



**National Transportation Safety Board
Washington, D.C. 20594**

Date: July 10, 2017

Regulatory Oversight Group Factual Report

A. Accident Identification

Operator: Washington Gas
Accident Site: Flower Branch Apartments, 8701 Arliss Street, Silver Spring, MD
Date/Time: August 10, 2016, at 11:53 p.m.
NTSB No.: DCA-16-FP-003
Event type: Building Explosion and Fire

B. Regulatory Oversight Group Members

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Hazardous Material Accident Investigator
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Washington Gas
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C. Accident Synopsis

See the Accident Synopsis in the docket.

D. Pre-Accident Description

The gas meters for the Flower Branch Apartments, building 8701, (8701 Arliss Street, Silver Spring, MD) were located in a storage room (hereinafter called “gas meter room”) on the basement level of the apartment complex. A rental office, an apartment, and a maintenance room were also located on this level. The gas meter assembly in building 8701 consisted of two mercury regulators manufactured circa 1955 by Reynolds Gas Regulator Company, connected to a common vent pipe and a meter rack/bank of fifteen gas meters, each of which serviced thirteen apartments, an office, and water heater for the building.

The gas meter room was reported to have no residential appliances, such as a washing machine and dryer, but did have a commercial-grade gas water heater about six feet away from the gas meter assembly, which provided hot water for building 8701. The gas meter room was also used as storage for the maintenance staff. At the time of the accident, the room was reported to have stored boxes of new air conditioning units and furnaces, new chain saw, pressure washer, back pack blower, 1-gallon gasoline container,¹ as well as equipment parts for appliances, and other supplies such as cleaning solutions and toilet paper.² The gas meter room was secured by a knob lock and vertical deadbolt and armed with an alarm system. Staff from Kay Management Company, the property management company, and Montgomery County Fire and Rescue Services (MCFRS), were the only people who had authorized access to that room. However, the key to the gas meter room had recently been changed earlier in 2016 and not provided to the MCFRS prior to the accident.³

E. Hazardous Materials Description and Information

Natural gas is a fossil fuel consisting mostly of methane but also contains variable amounts of other hydrocarbons and nonhydrocarbon gases. It is widely used to provide energy for residential, industrial and commercial uses in the U.S. and is mostly produced domestically. For residential areas like the

¹ ATF recovered the gas can after the explosion and reported its contents half full.

² Kay Management Inventory List for 8701 Gas Meter Room

³ Interview transcript of Mayra Pinto.

Flower Branch Apartments, natural gas is the fuel used to provide heat for warmth, cooking and hot water for such appliances as furnaces, stoves, and water heaters.

Natural gas is a non-toxic, colorless, odorless, and extremely flammable gas. Gas companies add an odorant such as mercaptan as a safety measure so it can be easily detected by smell if there is a leak. The flammability range, also known as the range between the lower explosive limit (LEL) and upper explosive limit (UEL), for natural gas is 5%-15% by volume of air. Natural gas can be explosive if it is in a confined area and there is a concentration between LEL and UEL, and an ignition source is present.

F. Regulatory Applicability

i. Pipeline Hazardous Materials Safety Administration and Maryland Public Service Commission

The Natural Gas Pipeline Safety Act of 1968 allows states to assume safety authority over the intra- and interstate gas and hazardous liquid pipelines through certification and agreements with the Pipeline and Hazardous Materials Safety Administration (PHMSA).⁴ For states to participate, they are required at a minimum to adopt federal regulations, although they are allowed to pass their own more stringent regulations for pipeline safety.⁵ Maryland is certified for intrastate gas pipelines and has adopted Title 49 Code of Federal Regulations (CFR) Part 192 in their state regulations, Code of Maryland Regulations (COMAR), under Title 20, Subtitle 55, Chapter 2. The Maryland Public Service Commission (MPSC) is the state regulatory agency authorized to administer and enforce PHMSA's regulations for pipeline safety and receives federal funding for carrying out its pipeline safety program.⁶ To maintain its certification, the MPSC submits an annual certification to PHMSA.

