

Propane-Powered Outdoor Patio Heater Use

in Boca Raton, Florida Restaurants

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CERTIFICATION STATEMENT

I hereby certify that this paper constitutes my own product, that where the language of others is set forth, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions, or writings of another.

Signed: Joseph M. Mayless Jr.

Abstract

In the City of Boca Raton, restaurants use propane-powered outdoor patio heaters to satisfy the needs and desires of their patrons. The problem was the Boca Raton Fire Rescue Services (BRFRS) department had not identified the restaurants in the city that were using propane-powered outdoor patio heaters. The purpose of this Applied Research Project was to identify the Boca Raton restaurants using propane-powered outdoor patio heaters, the regulations they are subject to and the hazards they pose based on past incidents involving this equipment. Using Descriptive research, this project attempted to identify the Boca Raton restaurants using outdoor patio heaters, the regulatory standards governing their use and emergency call history for incidents involving use of this equipment. Random site visits of restaurants in the city were conducted to determine which establishments had patio heaters on their premises. A literature review and interview of the city's fire marshal were conducted to gain insight on the patio heaters, their use in the restaurant setting and regulatory standards that address their use. Finally, an in-house records review was conducted to determine the emergency response history for calls involving this equipment. Results determined that 39 restaurants in the city were using outdoor patio heaters. While their use was within the guidelines of NFPA regulatory standards, improperly stored propane cylinders were discovered at two of those restaurants during emergency incidents involving outdoor patio heaters. As a result of these findings, it was recommended that the BRFRS department (a) create and deliver a public education curriculum on outdoor patio heater safety to local restaurants (b) ensure restaurants are required to notify the fire department prior to using outdoor patio heaters and (c) ensure emergency responders are notified when responding to emergencies at establishments that use and store these devices and the propane cylinders that fuel them.

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Propane-Powered Outdoor Patio Heater Use in Boca Raton, Florida Restaurants

In response to the increased popularity of outdoor dining and recreation amongst consumers, the restaurant industry has sought numerous ways to extend the outdoor dining season by ensuring conditions are comfortable for their patrons. One example of this is the industry's increased use of patio heaters in outdoor dining areas to keep guests comfortable during cooler months (RnR Market Research [RnR], 2013). Commensurate with the increased use of outdoor patio heaters has been the increased number of responses by the Boca Raton Fire Rescue Services (BRFRS) department to emergencies involving use and storage of this type of equipment at local restaurants.

The most common outdoor patio heaters are powered by portable cylinders containing the flammable LP-Gas known as propane. Restaurants using outdoor patio heaters commonly store these tanks on their property, at times indoors. The problem is, the BRFRS department has not identified the restaurants in the city of Boca Raton that are using propane-powered outdoor patio space heaters. The purpose of this research is to identify the restaurants in the city of Boca Raton that are using propane-powered outdoor patio space heaters, the existing policies that govern the use of outdoor patio heaters, and the fire department's response history for emergency calls involving these devices. Through the use of Descriptive research, the questions to be answered are (a) What restaurants in the city of Boca Raton are using propane-powered outdoor patio heaters? (b) What laws, ordinances and/or other policies govern the use of propane-powered outdoor patio heaters in the restaurant setting? and (c) What is the emergency response history for calls involving propane-powered outdoor patio heaters in the restaurant setting?

Background and Significance

BRFRS is an emergency response organization that provides Fire Suppression, Emergency Medical, Fire Prevention and Education and Special Operations (Hazardous Materials, Confined Space / High Angle Rescue, Marine related emergencies) services in the city of Boca Raton. The city is located on the South East coast of Florida, covering 29.6 square miles, with an approximate population of 84,000 full time residents. This number intermittently increases due to business community members commuting to the city for work and the fact that the city is a year round tourist travel destination. The city is also home to Florida Atlantic University (FAU), one of the largest universities in the state of Florida.

Transportation infrastructure running through the city includes Interstate 95 (Miami to Maine), the Florida East Coast (FEC) and CSX Railroads, transporting both passengers and freight, and the Intracoastal Waterway, an inland marine commuting option for vessels seeking protection from the sometimes extreme elements of the ocean. Air travel options are also available as the city contains one executive airport.

