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Reducing Fuel Emergencies

at the Pittsburgh International Airport

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CERTIFICATION STATEMENT

I hereby certify that this paper constitutes my own product, that were 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.

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Abstract

Jet fuel is the single greatest fire hazard at airports, representing a large number of an airport fire department's responses. At the Pittsburgh International Airport (PIT), fuel incidents accounted for over 12% of emergencies between 2006 and 2009. An ideal set of standards should be in place to minimize the occurrence of these fuel-related emergencies. The following questions were considered:

- What are the impacts of fuel-related emergencies?
- Where are the potential locations for fuel emergencies at the Pittsburgh International Airport?
- Are there any fuel emergency prevention programs currently in place in Pittsburgh?
- What are the procedures for responding to a fuel emergency in Pittsburgh?
- Are there any proposed changes for fuel emergency prevention and/or responses in Pittsburgh?

Standards for fuel emergencies as presented by the Federal Aviation Administration (FAA), National Fire Protection Association (NFPA), and other certified airports were reviewed and current locations of fuel and guidelines for its care at PIT were compiled. The FAA requires airports to maintain an Airport Emergency Plan (AEP) that addresses fuel emergencies, while the NFPA provides standards for fuel response and operations. Certified airports have found resource lists, categorization of fuel spills, and identification of vulnerabilities necessary components for response guidelines. Investigations of PIT's response plan found general procedures in place, but it lacked specifics regarding interoperability among departments, standardization of equipment and personnel, and numerous preventive measures including training. Given PIT's large number of fuel types and locations, more detailed standards are

necessary to effectively minimize fuel hazards. Recommendations to improve the response plan include: form a fuel committee, standardize training to airport fuelers, complete after action reports, categorize fuel spills, and form beneficial partnerships. Periodic evaluations of this improvement plan will indicate if these new standards are successful in reducing fuel emergencies at PIT.

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Introduction

Management of fuel emergencies is a key component to fire prevention efforts at airports (Lindstrom and Stewart, 2008; Federal Aviation Administration, 2010). An airport fire department is the primary resource to mitigate fuel incidents. The responsibility of any airport fire department is to respond to emergencies, unexpected situations that pose an immediate risk to life or property and require instant intervention, least of which include fuel spills. However, when faced with such an emergency, departments are challenged to ensure adequate resources are available to respond at a moment's notice (Page, 2001). Airport fire fighters are not only responsible for traditional emergencies, such as structure fires and emergency medical responses, but are also faced with handling aircraft and hazardous material emergencies. Therefore, airports require fire fighters to have specialized training in fuel response, especially given the vital role of fuel in airport operations. The high numbers of fuel incidents make a coordinated and effective response vital to proper fire department and airport operations.

The problem identified is that the Pittsburgh International Airport (PIT) continues to routinely experience fuel-related emergencies, but it is unknown how these emergencies can be prevented and the effects reduced. The research purpose is to determine how to minimize fuel-related emergencies and develop an emergency response plan to mitigate these emergencies at PIT. The research method is descriptive and will encompass a variety of research tools to determine how fuel emergencies can be prevented and the effects reduced at PIT, while considering several questions:

- What are the impacts of fuel-related emergencies?
- Where are the potential locations for fuel emergencies at the Pittsburgh Airport?
- Are there any fuel emergency prevention programs currently in place in Pittsburgh?
- What are the procedures for responding to a fuel emergency in Pittsburgh?

- Are there any proposed changes for fuel emergency prevention and/or responses in Pittsburgh?

Background and Significance

The Pittsburgh International Airport, which is located on 9,000 acres in the suburbs of Pittsburgh, Pennsylvania, services general aviation, commercial, cargo, and military aircraft. The airport opened in 1952, but new landside and midfield airside terminal buildings were constructed in 1992. The airport was operated by the Allegheny County Department of Aviation until the Allegheny County Airport Authority was formed in 1999.

The comprehensive infrastructure and dynamics of the airport create the atmosphere of a small city. It is of interesting note that the airport has its own post office, public works, police and fire, and other resources often found in communities. The airport encompasses numerous commercial and industrial facilities, including the world headquarters for Dick's Sporting Goods. The government has two active military bases at PIT: the Air Force Reserve 911th Base that operates C-130 cargo aircrafts and the Pennsylvania Air National Guard 171st Base that operates the KC-135 tanker aircrafts.