PHMSA conducts an annual Program Evaluation and Progress Report, scoring the states' adherence to federal regulations and performance for pipeline safety programs. The evaluation includes a review of the following: inspection procedures, program performance, compliance activities, incident investigations, damage prevention, and field inspections. The evaluation results in a score, which

⁴ 49 U.S.C. § 60105- 60106

⁵ U.S. DOT, PHMSA, "State Programs", <http://www.phmsa.dot.gov/pipeline/stateprograms>.

⁶ MPSC, "Natural Gas Pipeline Safety Program," <http://www.psc.state.md.us/gas/natural-gas-pipeline-safety-program/>.

determines the percentage of federal funding allocated to that state. PHMSA conducted Maryland's 2015 Gas State Program Evaluation between April 11-May 18, 2016, just prior to the Flower Branch Apartment explosion. Maryland received a score of 94.9 out of 100 points.

PHMSA also published "Guidelines for States Participating in the Pipeline Safety Program", that was last revised in December 2015. This comprehensive document provides guidance to states on how to implement its pipeline safety program. This over 600-page document details what should be included in a state's program such as procedures for incident investigations, inspection and compliance program, damage prevention program, one call notification, and training. The guidance also describes the application process and grant program for states. Appendix S of the guidelines provides an example of a pipeline safety program that includes procedures and a risk based inspection prioritization model. For procedures for new installations of piping, inspectors are to verify whether the regulator vent is "located in an area where it can vent safely to the atmosphere and is readily accessible." For field inspections, general guidelines call for the inspector to "conduct an on-site inspection" of the gas meter assembly, which includes the regulator and vents. MPSC adopted this guideline into their procedures for inspection, enforcement and incident investigation.

ii. *Inspections and Enforcement of Maryland Public Service Commission*

PHMSA requires state agencies maintain a current list of operators under its jurisdiction and have procedures on how to conduct and prioritize inspection activities.⁷ MPSC developed their pipeline safety program to model the one in PHMSA's guidance document, which includes procedures for inspection, enforcement and incident investigation procedures, and a list of its natural gas, master meter, and propane operators. Washington Gas was listed as one of the natural gas operators.

MPSC conducts both records and field inspections. For the records inspection, MPSC will review an operator's records for compliance in the areas of leak survey, corrosion control, odorization, patrolling, valves, maximum allowable operating pressure, regulator stations, relief devices, customer leak complaints, farm taps, master meters, drug testing, and training records. Field inspections consist of onsite review of the design, construction, maintenance and operation of gas piping and appurtenances. From 2013-2016, MPSC conducted 67 field and record planned inspections of Washington Gas

⁷ MPSC, "Natural Gas Pipeline Safety Program," <http://www.psc.state.md.us/gas/natural-gas-pipeline-safety-program/>.

activities and procedures. Among those inspections, MPSC identified areas where Washington Gas was not in compliance and sent warning letters, which gives notice to the operator on areas of concern that need to be corrected within a certain time period. Washington Gas received six warning letters in the last three years of inspections prior to Flower Branch Apartment incident, all of which they responded with corrective actions.⁸

MPSC prioritizes their inspections based on specific operator criteria, such as: previous inspections, compliance performance, prior incident and leak history, pipe data, time between inspections, and pipeline system expansion. The state agency also utilizes a system ranking that looks at the type of pipe, leaks reported since last inspection, enforcement letters, corrective actions by the operator, staffing changes, and visits by a management company. The MPSC also developed maximum allowable time intervals between inspections for most of its different type of inspections. For example, a “corrosion control field” inspection for a natural gas operator, must take a place within a 15-month period. However, a customer leak complaint inspection is conducted “as needed.” In the last three years prior to the incident, MPSC conducted four customer complaint inspections with Washington Gas in response to customer complaints. The MPSC inspection reviewed how Washington Gas responded to the customer, such as how they tested for gas, what equipment was used, what area was surveyed, and the location and testing of the regulator. The inspection does not identify if that location has had a history of odor/leak calls. None of the four customer complaint inspections were at the Flower Branch Apartment complex. Moreover, MPSC has no record of any inspections with Washington Gas at the Flower Branch Apartments on Arliss Street.