The Boca Raton Fire Department began in 1925 with a combination of volunteer and paid on call members operating out of the then City Hall facility. Financial compensation, for those who qualified, was four dollars per fire and two dollars per training drill. As the once quiet city and its demands for emergency services grew, so too did the Fire department.

Today, BRFRS is comprised of just over 200 members, including Operations personnel, Chief Officers and Administrative staff. Eight fire stations strategically located throughout the city are staffed with 45 – 49 operational personnel working 24 hour shifts. Combined, the stations house 10 Fire Suppression apparatus and 12 Medic Units. The number of in service

(staffed) Suppression and Medic units fluctuates with the demands for service at any given time. One station houses a Special Operations truck, two stations house Brush Trucks with wildland and aircraft fire suppression capabilities. A 28' boat with fire suppression and EMS capabilities is also manned as necessary.

Situated on the Atlantic Ocean with the cities of Miami and Ft. Lauderdale a short drive to the South and the city of West Palm Beach and Town of Palm Beach to the North, Boca Raton is a prime destination for tourists. During the winter months, visitors from around the country, and world travel to and through Boca Raton seeking to enjoy a number of outdoor activities, including fine dining, in warmer climates. However, despite the generally higher temperatures found in the South East U.S. during the winter season, the city of Boca Raton does experience temperatures as low as the 20s and 30s during these months. Much like restaurants throughout the U.S. and worldwide, many dining establishments in Boca Raton have sought to extend their outdoor dining season by using outdoor patio heaters to warm their patrons on cooler days and nights (Justin, 2007). This has resulted in an increased number of outdoor patio heaters owned and operated by restaurants in commercial areas of the city that are frequented by the public. Additionally, in the past 18 months, the BRFRS department has responded to calls for emergency services at local restaurants involving propane gas leaking from the cylinders used to power these devices.

Despite the fact that the majority of outdoor patio heaters are powered by propane, a compressed gas that is flammable in concentrations between 2.15 % and 9.6% (NPGA), the City of Boca Raton does not currently have any specific regulations, including permit requirements, that regulate the purchase and operation of these patio heaters by local restaurants. As a result, other than random discoveries by BRFRS personnel in the course of routine fire inspections and

emergency response, the fire department has not identified those restaurants in the city that store and operate this equipment.

The U.S. outdoor furniture and grill industry, which includes outdoor patio heaters, is projected to grow four percent annually between 2013 and 2017 (RnR, 2013). Sales of patio heating products, including propane powered portable patio heaters, are projected to see the fastest growth in this sector. The growing popularity of outdoor patio heaters, combined with a continued determination on the part of local dining establishments to attract patrons during the cooler months, suggests that the number of outdoor patio heaters owned and operated by local restaurants as well as the number of BFRFS emergency responses to incidents involving this equipment may continue to increase.

The National Fire Academy's Executive Fire Officer Program encourages Executive Fire Officers to exercise leadership in making changes that better their organization, community and the fire service in general. The program's Executive Leadership course curriculum and literature challenges them to think both systemically as well as politically when approaching problems and issues that impact the organization (U.S. Department of Homeland Security [USDHS], 2013). In addressing the issue described above, one must consider systemic elements such as the structures in place, resulting culture and default responses that contribute to the problem. Additionally, one must think politically in identifying the stakeholders involved, their competing interests and what they stand to gain or lose in addressing the issue. These principles are the foundation for the research undertaken to examine the use of outdoor patio heaters by Boca Raton restaurants. The results of this effort will serve to support United States Fire Administration (USFA) operational objectives by not only improving the BFRFS department's level of planning and preparedness but also reducing risk at the local level through prevention and mitigation efforts.