The Federal Aviation Administration (FAA) operates a large control tower at PIT to control departures, arrivals, and ground movement on the four runways and over 20 taxiways and de-icing pads. The airport operates 50 gates at its airside terminal to accommodate the millions of travelers that pass through PIT annually. The airport terminal includes over 100 retail stores, numerous rental car agencies, and a Hyatt Regency Hotel.

The International Association of Fire Fighters (IAFF) Local #1038, Allegheny County, are responsible for all fire, rescue, medical, and hazardous material emergencies at PIT. The Fire

Department currently consists of 35 full-time fire fighters, 6 lieutenants, 2 deputy fire chiefs, an administrative assistant, and a fire chief.

The Fire Department at PIT averaged around 500 annual emergency responses between the years of 2006 and 2009, excluding emergency medical responses. This figure includes structural, vehicle, rescue, and aircraft related emergencies. The number of spills and hazardous material responses account for over 12% of the emergency responses. The actual number of reported fuel spills has decreased slightly during the most recent four-year period, 37 spills reported in 2006 compared to 30 spills reported in 2009. However, this decrease in reported spills is still a growing concern because the total number of emergency calls has decreased during this four-year period. The 30 spills in 2009, although seeming like an improvement when compared to the 37 spills in 2006, actually accounts for a larger percentage of total emergencies (Affiliated Computer Services, 2010).

A fuel emergency is any emergency or unwanted circumstances involving fuel (Hildebrand and Noll, 2004). Fuel emergencies can pose several different concerns for airport operators and emergency responders, such as environmental concerns, health hazards, and fire or explosions. Although most fuel emergencies are relatively minor, there is a significant hazard and potential for disaster when dealing with fuels. This potential hazard is often realized when employees and even the systems in place at PIT become complacent about the hazards of fuels and the required safety precautions. This is a concern not only given the increased number of fuel-related emergencies at PIT, but also because the implications for disaster or larger-scaled emergencies are greater due to Pittsburgh Airport's community-like atmosphere.

In order to properly control this hazard, it is necessary to fully understand aircraft fuels and their characteristics because the fuels carried on aircraft represent the primary hazard to both occupants and Aircraft Rescue and Fire Fighting (ARFF) fire fighters. PIT has various types and quantities of fuel stored and transported across the airport. The most common fuels used by aircrafts at PIT are Jet A fuel used by commercial jets, JP-8 fuel used by the military, and aviation gasoline (Avgas) for the general aviation aircraft. However, manufacturers are currently researching and developing an alternative “bio-fuel” that is derived from biological matter, such as corn, soybeans, and sugarcane, though this is currently not in use at PIT (ExxonMobil, 2003). Additionally, there are large quantities of gasoline and diesel fuel found in vehicles in the parking lots and in ground service equipment (GSE) vehicles.

The problem facing PIT is they continue to experience fuel-related emergencies. This applied research project will review the current situation at PIT and the impact of fuel emergencies. It will include recommendations of an appropriate response to fuel emergencies by the PIT Fire Department. As discussed in the Executive Analysis of Community Risk Reduction Program at the National Fire Academy, this applied research project will initiate a comprehensive risk-reduction plan, as suggested by the U.S. Fire Administration’s 5-year operational objectives, specifically for fuel-related emergencies at PIT.

Literature Review

All of the aircraft at PIT, including general aviation, commercial, cargo, and military, share a common fire hazard: aviation fuel. In fact, according to the FAA, “fueling operations are the number one fire prevention consideration at airports” (Federal Aviation Administration, 2010). The two most prominent organizations that provide guidance for preventing and handling fuel emergencies at airports are the FAA and the National Fire Protection Association (NFPA).

All airports that have regularly scheduled commercial flights with nine or more passengers, which is true of PIT, are required to be certified by the FAA. The FAA sets and enforces regulations at these certified airports across the nation. The certification sets minimum standards for most activities performed at airports, including aircraft fuel servicing. Also with respect to fuel, the FAA provides information on fuel safety to all certified airports under the Code of Federal Regulations (CFR) Part 139 (Federal Aviation Administration, n.d.).

