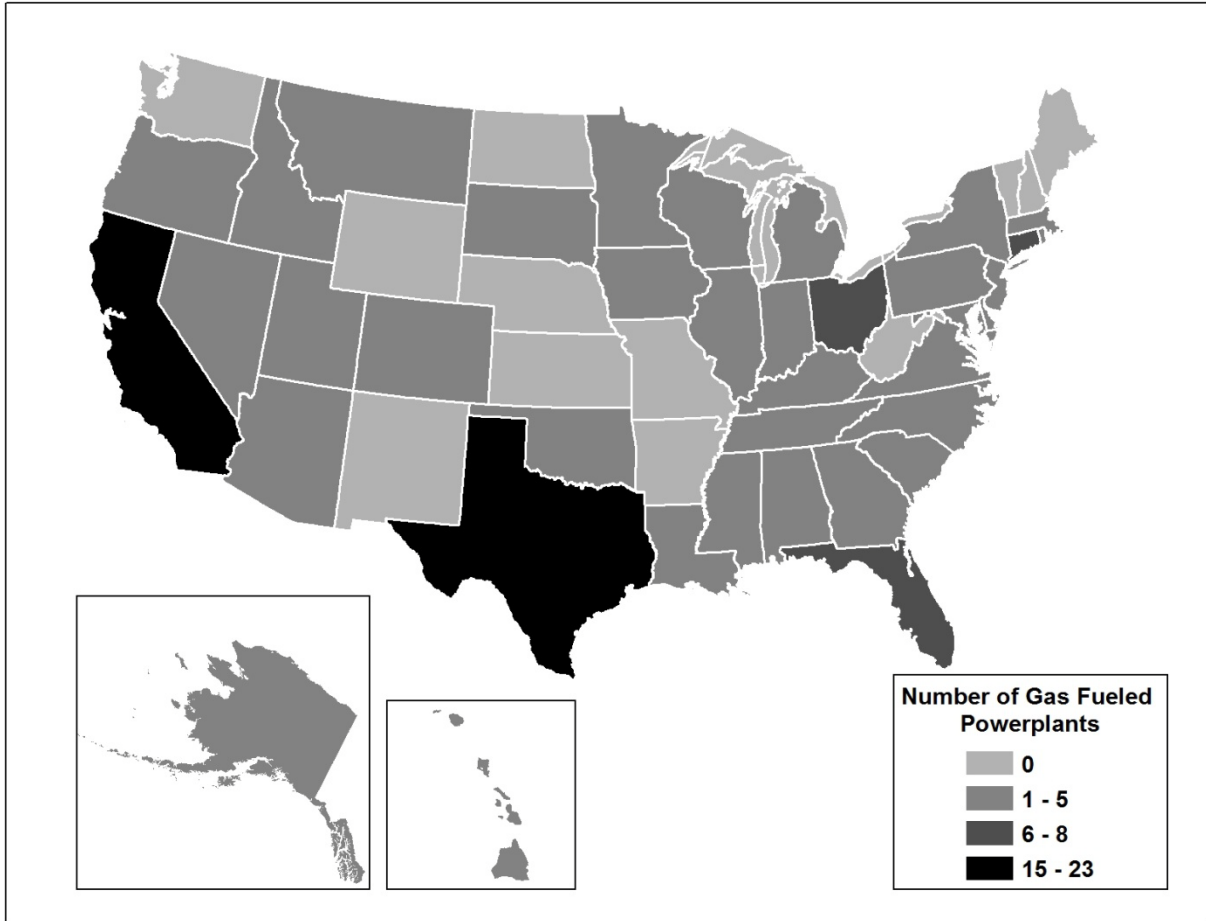


Figure 6. Approximately 125 new gas-fire power plants are expected to come into operation over the next five years across the United States. The majority of states have new plants under construction.