Literature Review

The literature review for this project focused on the use of outdoor patio heaters by the restaurant industry, the physical and chemical properties of the LP-Gas used to power them and the regulations that govern the use of these devices and their fuel source. The only available literature found on use of this equipment by restaurants focused on the purpose they serve for that industry as well as the concerns they pose from an environmental perspective. Information on the physical and chemical properties of the LP-Gas propane shed light on the hazards this material may pose in various settings. Finally, the literature on regulations pertaining to the use of outdoor patio heaters in the restaurant setting provided information on both the industry's access to these devices as well as the fire department's ability to regulate the use of this equipment.

An effort was also made to study the history of fire department response to emergency incidents related to the use of outdoor patio heaters. However, as there is no specific category for "outdoor patio" heaters in the reporting data compiled by National Fire Incident Reporting System (NFIRS) officials and no literature was found citing individual incidents, emergency response history at the national level was undetermined.

Restaurant Industry Use of Outdoor Patio Heaters

In an effort to satisfy customer demand for outdoor dining during the cooler months of the year, restaurants nationwide are using outdoor patio heaters (RnR, 2013). In some regions, the use of this equipment is in response to restaurant patrons' desire both to enjoy the outdoors and to be seen at trendy destinations (Justin, 2007). In other cases, in both the U.S. and Europe, use of these devices comes in an effort to provide alternatives for those customers who have been

forced outside by the implementation of new legislation that bans smoking indoors (Widdup, 2007). Regardless of the motivating factors, fueled by the LP-Gas propane, these devices are capable of generating up to 46,000 BTUs of heat, enough to warm an area up to 18 feet in diameter (Fire Sense, 2014). As a result, the use of outdoor patio heaters in the restaurant setting has become increasingly popular and industry reports confirm this trend is projected to continue in the future.

While the use of outdoor patio heaters may serve to improve the comfort of patrons seeking relief from cold temperatures and hence, improve business for restaurateurs, environmentalists are not as enthusiastic about the use of those devices that are powered by the LP-gas propane. Despite claims by the National Propane Gas Association (NPGA) that propane is an approved alternative clean fuel (NPGA, 2001), some argue that in addition to heating the outdoor spaces at individual restaurants, the emissions from propane-powered patio heaters also contribute to overall climate warming (Widdup, 2007). Environmental activists say that the average annual use of one patio heater generates an amount of carbon dioxide equivalent to that of driving an automobile a distance of 6,000 miles. While some businesses have responded to these concerns by discontinuing the sale of these items, true to industry projections, the majority of vendors have chosen to continue providing these goods to the public (Shah, 2007).

Physical and Chemical Properties of Propane

Propane used to power portable outdoor patio heaters is most commonly found in 20 pound portable cylinders, the same as those used to power portable barbecue grills. Under pressure within these cylinders, propane exists in both a liquid and gaseous state. Once released into the atmosphere, this fuel expands to 270 times its initial volume in the form of gas vapors

(NPGA, 2001). While the vapors are tasteless, colorless and odorless, an odorant is commonly added to the propane in order to facilitate detection in the event of a leak (Hildebrand & Noll, 2007). The addition of this odorant is due, in large part, to the fact that propane is flammable and explosive in vapor concentrations ranging from 2.15 % to 9.6 % in an air-gas mixture.

The vapor density, or weight of propane as compared to normal room air, is another factor that influences the behavior of this gas when released into the atmosphere. While normal room air is assigned a vapor density value of 1, propane has a vapor density of 1.52 at 60 degrees Fahrenheit (NPGA, 2001). As propane vapors are approximately 1.5 times heavier than room air, if they are not being burned off by a heat source such as the flame from a patio heater or barbecue grill, they will accumulate at ground level when released from a pressurized cylinder. Although wind conditions may dissipate some of these vapors, most tend to settle in low-lying areas around the point of release. The propane vapors that accumulate in a confined space will displace the normal breathing air, including oxygen, in that area (International Fire Service Training Association [IFSTA], 2008). Due to the fact that this can lead to suffocation, propane is also classified as an asphyxiant.

Regulation of Outdoor Patio Heater Use

Outdoor patio heaters are readily available for purchase by the general public. The only existing regulatory standards pertaining to the device itself focus on location of the heaters when used in assembly occupancies (Lemoff, 2008). Beyond the location requirement, the standards direct the operator to follow the manufacturer's instructions that come with the product. The balance of regulatory standards that impact the use of these patio heaters focus on the portable

cylinders and product used to fuel these devices. In most cases, this product is the LP-gas known as propane.