The NFPA, an international non-profit organization with a membership that includes more than 75,000 individuals from nearly 100 nations, is the world's leading advocate of fire prevention and an authoritative source on public safety (International Association of Fire Chiefs, 2001). The NFPA provides fuel guidelines through NFPA 407, *Standard for Aircraft Fuel Servicing* (National Fire Protection Association [NFPA], 2007a).

Both the FAA and NFPA require many routine inspections and tests of the fuel operations and emergency response plans at airports (FAA, n.d.; NFPA, 2007a). Depending on the size of the airport and employee staffing levels, airport operators can assign these tasks to various departments. Some of the personnel commonly tasked with performing these inspections include: airport operations, maintenance, and/or the fire department.

Though these standards are helpful, fuel emergency responses are unique and complicated since they can involve various types and quantities of fuel. A thorough knowledge of fuels is necessary since not all fuels require the same response or same precautions. Jet A is the fuel most commonly used for turbine powered aircraft, which represents most of the commercial airliners. Jet A fuel is a blend of kerosene, which makes it a relatively stable fuel with a lower flame spread rate than many other aircraft fuels. Since kerosene is the key component in Jet A fuel, these fuels have a flash point above 100°F. Flash point is the minimum temperature at which a liquid gives off enough vapors to form an ignitable mixture with air near the liquid's surface. If a liquid has a flash point above 100°F, such as Jet A, then the liquid is considered a combustible liquid. However, if a liquid has a flash point below 100°F, then the liquid is considered to be a flammable liquid. Flammable liquids are easier to ignite and thus more dangerous than combustible liquids. Therefore, knowledge of flash points is a key component to any fuel response effort, and, in this case, Jet A fuel requires a certain type of response because its flash point indicates that it is combustible (Lindstrom and Stewart, 2008).

The military uses JP-8 in most military aircraft, which is very similar to the civilian Jet A fuel. The JP-8 fuel contains a few additional additives for anti-icing, corrosion inhibitor, and anti-static, but JP-8 still has a flash point above 100°F, thus making it combustible. However, the military does have some performance aircraft that use specialized fuel that contain additives to improve performance but also pose additional fire and safety hazards. Some of these specialized fuels are more volatile and have flash points well below 100°F, which makes them flammable liquids rather than combustible liquids. Therefore, additional precautions should be observed when dealing with specialized military or any unknown fuels (U.S. Coast Guard, 2000).

Avgas is used in most general aviation piston engine aircrafts. It is similar to the gasoline used in automobiles except Avgas has a higher octane rating than automotive fuel. The three most common grades of Avgas include: Avgas 80, Avgas 100, and Avgas 100LL, as compared to the octane ratings in automobiles that typically range between 87 and 92. Avgas is a mixture of components derived from crude petroleum and synthetic hydrocarbon blending agents, with the addition of very small quantities of chemical agents, inhibitors, and dyes. Avgas has a flash point below 100°F, therefore making it a flammable liquid that is highly volatile. These characteristics combine to make fuel emergencies involving Avgas inherently more dangerous than emergencies involving Jet A or JP-8 fuels (U.S. Department of the Interior, 1994).

Gasoline is a petroleum based fuel used in the internal combustion engine found in automobiles. Gasoline has many additives to improve performance and reduce emissions, but these additives increase the volatility of gasoline, thus making it more susceptible to fire than any of the other fuels discussed. Volatility refers to the likelihood of a chemical to vaporize, which is required to sustain combustion. Gasoline also has the lowest flash point of all hydrocarbon-based fuels discussed, thus making it highly flammable. Knowledge of these characteristics of gasoline determines the appropriate response (ExxonMobil, 2003).

Diesel fuel, as with gasoline, is also a petroleum-based fuel, but is used in the diesel engine rather than in the internal combustion engine. Although diesel fuel is more efficient and more stable than gasoline, it has a much higher Sulfur content that causes soot and the infamous diesel odor. Diesel fuels are more similar to jet fuels, rather than gasoline, and require responses similar to those for jet fuel emergencies (ExxonMobil, 2003).

Jet A, JP-8, specialized military fuels, Avgas, gasoline, and diesel fuels can all be found throughout airports. Understanding fuel types is essential to an appropriate emergency response; however, an understanding of locations of these fuels is equally important in planning for possible fuel-related emergencies. The most common locations of fuel on airport property include: fuel farms, fuel piping, fuel trucks, aircrafts, fuel stations, passenger vehicles, and temporary above-ground fuel tanks.