iii. Washington Gas

The Flower Branch Apartment Building 8701 received natural gas from a 2-inch service line, owned and operated by Washington Gas, who also delivers natural gas to more than one million residential, commercial and industrial customers throughout Washington D.C., and surrounding regions in Maryland and Virginia.⁹ As a gas supplier, Washington Gas must comply with Department of Transportation (DOT) regulations, such as Part 192, and COMAR Title 20, Subtitle 55. In Maryland,

⁸ MPSC warning letters to Washington Gas, 2013-2016.

⁹ Washington Gas, <https://www.washingtongas.com/about/company-profile> (accessed August 26, 2016).

Washington Gas is audited and inspected by the MPSC periodically to ensure compliance with both federal and state regulations.

The natural gas main and service lines going into the Flower Branch apartments up to the outlet of the gas meter are under the jurisdiction of the Maryland Public Service Commission. Washington Gas is required to service and maintain jurisdictional gas lines. The piping that goes from the outlet of the meter to the appliances in the apartment are called the “house lines” (See Figure 1). The property owners are responsible for the installation, operation and maintenance of the house lines and must comply with county regulations. Kay Management was managing the Flower Branch apartment complex and therefore responsible for the maintenance of the house lines and must comply with the local county requirements. The local authority over the Flower Branch Apartments is Montgomery County, which has adopted the International Fuel Gas Code (2015 edition), as well as 2015 Plumbing and Fuel Gas Code of the Washington Suburban Sanitary Commission (WSSC).¹⁰

¹⁰ Washington Suburban Sanitary Commission is a water and wastewater utility that oversees water and sewer pipeline in Prince George’s and Montgomery counties in Maryland.



Figure 1: Exemplar Gas Meter in Flower Branch Apartment Complex

G. Applicable Codes and Regulations

i. Regulators

The gas meter rack in building 8701 included 15 gas meters and two mercury regulators. Figure 2 shows a typical installation of two regulators and piping assembly from a nearby Flower Branch apartment building, which is similar to the piping configuration that was in Building 8701. The mercury regulators involved in the accident from Building 8701 are further described in Material Laboratory Factual Report No. 16-097.