As early as 1912, the first propane-powered stove was used for cooking in the residential setting (NPGA, 2001). Additional uses throughout the 1920's included powering vehicles and equipment used to cut metals. Due to the growing popularity of this LP-gas and a concern for the safety of employees, the public and emergency responders when working with or otherwise exposed to propane, voluntary consensus standards were created that address the use and storage of this compressed, flammable gas (Hildebrand & Noll, 2007). These standards focus on the manufacture of equipment used to store and transport propane as well as fire prevention and operational safety concerns. These standards are the result of efforts of members from both professional organizations and trade associations representing a variety of interests, including representatives of the American National Standards Institute (ANSI), the American Society of Mechanical Engineers (ASME) and the National Fire Protection Association (NFPA). The ANSI and ASME contributions to the formulation of these standards focus on the manufacture and operation of the pressurized cylinders used to store propane. The NFPA contributions address fire prevention and operational safety issues. Hence, the balance of the literature review concentrated on the efforts of the NFPA and the impact they have on the regulation of outdoor patio heaters used in the restaurant setting.

The NFPA is a non-profit association dedicated solely to the creation of voluntary standards pertaining to fire prevention and safety concerns for a variety of industries and public safety organizations. Individual NFPA standards that address the use and storage of equipment and materials are relied upon as recommended practices. However, they do not have the force of law unless specifically adopted by the authorities having jurisdiction (AHJ) in individual

government agencies (Hildebrand & Noll, 2007). According to BRFRS Fire and Life Safety Assistant Chief David Woodside (personal communication, February 11, 2014), the City of Boca Raton's fire department is one such agency that has adopted these standards (see Appendix A for interview summary). NFPA standards pertaining to outdoor patio heaters focus on notice of installation requirements, patio heater location when used in assembly occupancies, qualifications and training of personnel using the equipment and storage of the LP-gas cylinders used to power these devices (Lemoff, 2008). Cumulatively, these standards are designed to ensure the safety of those working with or in proximity to the patio heaters and their fuel source.

In summary, use of outdoor patio heaters in the restaurant setting is a common practice in the U.S. today (RnR, 2013). According to market research, despite pressure from environmental activists, this trend is expected to continue in the future. When not properly burned off upon release into the air, the LP-Gas used to fuel these patio heaters is both flammable and explosive in the proper concentrations (Hildebrand & Noll, 2007). Despite these hazards, these devices are available for purchase by the public without permitting requirements and formal regulations addressing their use in the restaurant setting are minimal (Lemoff, 2008).

In the City of Boca Raton, outdoor patio heaters are commonly used by restaurants in an effort to serve the needs and desires of their patrons. Accidental release or other misuse of the LP-Gas used to fuel these heaters poses a hazard in the form of asphyxiation, fire and/or explosion to those in the general area of product release (Hildebrand & Noll, 2007). At restaurant locations, this often includes large numbers of the general public. Incidents of this nature not only tax the resources of emergency response agencies, they also subject firefighters and other emergency response personnel to the risk of being injured or killed when attempting to mitigate these hazards. It was these principles that motivated the effort to identify those

restaurants in the City of Boca Raton using outdoor patio heaters, the regulations that govern their use and the emergency response history for calls involving these devices at restaurants.

Procedures

To conduct this Applied Research Project, a variety of procedures were implemented. These included site visits to Boca Raton restaurants, a literature review on specific areas of the outdoor patio heater industry related to this topic, an interview of the BRFRS Fire Marshal and an in-house records review.

Site Visits

Between February 28, 2014 and April 20, 2014 a series of site visits to Boca Raton restaurants were conducted. Site visits were conducted during peak dining periods, between the hours of 5:00 p.m. and 10:00 p.m. on Fridays, Saturdays and Sundays. The visits were also limited to those evenings when the ambient temperature was below 65 degrees Fahrenheit. These visits allowed visual observation of those restaurants currently using outdoor patio heaters (see Appendix B for list). Despite efforts to limit site visits to times and temperatures that would maximize demand for deployment of the outdoor patio heaters by restaurant staff, it is possible that not all patio heaters currently owned by local restaurants were in operation at the time of the visits.