Delivery of these jet fuels may also pose a possible threat. There are three primary methods for delivering jet fuel to aircrafts, which include fuel islands, fuel trucks, and underground piping. Each of the delivery methods has advantages and disadvantages that are considered when engineering an airport fuel delivery system.

One type of fueling method is through the use of a fueling island. This operation is similar to an automobile gas station, where a small aircraft can taxi to the fuel pumps to receive fuel. Fuel islands are common at airports that serve small general aviation and business aircraft.

Another method for jet fuel delivery at larger airport facilities is accomplished by transferring fuel by underground piping, which terminates at a sub-surface fuel hydrant located at each gate. A fuel service truck or cart connects to the underground system and transfers the fuel into the aircraft (Kluttz, 2005).

A third, and most common, type of jet fuel delivery is by tank trucks. These tankers transport fuel from a storage location and pump their contents into the aircraft. The typical capacities of these tankers can range from 500 to 10,000 gallons (Erwin, 1979). The contractors that provide airport fuel service are usually located on the airport property; however, sometimes these services can be provided from a remote location.

Regardless of the type of fuel delivery system present, all systems incorporate safety devices to help prevent fuel-related emergencies. Some of the safety devices include: placards, fire extinguishers, emergency fuel shutoff switches, and deadman devices. A deadman device can either be a switch or rope that must be held open during fueling operations. The device is spring-loaded and stops the flow of fuel if the tension is released from the device. This required safety device is used to ensure fuel flow is stopped immediately if the fueler releases the deadman device in the event of an emergency or if the fueler becomes incapacitated (Erwin, 1979; Kluttz, 2005; NFPA, 2007a).

The number of available gates, demand for on-time performance, and operations during inclement weather conditions often leads to fueling in a very quick manner during all hours of the day and night. This increases the risk of fuel handlers cutting corners on safety procedures and exposing themselves and others to fuel emergencies. Some examples of unsafe fueling operations include circumventing safety shutoff devices, operating poorly maintained vehicles or equipment, and overfilling aircraft or truck tanks.

Fueling operations and the presence of a variety of fuel types on airport property are not the only sources of possible danger. Aircraft emergencies are a significant challenge, in general, given that a commercial airplane is similar to a crowded office building but without the luxury of sprinklers, standpipes, and fire department connections. Jeffrey A. Marcus, from the FAA, has illustrated this scenario best:

> Take a few hundred people, put them in a long, narrow, aluminum tube, seat them closely together, surround them with thousands of gallons of jet fuel, give them only a few exits to use, and you have what may be a fire safety official's worst nightmare (Coalition for Airport and Airplane Passenger Safety [CAAPS], 1999, p. 1).

In an attempt to mitigate such immense emergencies, the FAA also requires all certified airports to maintain an Airport Emergency Plan (AEP) that addresses potential emergencies at or near an airport. A crucial component in the AEP is a section discussing procedures and guidelines for dealing with fuel emergencies at airports. Specific to the fire department, an integral part of the response efforts, current standard operating guidelines for fuel spill response are vague, with statements limited in scope. Upon arrival, the fire department will immediately establish Incident Command and begin coordinating all efforts under Unified Command. A thorough assessment of the emergency scene will help in determining the course of action. These include decisions regarding the care for any injured personnel, controlling any fire or spills, protecting any exposures, evacuation considerations, requesting mutual aid assistance if additional resources are needed, evaluating environmental impacts, and ensuring the airport remains operational (*Airport Emergency Plan*, 2004).

In more serious fuel emergencies, additional fire, medical, or hazardous material resources may need to be requested from agencies other than the airport. An airport's AEP will contain a detailed list of mutual aid resources available within close proximity to the airport. Often, airports only train with mutual aid resources during mandatory FAA airport triennial full scale disaster drills.

Emergencies involving fuel can present several different hazards. The types and severity of these hazards can be identified by referring to the Emergency Response Guidebook (ERG) and to the Material Safety Data Sheet (MSDS) (*Emergency Response Guidebook*, 2008; Tesoro Refining, 2010). These sources list the primary hazard of fuel as fire and the secondary hazard as health. Knowledge of these two resources would be a key aspect of an effective response.