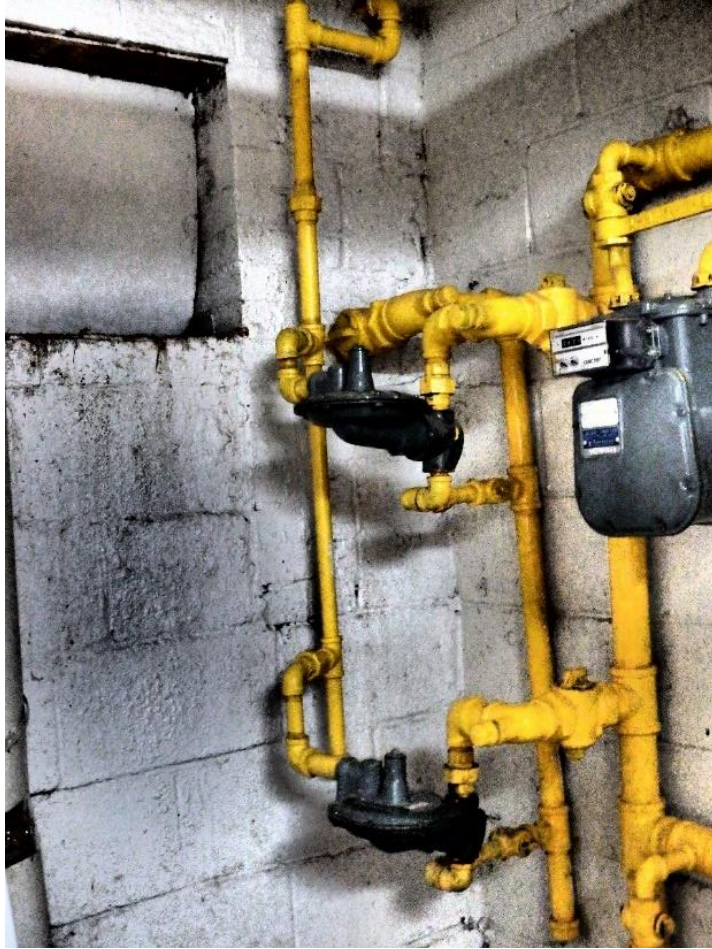


Figure 2: Exemplar Regulator Assembly in a nearby Flower Branch Apartment Building on Arliss Street

Minimum requirements for the installation, location, and protection of regulators are found under 49 CFR Parts 192.353 through 192.357. The requirements call for service regulators to be installed in a “readily accessible location and be protected from corrosion and other damage.” The service regulators that are installed within a building must be located “as near as practical” to the point of service line entrance. The regulation also requires that the meters must be located in a ventilated place, not less than 3 feet away from any source of ignition or any source of heat, which might damage the meter.

The meters at the 8701 Flower Branch Apartments were located in a locked basement room that had a water heater, which was activated by a pilot light during a heating cycle, which is further described in the Materials Laboratory Factual Report No. 16-100. In other Flower Branch apartment buildings, there was a similar spacing between the water heater and the meter assembly, as seen in Figure 3. However, other than the water heater, there were no other appliances in the basement of Building 8701

and the water heater in Building 8701 was not protected by a security cage, as seen in other Flower Branch Apartment buildings in Figure 3.¹¹ Also recovered from the accident is an electrical panel that was located in the basement of building 8701, similar to the one seen in Figure 3.



Figure 3: Exemplar Gas Meter room in the Flower Branch Apartment Complex

ii. State and Local Codes

The State of Maryland has adopted several nationally recognized codes that are developed by the International Code Council (ICC) and the National Fire Protection Association (NFPA), to provide minimum requirements for the safety of life and property. The State of Maryland requires its local

¹¹ Transcripts of Ronald Neil and Eduardo Hidalgo.

jurisdictions to adopt and enforce certain ICC and NFPA codes. Montgomery County has adopted many of those codes into the Code of Montgomery County of Regulations (COMCOR).

The State of Maryland adopted the 2015 International Building Code (IBC) and requires each of its jurisdictions to use the same edition of the building codes. Montgomery County adopted the 2015 IBC in July 2015.¹² The IBC prescribes occupancy requirements for different types of buildings. The Flower Branch Apartments fall under Group R, Residential occupancy, specifically R-2.¹³ The 2015 IBC requires Group R-2 occupancies to be equipped with a fire alarm system, a sprinkler system and visible alarm notification appliances within the individual dwelling and sleeping units.^{14,15} Under certain circumstances, carbon monoxide alarms are the only other alarms required for these occupancies under the IBC. Building 8701 was constructed in 1955 and at the time was not required to have carbon monoxide alarms, fire alarm systems, automatic fire sprinklers or visible alarm notifications.¹⁶ Prior to the explosion, the building had a manual fire alarm box, or pull station, and a bell that was located at the front entrance of the building. A second bell was located on the second floor. The fire alarm notifies residents to evacuate but does not notify emergency responders; they must be notified by individuals.¹⁷