Literature Review

Between February 8, 2014 and April 24, 2014, a literature review was conducted to identify factors related to the use of outdoor patio heaters including regulatory agencies and standards that impact the restaurant industry's access to these devices and the fire department's ability to regulate their use. Current entities having influence on the regulation of outdoor patio heaters were identified as were the regulations that pertain to use of these devices.

Interview

On February 11, 2014, a personal interview was conducted with Chief David Woodside, Assistant Chief of the BRFRS Fire and Life Safety division and Fire Marshal for the City of Boca Raton. The purpose of this interview was to determine the fire department's knowledge of local restaurants currently using outdoor patio heaters, its method of identification and its role in regulating the use of these devices in the restaurant setting.

In-House Records Review

Between February 1, 2014 and March 14, 2014, an in-house records review was conducted to determine the BRFRS department's emergency response history to incidents involving the use of outdoor patio heaters at local restaurants. Run report records for all calls with a nature code indicating the presence of a gas odor (GSO) occurring during the five year period from January 2009 to December 2013 were requested and written narratives of each report were reviewed to identify the incidents that involved use of these devices.

Results

The site visits, literature review, interview, and in-house records review provided detailed information on the use, regulation and emergency incident history of outdoor patio space heaters. These results are provided in three categories including site visits, regulatory standards and emergency call history.

Site Visits

Random site visits revealed a total of 39 restaurants in the city of Boca Raton were using outdoor patio heaters (see Appendix B for complete list). These included single stand-alone restaurant sites in commercial areas as well as multiple restaurants concentrated in individual commercial shopping centers.

Regulatory Standards

The NFPA standards that address the use of outdoor patio heaters and the LP-Gas that fuels them are found in the NFPA 58, Liquefied Petroleum Gas Code (Lemoff, 2008). A general summary of these standards is provided below.

Notice of installation requirements vary based on the size and portability of the LP-Gas cylinders used to fuel the patio heater, its location and the population density of the installation site. Use of portable LP-Gas devices, including outdoor patio heaters fueled by 20-pound propane cylinders, does not require prior notification of the AHJ, which in most cases is the local fire department. Smaller fixed installations, including one and two-family homes and small commercial service sites using DOT-approved cylinders of less than 2000 gallon individual water capacity are considered simple installations that, in most cases, follow standard installation procedures. According to NFPA standards, these installations can also be done without notification of the AHJ, (Lemoff, 2008). However, in cases where these sites are in heavily populated or congested areas, authorities do have the option to require formal notification. Larger commercial installations (individual container(s) with greater than 2000 gallons water capacity or aggregate capacity exceeding 4000 gallons), including all rooftop installs, require formal notification and approval prior to commencing with an LP-Gas installation.

Location requirements address the physical location of the outdoor patio heater and LP-Gas cylinder when used or stored in assembly occupancies. Assembly occupancies include any occupancy used for the gathering of 50 or more persons for a variety of activities, including eating and drinking (Lemoff, 2008). At these establishments, patio heaters connected to a fuel source may not be located within five feet of an exit. This requirement is intended to ensure the

safety of persons exiting from these types of occupancies. There are no NFPA standards that address location or storage requirements for patio heaters that are not connected to a fuel source.

Formal qualification and training requirements for personnel working with LP-Gas vary according to the nature of each individual's interaction with the material. In general, NFPA standards require personnel whose job description includes the transfer (including filling cylinders) or transport of LP-Gas to be trained in proper handling procedures (Lemoff, 2008). Personnel who handle cylinders as an incidental part of their job, including clerks at retail stores who exchange empty propane cylinders for full ones, are exempt from training requirements. This exemption also pertains to restaurant staff who are responsible for placement, operation and storage of the outdoor patio heaters at individual establishments.