All fuel spills are unique based on the type of fuel, size of leak, location of spill, weather conditions, and location of nearby structures, waterways, and possible ignition sources. There are several specific precautions that should be followed at all fuel spills, including: safely attempt to stop the flow, prevent ignition sources, consider evacuation, ensure emergency responders are wearing full PPE including SCBA, contain spilled fuel, protect waterways, position equipment uphill and upwind, prepare for fire suppression in the event of a fire, and consider applying foam to prevent ignition and control vapors.

The minimum level of personal protective equipment that should be worn by fire fighters responding to fuel emergencies includes: turnout coat, turnout pants, safety boots, gloves, flame resistant hood, helmet, and a self-contained breathing apparatus. NFPA 1500, *Standard on Fire*

Department Occupational Safety and Health Program, provides strict standards for the various articles of personal protective equipment worn by emergency responders (NFPA, 2007b).

Exposure to fuel can cause potential health effects through contact, ingestion, and inhalation. Repeated exposure to fuel has been known to cause cancer, thus making it a carcinogen. The target organs for fuel include eyes, skin, and the respiratory system, which means hydrocarbon fuel exposures include dermal routes, pulmonary inhalation, and oral ingestion. Minor symptoms include eye irritation, skin rash, vomiting, and diarrhea. More serious exposures can result in convulsions, loss of consciousness, respiratory distress, and even death.

Health can be effected by acute or chronic exposures to gasoline, diesel, and jet fuels (Alsuwaida, 2010; Carlton and Smith, 2000; Ritchie, Still, Alexander, Nordholm, and Wilson, 2001). Some studies have also shown neurotoxic effects of hydrocarbon exposures that may lead to neurobehavioral consequences. Jet fuel exposure is the largest source of chemical exposure found on military bases of the NATO nations, and it has been associated with adverse health effects such as neurological effects and cancers (Kim, Anderson, Nylander-French, 2006). Some research, and a particular hospital case, has indicated nephrotoxicity (or renal effects) due to exposure to hydrocarbons (Alsuwaida, 2010). A review of such related research has led to suggestions of reviewing and revising exposure standards for hydrocarbon fuels (Ritchie, Still, Alexander, Nordholm, and Wilson, 2001).

Enormous amounts of gasoline, diesel, and jet fuel are consumed annually in the United States. In fact, over 60 billion gallons of jet fuel are consumed worldwide, with 26 billion of those consumed in the United States. Unfortunately, this results in over two million military and civilian personnel exposed to jet fuel each year (Ritchie, Still, Rossi, Bekkedal, Bobb, and Arfsten, 2003).

The general public is also a concern, as they may be exposed to small levels of jet fuel vapor through contamination of the atmosphere or through contact with contaminated soil and groundwater. Though data has not linked exposures to fuel-induced death or cancer, there have been self-reported health consequences, thus research continues in studies of biological or health effects from jet fuels and kerosene (Ritchie, Still, Rossi, Bekkedal, Bobb, and Arfsten, 2003). Additionally, acute and chronic exposures to jet fuels have been studied at Air Force bases through neurocognitive testing, breath analysis, and liver and kidney functions (Tu, Mitchell, Kay, and Risby, 2004).

US Air Force fuel-cell maintenance workers were tested for dermal exposure to jet propulsion fuel. Factors affecting exposure included: skin irritation, bootie use, working inside the fuel tank, and duration of exposure. Observed effects on exposure victims include but are not limited to nausea, headache, fatigue, neurobehavioral changes, neurocognitive changes, psychiatric disorders, posture balance problems, effects on reproductivity, immune system damage, and skin irritation. Results indicate that the skin is a significant route of jet fuel exposure and that it is necessary to act to reduce such exposures (Chao, Gibson, and Nylander-French, 2005).

Dermatitis due to dermal exposures to chemicals at airports can occur (Leggat and Smith, 2006; Trigger and Eilbert, 2009), especially with hydrocarbon based fuels, indicating that preventative measures should be considered to minimize such contacts and exposures (Leggat and Smith, 2006). Preventative measures to exposure have been suggested and include but are not limited to: engineering controls, personal protective equipment, and initiation of worker education programs (Alsuwaida, 2010). Skin damage has been tested through magnetic resonance microimaging (MRM), which indicates an effect on hair follicle atrophy and change in thickening of dermis and exfoliating epidermis (Sharma and Locke, 2010). This can be a useful way to test toxicity of hydrocarbons.