In post-accident interviews residents in Building 8701 reported not hearing any fire or smoke alarms after the explosion occurred. The Maryland Fire Prevention Code, under COMAR 29.06.01, establishes minimum requirements for fire prevention and control to safeguard life, property, or public welfare from the hazards of fire and explosion. Maryland has incorporated by reference NFPA 1 Fire Code, 2015 ed., as well as NFPA 101 Life Safety Code, 2015 ed., which references NFPA 72 regarding the maintenance and testing of fire alarm systems. Montgomery County adopted these codes with amendments in COMCOR Chapter 22, Fire Safety Code. The fire alarm in building 8701 was last tested on April 27, 2016 by a third-party alarm testing company and was found functioning as

¹² County Council for Montgomery County, Maryland, Resolution No. 18-218, July 21, 2015.

¹³ Residential Group R-2 occupancies are defined in the 2015 IBC as sleeping units or more than two dwelling units where the occupants are primarily permanent in nature, including apartment houses.

¹⁴ IBC 2015, Chapter 2, *Definitions*: A visible alarm notification appliance is a notification appliance that alerts by the sense of sight.

¹⁵ IBC 2015, Chapter 9, *Fire Protection Systems*, Section 907.5.2.3.3. Group R-2

¹⁶ At the time of construction, the 1951 NEC (NFPA 70) and BOCA Building Code for Maryland, Washington Regional District in Montgomery and Prince George's Counties was in use.

¹⁷ Transcript of David Mandel.

designed.¹⁸ This alarm was reported to be tested annually by the certified contractor in accordance with the provision of NFPA 72; however, these systems are also required to be tested monthly per the Montgomery County Fire Safety Code.¹⁹

Montgomery County Department of Permitting, Division of Fire Prevention and Code Compliance, inspected the Flower Branch Apartment complex on March 23, 2016. The inspection identified a number of compliance issues in violation of Montgomery County's Fire Safety Code and NFPA 1, regarding storage of combustible materials in the boiler rooms, mechanical rooms, and electrical equipment rooms, and storing items that could block access to the gas meters in the utility room. The Flower Branch Apartment reported correcting these violations on May 5, 2016.²⁰

The Maryland State Fire Marshal requires local jurisdictions adopt the most recent model electrical code. The state has adopted National Electrical Code (NEC), NFPA 70. This code not only addresses the safe installation of electrical wiring but also defines hazardous areas where fire or explosion hazards may exist due to the presence of flammable gases, vapor or liquids, as well as other hazardous materials such as combustible dust or ignitable fibers. Electrical area classification is the process of determining the existence of a hazardous location in a building that may contain any of those hazards. The NEC includes provisions for combustible gas detection systems but only for industrial establishments. Montgomery County recently updated its codes in 2016 and adopted the 2014 NEC with state-specific amendments.²¹

The 2015 Washington Suburban Sanitary Commission, Plumbing and Fuel Gas Code provides minimum requirements and standards regarding plumbing and fuel and gas systems for the protection of public health and safety. The code includes provisions only for carbon monoxide alarms for new construction, and for specific Group R occupancies, R-3, for existing buildings. The code adopts and incorporates by reference the International Plumbing Code and the International Fuel Gas Code.

¹⁸ ASTI Fire Alarm Testing Record, Testing Date: April 27, 2016.

¹⁹ COMCOR Sec. 22-25 "Inspection and tests of suppression systems, etc."

²⁰ Montgomery County Department of Permitting Services, Division of Fire Prevention and Code Compliance, Fire and Life Safety Inspection of Flower Branch Apartments, March 23, 2016.