NFPA standards pertaining to the storage of LP-Gas cylinders address a variety of safety related issues. These standards take into consideration the size and quantity of the pressurized cylinders, the type of occupancy where they are to be stored and protection of the cylinders from physical damage or tampering whilst being stored (Lemoff, 2008).

The size and quantity of LP-Gas cylinders permitted to be stored vary based upon the type of occupancy and location. Other than LP-Gas cylinders with a water capacity of 2.7 pounds or less, all pressurized LP-Gas cylinders must be stored outdoors (Lemoff, 2008). Residential occupancies are permitted to have no more than two of these 2.7 pound cylinders stored within them. The size of individual cylinders allowed to be stored inside commercial buildings frequented by the public is also limited to 2.7 pounds each, with a total quantity not to exceed 200 pounds in any one location in a non-sprinklered building. This limit is raised to 1000 pounds in commercial buildings equipped with fire sprinklers. Individual LP-Gas cylinders may

not be stored within five feet of a door or opening in a public building that has at least two exits. For public buildings with only one exit, the minimum distance from a door or opening in the building is increased to 10 feet.

Regardless of occupancy type, all LP-Gas cylinders in storage must be located to minimize exposure to excessive temperature rises, physical damage or tampering (Lemoff, 2008). Existing NFPA standards offer multiple options to protect these cylinders, not only from excessive temperatures but also physical damage, including that from malicious tampering. Cylinders stored outside of a building in an area open to the public must be protected by an industrial type/chain link fence a minimum of six feet high with a minimum of three feet of clearance at the required means of egress. The only option to this method is storing the cylinders in a lockable, ventilated enclosure fabricated with metal exterior construction.

According to BRFRS Fire and Life Safety Assistant Chief David Woodside (personal communication, February 11, 2014), the City of Boca Raton adheres to these NFPA standards when addressing the use of outdoor patio heaters in the restaurant setting. Hence, neither the City nor the BRFRS department require notification from restaurants prior to their use of outdoor patio heaters. As the fire department does not maintain a list of establishments using this equipment, the only time deviation from NFPA standards is addressed is when violations are found by BRFRS Fire and Life Safety inspectors in the course of routine property inspections or in the event they are discovered by Operations personnel responding to emergency incidents.

In-House Records Review

The in-house records review revealed that there were two emergency calls for incidents involving use of outdoor patio heaters in the restaurant setting between January 2009 and

December 2013. One incident occurred in a stand-alone restaurant site in a commercial area and one at a restaurant in a commercial shopping center. Both incidents involved the presence of a propane-gas vapor cloud in a heavily traveled public area due to leaking cylinders. In both incidents, employees responsible for operating the devices failed to properly close the shutoff valve and store the cylinders after using the patio heaters. Additionally, further investigation revealed multiple 20-pound propane cylinders were improperly stored inside the dining and kitchen areas of both restaurants.

In both incidents, the hazards were mitigated without injuries or property damage. Subsequent follow up by BRFRS Fire and Life Safety division personnel resulted in the education of restaurant staff on proper use and storage of outdoor patio heaters and the portable propane cylinders that fuel them as well as correction of the violations.

Discussion

The research conducted for this applied research project provided information on the use and regulation of outdoor patio heaters in the restaurant setting. These efforts also provided details on fire department response to emergency incidents involving use of these devices. The following discussion analyzes these findings in an effort to identify any areas of safety-related improvement and determine possible courses of action that may be taken to further this cause.

The use of outdoor patio heaters by restaurants across the nation and abroad in an effort to satisfy customer demand for outdoor dining is a common occurrence (RnR, 2013). Similar to restaurants worldwide, site visits to Boca Raton restaurants revealed that 39 establishments throughout the city are currently operating propane-powered outdoor patio heaters. Propane is both flammable and explosive (Hildebrand & Noll, 2007). When released in confined spaces, it

is considered an asphyxiant as it displaces room air gases, including oxygen. Given that all 39 restaurants were located in areas frequented by the public, it is possible that the accidental release of propane vapors at any of these sites could pose a risk to multiple members of the public in the general vicinity of the leak.