Importantly, pulmonary effects have been connected to fuel exposures. Toxicity of jet propulsion fuel in the lung has been tested as related to lung epithelial cell apoptosis (cell death) and edema (fluid collection in the lungs). Significant stress was found to be placed on lung epithelium after exposures for only seven days. Particular protein expression tests were completed and the resultant decreased level of one particular protein, α1-anti-trypsin, indicates that exposures have implications toward development of pulmonary disorders (Chao, Gibson, and Nylander-French, 2005).

There has been limited data that show air medical personnel exposures to jet fuel, but exposure rates have been recorded as low and do not exceed established standards; however, the research still suggests limiting exposure especially during start-up and take-off (MacDonald, 2010). This research is consistent with the overall recommendation that standards for exposures be reconsidered and preventative measures be revised and more applicable ones employed.

The environmental impact of fuel is another factor that must be addressed. Fuel spills should be carefully stopped and contained as soon as it can safely be accomplished. Fuel spills should be prevented from reaching exposures (buildings, aircrafts, etc.), waterways (streams, storm water drains, etc.), and ignition sources (sparks, engines, etc.). Other considerations when handling fuel spills are wind direction, weather, and ground temperatures.

Fuel vapors pose another hazard during fueling operations. As fuel is pumped into an aircraft tank, the incoming fuel forces vapors out through tank vents that are usually found at the wingtips of the aircraft. The vapors that are expelled during the vents can create an explosive vapor-air mixture during the fueling operation. The amount of fuel vapors generated is usually greater with larger aircrafts and with elevated ambient air temperatures. The invisible fuel vapors are heavier than air and often settle at ground level. These vapors can pose a serious fire hazard if they find an ignition source or spark. This led to a FAA and NFPA requirement for fuel trucks to be equipped with spark arrestors on their exhaust systems to prevent a spark or backfire that could ignite fuel vapors (Lindstrom and Stewart, 2008; NFPA, 2004).

In the event of a fire, the suitable extinguishing agents include: carbon dioxide, dry chemical, water spray with extreme caution, and foam. The most desirable fire fighting agent for fuel is foam because it not only extinguishes the fire, but it also creates a foam blanket that provides additional protection by preventing the fire from re-igniting and suppressing fuel vapors (Lindstrom and Steward, 2008).

There are several different methods for cleaning fuel spills. Fuel spilled on a hard surface can be absorbed with sand, oil dry, or absorbent pads. If fuel begins to pool or form puddles, then fuel soppers can be used to collect the fuel. A fuel sopper is a machine that consists of a series of rollers that are pushed over a fuel spill. The rollers on the ground that contact the fuel are made of highly absorbent material, such as foam. As the fuel is absorbed by the absorbent rollers, it is then squeezed by hard metal rollers that force the fuel out of the absorbent roller and into a container for collection. The fuel soppers are very effective for removing standing fuel on hard surfaces but still leave some residual fuel that must be cleaned with sand, oil dry, or absorbent pads.

For additional safety the airport’s drainage system is designed to control the flow of fuel that may be spilled on a ramp and to minimize environmental impacts. FAA and NFPA codes require fueling ramps to be sloped away from structures and drains must pass through a fuel and water separator before entering storm water drains (NFPA, 2008).

Fuel that has entered a waterway is often more difficult to clean than fuel on a hard surface and may require a coordinated effort with other departments or agencies. Since fuel's specific gravity is less than that of water, 0.8 and 1.0 respectively, fuel will float on water. This property of fuel is important when attempting to remove fuel from a waterway. If fuel enters a waterway, absorbent booms and pads are generally placed in a strategic location in an attempt to soak as much fuel from the water as possible. The absorbent materials are designed to allow water to pass through the material but the fuel particles are trapped in the absorbent material and eventually disposed. Once fuel has entered a waterway, it can have detrimental effects on plants, animals, water treatment facilities, and humans (Lindstrom and Stewart, 2008).

Some airports have slightly different programs in place for fuel prevention and responses. For example, at the Orlando International Airport, the Incident Commander makes a determination and reports the amount of fuel or product spilled in terms of a category. Category "A" spills are between 1 to 25 gallons, Category "B" are 26 to 100 gallons, and Category "C" are greater than 100 gallons (Greater Orlando Aviation Authority, 1998).