²¹ County Council for Montgomery County, Maryland, Resolution No. 18-555

H. Odor/Leak Calls

PHMSA regulations require that natural gas be odorized and be detected at one-fifth (or 20%) of the LEL. This safety feature is required for all distribution lines.²² The State of Maryland requires a more stringent requirement of one-tenth (10%) of the LEL.²³ At the Flower Branch complex, the service lines that received natural gas were tested for odorant and were found to have met the regulatory limits.²⁴

If residents smelled a gas odor, they would call Kay Management staff, Washington Gas, or 9-1-1. Kay Management maintenance staff would respond by first going into the apartment with a TIF²⁵ combustible gas detector and test for leaks. If no leak was found, they would continue to test other apartments and rooms within the building. If a leak was detected from an appliance within an apartment, maintenance staff would attempt to fix it. If they were unable to fix it, they would call Washington Gas. From September 2015 to June 2016, Kay Management received six gas odor calls from residents of Building 8701.²⁶ Washington Gas had no record of reporting to a gas odor call to Building 8701 during that same time period.

If a resident from the Flower Branch Apartment called 9-1-1 for a gas odor call, the Montgomery County Fire and Rescue Services would respond. In accordance with their policy and procedures for responding to a natural gas incident, a rescue unit would be dispatched to the location of a suspected leak. A unit officer would confirm whether there is a gas leak and determine if it is considered a “major” or “minor” leak. A major leak is defined as “a natural gas leak with an imminent threat of life safety” and examples are provided that such a leak would be one that has migrated throughout an occupied structure, health care facility, or high occupancy structure with high life hazard risks; or a leak from a transmission (non-odorized) supply pipeline. A minor leak is one “not believed to pose an imminent threat of life safety” and does not involve a fire. When a leak is confirmed, the incident commander sets up a hot zone. The minor gas leak procedure includes a provision for the gas company personnel

²² 49 CFR Part 192.625

²³ COMAR 20.55.09.06

²⁴ Post-Accident Washington Gas Odorant Test.

²⁵ TIF Instruments is an electronics company that develops detection instruments and lab technology for field service technicians.

²⁶ Kay Management Work Order History August 1, 2015 to August 25, 2016 for Building 8701 Arliss Street.

to report to the incident commander when they arrive; however, there is no requirement for the fire department to notify the gas company when a leak is detected. The procedure does state under a major gas leak, that gas personnel are to be considered the “expert gas resource officer.”²⁷

After reviewing incidents reports for Building 8701 from Montgomery Fire and Rescue, fire personnel responded to Building 8701 three times between October 2015 through July 2016, only one of which was a report for a gas odor. On July 25, 2016, the Montgomery County Fire Department received an odor complaint at Building 8701 at 10:16 pm and arrived on scene at 10:20 pm. Statements from fire department personnel who responded that day reported turning on a recently calibrated 4-gas multi meter before approaching the building. The crew approached residents who directed them to the main hallway of the first floor and the fire personnel detected no gas readings, nor smelled gas odor. One fire personnel reported smelling “something” but also detected zero readings of gas. They proceeded through the apartment complex checking inside apartments that were occupied and underneath doors of the unoccupied apartments, and were unable to confirm a gas leak. The crew went down into the basement to evaluate the two storage rooms but were unable to access the rooms because the locks had recently been changed and the new keys were not available. The crew did monitor the top of the doors of both storage rooms but detected no gas. The fire crew left the scene at 10:33 pm, as there were zero gas readings throughout the building.²⁸ Washington Gas never received a call from the fire department on this odor complaint.

If a resident from the Flower Branch Apartment Complex called Washington Gas directly, the gas company personnel would report to management during business hours to check and request a key for access to rooms in the building. However, Kay Management would not know if Washington Gas had visited after hours had a resident called the gas company and given them direct access to the building.²⁹

PHMSA regulations require that an operator develop an emergency plan that is required to have procedures for a “prompt and effective response” for a natural gas emergency, such as gas detected

²⁷ Montgomery County Fire and Rescue Commission, Policy and Procedure, “Natural Gas Incident Response”, No 25-07.

²⁸ Montgomery County Fire and Rescue Incident Report July 25, 2016 and Statement of Lieutenant Chase Fabrizio August 21, 2016.