Despite the hazards posed by propane-powered outdoor patio heaters, regulation of the use of these devices in the restaurant setting is minimal (Lemoff, 2008). The absence of a requirement to obtain a permit or otherwise notify the AHJ prior to using these devices has resulted in multiple restaurants in the city of Boca Raton using and storing the patio heaters and propane cylinders on their premises, without the fire department's knowledge. Unless a notice of installation requirement is implemented, the hazards posed by this equipment may not be identified by the BRFRS department prior to fires and other emergencies at these properties in the future.

NFPA standards recommend placement of outdoor patio heaters be a minimum of five feet from exits when used in assembly occupancies, including restaurants (Lemoff, 2008). All patio heaters observed during the site visits conducted for this ARP were in compliance with this location guideline. Future adherence to this standard will minimize the possibility of injuries or other harm to restaurant patrons resulting from incidents involving outdoor patio heaters.

According to NFPA standards, restaurant staff that handle the patio heaters and LP-Gas cylinders as an incidental part of their job are not required to have special training prior to placement and operation of this equipment (Lemoff, 2008). The only guidance these standards give pertaining to the operation of outdoor patio heaters directs the user to follow the manufacturer's instructions when using this equipment. A review of these instructions revealed

thorough notice of the properties and hazards of propane as well as a clear summary of how to properly use and store the devices and their fuel sources (Fire Sense, 2014). If all restaurant staff members responsible for use and storage of this equipment are trained according to the manufacturer's instructions, the likelihood of an incident involving improper use or storage will be minimized.

The manufacturer's instructions described above adhere to the NFPA standards that require 20-pound propane cylinders to be stored outside of buildings (Lemoff, 2008). As propane vapors are flammable and explosive in the proper concentrations, compliance with these standards will minimize the hazards posed in the event of a propane-gas leak (Hildebrand & Noll, 2007). On the emergency incidents involving outdoor patio heaters at local restaurants, BRFRS Operations personnel arrived to find propane vapor clouds in areas occupied by the public. After mitigating these hazards, personnel also found both individual 20-pound propane cylinders as well as patio heaters with attached fuel cylinders improperly stored inside the establishments' dining and kitchen areas. Further, none of the restaurants had an NFPA-approved storage area or enclosure for storing the portable 20-pound propane cylinders on their property. Whether this was due to a lack of storage requirement knowledge or a lack of space was not determined. In either case, improperly stored propane increases the hazards to the public as well as emergency responders in the event of a gas leak or fire incident at those locations.

According to BRFRS Fire and Life Safety Assistant Chief David Woodside (personal communication, February 11, 2014), one possible means of reducing the hazards posed by the improper use and storage of outdoor patio heaters and propane cylinders at local restaurants involves implementation of a public education campaign by the fire department. The National Fire Academy's EFO Executive Leadership course suggests that one must think systemically as

well as politically when taking such action (USDHS, 2013). The efforts of this ARP have identified systems and structures in place, including 39 local restaurants using these devices, the factors motivating them to do so and the current regulatory standards designed to enhance the safety of these actions. Further, cultural norms of some local restaurants using these devices were also identified at locations that experienced emergencies involving the patio heaters and their fuel sources. By reaching out to local restaurants using outdoor patio heaters with a well planned public education campaign, one which considers all stakeholders and their respective interests in it's design and implementation, the BRFRS department will reduce the probability of improper use and storage of outdoor patio heaters and propane cylinders at these establishments. This effort will not only serve to reduce risk in the community, but also improve the preparedness and safety of BRFRS Operations personnel responding to local restaurants for emergency incidents involving use of this equipment in the future.

Recommendations

It is recommended that Boca Raton Fire Rescue Services take the following actions:

- Create a public education campaign curriculum on outdoor patio heaters, including proper use and storage of these devices and the propane cylinders that fuel them.
- Deliver the public education information to the 39 Boca Raton restaurants that were identified as establishments currently using outdoor patio heaters.
- Consider requiring Boca Raton restaurants to obtain a permit and notify the BRFRS department prior to using outdoor patio heaters in the future.
- Ensure restaurants storing multiple propane cylinders on their premises be listed in the City of Boca Raton's 911 Dispatch Center computer network to facilitate notification of

emergency response personnel when responding to these locations for emergency incidents.

