D30 Fuel Gas Odorization: History, Requirements, Application, and Challenges for Natural Gas and Propane

Tim G. Dunn, MS, Dunn Laboratories, Inc, 230 Spring Ridge Trace, Roswell, GA 30076*

After attending this presentation, attendees will gain insight into the history of fuel gas odorization, present applications for odorizing natural gas and propane, and the challenges faced for the odorant to provide a means of warning.

This presentation will impact the forensic science community by providing an understanding of the issues pertaining to gas odorization.

For many forensic engineers, the first question following a fuel gas explosion or fire is whether victims or witnesses noticed a gas odor, and if not, why not? The practice of adding a malodorant to a fuel gas goes back to the 1880s, when ethyl mercaptan was used to odorize water gas — hydrogen/carbon monoxide. For many years, coal gas, which contained a substantial level of carbon monoxide, obviously making it very toxic fuel gas, was used in both Europe and the United States. From the 1950s to the mid-1960s, new transmission pipelines brought natural gas to various parts of the country, bringing with it more focus on odorization practices.

There were several studies conducted by the United States Bureau of Mines (BOM) from 1919 to 1931 that addressed the topic of warning agents for fuel gases. In the 1931 BOM study, other means of warning were considered, such as the use of irritants (eye, nasal) and sternutators (sneezing agents).[1] Many of the warning agents were limited by the fact that they were unsuitable due to toxicity or corrosivity. This study reached the conclusion that ethyl mercaptan was the most effective product for causing complaints of leaks; crotonaldehyde, an irritant, was determined to be the next best candidate. The necessity for a warning agent in fuel gases came to the forefront following the natural gas explosion at the New London/Texas High School, which occurred on March 18, 1937: 239 persons lost their lives from the results of a leak of unodorized gas piped into the building from a nearby oil field. The day after this accident, the State of Texas proposed the first law requiring that fuel gases be odorized. The requirement for odorizing propane came a short time later with the National Bureau of Fire Underwriters (NBFU) (the predecessor to the National Fire Protection Association (NFPA)) pamphlet 58.

The Natural Gas Pipeline Safety Act of 1968 delegated responsibility for regulation and monitoring of pipeline transport of gas to the Secretary of Transportation. The Office of Pipeline Safety was formed in 1968. In the Code of Federal Regulations, 49CFR Part 192.65, Odorization of Natural Gas specifies the following: "(a) A combustible gas in a distribution line must contain a natural odorant or be odorized so that at a concentration in air of one-fifth of the lower explosive limit, the gas is readily detectable by a person with a normal sense of smell." For propane, similar requirements were found in the Liquefied Petroleum (LP) Gas Code, National Fire Protection Association (NFPA) pamphlet 58: "All LP-Gases shall be odorized prior to delivery to a bulk plant by the addition of a warning agent of such character that the gases are detectable, by a distinct odor, to a concentration in air of not over one-fifth the lower limit of flammability." The challenge presented by these situations is to apply engineering principles to meet these performance standards!

This presentation will discuss the means by which natural gas and propane is odorized, describe the prominent odorants used today, and the challenges encountered for an odorant-based warning system. With propane, the presentation will discuss the 1977 testing conducted in the Bartlesville study, additional testing by the Institute of Gas Technology, now Gas Technology Institute (GTI), and testing performed with released fuel gas in Round Lake, MN.[2]

Due to the properties of fuel gases and the results of the testing, the conclusion reached is that electronic flammable gas detectors offer an added level of safety to the gas consumer.

Reference(s):

1. United States Bureau of Mines, 1931, *Warning Agents for Fuel Gases*.
2. United States Department of Energy, Bartlesville Energy Research Center study, *A New Look at Odorization Levels for Propane Gas*.

Odorization, Fuel Gas, Warning Agent