²⁹ Interview transcripts of Mayra Pinto and Rafael Portillo.

inside or near a building.³⁰ Washington Gas developed a procedure in its Operations and Maintenance Manual for “Responding to Emergencies”, that specifies that leak and emergency orders are given priority over non-emergency work, requiring personnel to respond to every report of suspected gas order. The procedure includes provisions specifically for “On-Scene Initial Response” and “Investigation of Leaks.” Once they arrive on-scene Washington Gas personnel are directed to report to Operations Dispatch: a street address, evidence of fire or explosion, clearing of unauthorized persons, approximate location of jurisdictional pipelines, and the need for assistance from additional crews or emergency response, Washington Gas received no gas odor calls for either Buildings 8701 and 8703 thirty days prior to the incident. In addition, they did not receive any gas odor calls for building 8701 in the last five years.

MPSC will review an operator’s history of leak calls during an investigation of an incident. The state agency must investigate all incidents involving operator procedures or facilities resulting in death, injury requiring hospitalization, or property damage in excess of \$50,000. Incidents that do not meet any of the three thresholds is left to the discretion of the inspector to investigate. No procedure or requirements exist to investigate if there are multiple odor or leak calls at a particular location.

i. Methane Detection Systems

As described in the Operations Group Factual Report, methane detection systems are commercially available for residential properties but not required by state or federal regulations. However, both state and city legislation has been proposed to require combustible gas detectors in residential occupancies. The State of New York recently considered a bill to install combustible gas detectors for every one or two family dwellings, condominiums and multiple dwellings. This bill was passed with amendments by the assembly and is next to be delivered to the governor.³¹ New York City enacted a local law that revised their housing maintenance code and building code to require the installation of natural gas detecting devices after an industry standard has been developed.³²

³⁰ 49 CFR Part 192.615(a)(3)(i).

³¹ Assembly Bill A469, <https://www.nysenate.gov/legislation/bills/2017/A469#yes>.

³² Local Law 157, <http://legistar.council.nyc.gov/LegislationDetail.aspx?ID=2576426&GUID=D9EE7190-AF91-411D-A017-8305FF6D6F0D&Options=Advanced&Search=>.

Methane detection technology is currently used by the oil and gas industry for monitoring emission levels, as required under the Clean Air Act, which is enforced by the Environmental Protection Agency.³³ Methane is a significant greenhouse gas polluter that is emitted during oil and gas operations, as well as other locations such as landfills. Detection equipment is installed during these operations or locations to ensure that methane emissions do not exceed regulatory limits. EPA also regulates methane for safety purposes for municipal solid waste landfills under the Resource Conservation and Recovery Act, requiring that methane gas never exceed its explosive limits at such facilities.³⁴ States have incorporated these requirements into their regulations. For example, Maryland requires that solid waste landfills do not generate explosive gases, such as methane, “to exceed 25 percent of the lower explosive limits of the gases in facility structures...and the lower explosive limit for gases at the property boundary.”³⁵

Existing technologies for residential properties are currently being researched and tested. The Gas Technology Institute (GTI), an industry funded research organization, initiated the Residential Methane Detectors Program. The program was started because of low customer adoption and the lack of general awareness of the safety devices. The program is aimed to address barriers to customer adoption and assisting utility companies to add to their environmental and safety public awareness programs by offering technically validated information on methane detector alarms. The program involved a consumer behavior study, research on establishing an appropriate detection level, and is currently in the stages of pilot testing alarms in residential homes.³⁶ In addition, NYSEARCH, which is a voluntary sub-organization of the Northeast Gas Association, is working alongside GTI to develop reliable, robust, methane sensors.

³³ 40 CFR Part 60 Subpart OOOO.

³⁴ 40 CFRT Part 258.23, “Explosive gases control.”

³⁵ COMAR 26.04.07.03, “General Restrictions and Specifically Prohibited Acts.”

³⁶ Operations Technology Development Summary Report, Project No. 1.14g and No. 1.15e.