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Appendix A

Interview

David Woodside, Assistant Chief of Fire and Life Safety

BRFRS Administration Building, February 11, 2014

Questions

1. Is the BRFRS department notified prior to restaurants in the city using propane-powered outdoor patio heaters on their properties?

No. Currently, the City has no existing notification or permit requirements that address the use of these devices by restaurants.

2. Has the BRFRS department identified those restaurants in the city that are using propane-powered outdoor patio heaters?

In the course of routine fire department inspections, Fire and Life Safety division inspectors have found some restaurants in the city using these devices on their property.

3. Does the BRFRS department maintain a list of these restaurants found to be using propane-powered outdoor patio heaters on their properties?

No. If safety violations are discovered, restaurant staff is directed to make the necessary corrections. However, no list of the properties using these devices is maintained.

4. What role does the BRFRS department play in the regulation of the use of propane-powered outdoor patio heaters?

The Department has adopted the standards found in the NFPA 58, Liquefied Petroleum Gas Code. These standards address location of the heaters when used in assembly occupancies as well as the use and storage of the LP-Gas cylinders used to fuel these devices.

5. Do you foresee an increase in regulatory standards as the use of propane-powered outdoor patio heaters in the restaurant setting becomes more popular?

I'm not certain that an increase in regulation is necessary. I believe a public education campaign that addresses the safe use and storage of outdoor patio heaters and LP-Gas cylinders, including an overview of current NFPA standards, would serve to ensure compliance and reduce risk at these properties.

Appendix B

Boca Raton, Florida Restaurants Using Propane-Powered Outdoor Patio Heaters

Restaurants Located in Commercial Shopping Centers

The Shops at Boca Center

5050 Town Center Circle

Boca Raton, FL 33486

Brio Tuscan Grille

English Tap

Rocco's Tacos

Sushi Ray

Uncle Tai's

Boca Valley Plaza

7401 N. Federal Highway

Boca Raton, FL 33487

Fah Asian Bistro and Diner

The Commons at Town Center

2240 N.W. 19 Street

Boca Raton, FL 33431

Hooters

Sushi Masa and Thai Cuisine

Glades Plaza

2200 W. Glades Rd.

Boca Raton, FL 33431

Brewzzi

Mizner Park

327 Plaza Real

Boca Raton, FL 33432

Jazziz

Kapow

Max's Grille

Tanzy

Trulucks

Uncle Julios

Villagio

Regency Court Shopping Plaza

3013 W. Yamato Rd.

Boca Raton, FL 33434

Lucille's BBQ

Meatball Room

Royal Palm Place
101 Plaza Real South
Boca Raton, FL 33432

Al Tannour

Biergarten

Casimir Bistro

Giovanis

Lemon Grass Asian Bistro

Sapori

Saquella Café

Sushi Asian Bistro

The Olive Tree

Twenty Twenty Grille

Town Center at Boca Raton

6000 W. Glades Rd.

Boca Raton, FL 33431

Blue Martini

University Commons

1400 W. Glades Rd.

Boca Raton, FL 33431

Mario's Osteria Italian Restaurant

PF Chang's China Bistro

Stand-Alone Restaurants Located in Commercial Areas

13 American Table	451 E. Palmetto Park Road, Boca Raton, FL 33432
Darna Hookah Lounge	99 S.E. Mizner Blvd., Boca Raton, FL 33432
Flashback Diner	1450 N. Federal Highway, Boca Raton, FL 33432
Fork and Knife	99 S.E. Mizner Blvd., Suite 110, Boca Raton, FL 33432
La Stella's	159 E. Palmetto Park Road, Boca Raton, FL 33432
Ninja Spinning Sushi Bar	41 E. Palmetto Park Road, Boca Raton, FL 33432
Nori Thai	217 E. Palmetto Park Road, Boca Raton, FL 33432
Trattoria Romana	499 E. Palmetto Park Road, Boca Raton, FL 33432