

THE BOOMING ABUNDANCE OF NATURAL GAS AND PROPANE; RELATED FIRE/EXPLOSION STATISTICS AND SOME FACTORS AFFECTING CAUSATION TRENDS

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ABSTRACT

For each of the last several years, U.S. fire departments have responded to about 1.25 million fires, resulting in over 3200 civilian deaths and 16,000 civilian injuriesⁱ. This paper focuses on the fuel gas portion of the fire problem in the U.S., about 51,600 fires per yearⁱⁱ (2007-2011 data). Those fires generally involve natural gas and propane fuels, and result in about 168 civilian deaths and 1029 civilian injuries each year. A booming abundance of these fuels suggests a need for review of their fire problems. Trends and factors are identified that help estimate future incidence factors. This information will improve fire investigators' understanding of gas-related fire accidents and improve his/her ability to form credible causation hypotheses. Fuel gas systems and fuel gas properties are defined. Fire incidence data for Utility Gas Distribution Systems and customer-owned utilization systems are examined and analyzed for origin and causal factors, as possible. NFPA, USFA, DOT-PHMSA and other statistical data are utilized. Some factors affecting current and future causation trends are identified and examined including: Increasing use of natural gas/propane due to availability and global warming issues; Increasing use of LNG facilities; Aging pipeline infrastructure and pipeline replacement; Stricter regulations for pipeline operators; Mandatory use of excess flow valves (EFV) proposed expansion; Lateral service insertions-crossbores; Phasing out of uncoated brass appliance connectors; Overfill prevention devices (OPD) for small LPG cylinders; Better consumer awareness and use of one-call systems; More sophisticated leak detection and monitoring equipment.

FUEL GAS SYSTEMS

There are approximately 118.1 million home fuel gas systems and about 7 million non-home fuel gas systems in the U.S.^{iii iv v}. About 58.6% of homes utilize natural gas with the remainder 41.4% utilizing LPG (liquid propane gas), though not all for heating. Natural gas systems are supplied by a complex system of underground pipelines, starting from wellheads through gathering systems to processing equipment, and then to transmission pipelines which directly feed local distribution systems at city gate stations. LPG systems are typically supplied by truck and rail transport from bulk distribution plants, with the product derived from natural gas processing plants, refineries and other plants. LPG system storage is typically tank-based and those tanks are filled by the distributor.

These two fuel gases comprise nearly 51% of home energy supplies in the U.S.^{vi} While other fuel gas systems are available, i.e. manufactured gas, butane, etc., they are not discussed here due to their limited use.

FUEL GAS PROPERTIES

Natural Gas and LPG fuel gas types each have their own characteristic physical properties and unique hazards.

Natural gas is basically of thermogenic origin and composed of methane, ethane, butane, other hydrocarbons and carbon dioxide, argon, etc. As delivered, the gas doesn't liquefy at typical environmental temperatures, so it doesn't have a practical flash point. It is lighter-than-air with a specific