Several fuel emergencies have occurred in the past that serve as a reminder of the potential magnitude of disaster, as well as provide case studies and valuable lessons for emergency responders that handle fuel-related emergencies. One such incident occurred when a four-alarm fire resulted when an automobile and a tank truck carrying 3,000 gallons of Jet A fuel collided at a downtown intersection in Tampa on October 14, 1982. The following is a list of resources that were needed to bring the blaze under control: 6 engines, 3 aerials, 3 foam vehicles, 1 foam tender, 1 foam trailer, 3 rescue vehicles, 1 ladder tower, 1 snorkel unit, 1 ARFF crash truck, several chiefs, Tampa Police, Tampa Public Works, and the U.S. Coast Guard. The fire suppression agents used to battle the fire included: 275 gallons of alcohol resistant foam, 150 pounds of Purple K dry chemical, 100 gallons of pre-mixed 6% Aqueous Film-Forming Foam (AFFF), and 45 gallons of oil dispersant. The total loss was estimated at over $250,000 (Bradish, 1983).

Another incident that demonstrates the potential outcome of a fuel emergency involved an accidental fire that burned for 55 hours at a fuel tank farm that supplies Denver's Stapleton International Airport with fuel. The fire eventually destroyed or damaged seven tanks and consumed more than 1.6 million gallons of jet fuel. The fire burned for more than two days and highlights the importance of contingency planning to ensure access to critical resources and expertise. The final damage estimate was over $30 million (Isner, 1992).

The initial response to the Denver fuel farm fire included: 4 ARFF crash trucks, 1 rapid intervention vehicle, 3 pumpers, 2 trucks, a district chief, and an airport chief. A second alarm included: 3 pumpers, 2 trucks, 1 rescue, and 2 assistant chiefs. Responding units advised that they could see fire extending 25 to 30 feet in the air (Isner, 1992). The fire fighters that responded to this emergency later indicated this incident presented a three-dimensional flammable liquids fire requiring unique suppression tactics and equipment. The fire exceeded fire fighters' suppression capabilities within minutes of their arrival and forced personnel to assume a defensive approach.

A third incident involved a routine operation that occurs countless times a day at airports across the country. Refueling an aircraft is as common a sight at airports as loading luggage. This particular incident involved a Boeing 777 aircraft being refueled at a gate by an employee of a large fuel contractor. The aircraft had 10 passengers and 16 crew members onboard during the fueling operation. The aircraft was being refueled from an elevated basket when the fueling hose separated from the aircraft and sprayed 50 to 120 gallons of fuel onto the fueler, equipment, and ramp. Within seconds, the fuel ignited and engulfed the fueler, fuel truck, and engine cowling. Airline employees working nearby observed the accident and quickly responded with two dry chemical wheeled units from the ramp. The airport fire department was notified and responded within minutes of the accident. This incident had a tragic end as the fueler died at the hospital from his injuries and the aircraft sustained about $5 million in damages (Nicholson, 2002).

Unfortunately, fuel spills are a common occurrence at airports. These spills can be the result of equipment failure but more often are the result of carelessness. According to Denver International Airport's Fuel Officer, Bob Werner, they often experience over 70 fuel spills per year. Werner indicated the fuel emergencies can be particularly dangerous when the fuel is under pressure and sprayed rather than spilled in liquid form (Nicholson, 2002).

Fuel-related emergencies at airports are complicated given the numerous considerations that are a vital part of any airport fire department's response efforts. These include numerous standards developed by the NFPA, FAA, and the specific airport. These concerns also include, but are not limited to: coordination concerns, response for particular fuel types, health concerns, environmental impacts, best practices for clean-up, necessity of mutual aid, training level of responders from various departments, and numerous safety concerns.

Procedures

This study used the descriptive research method by encompassing a variety of research tools to determine how fuel emergencies can be prevented and the effects reduced at the Pittsburgh International Airport. Several questions were considered. What are the impacts of fuel-related emergencies? Where are the potential locations for fuel emergencies at the Pittsburgh International Airport? Are there any fuel emergency prevention programs currently in place in Pittsburgh? What are the procedures for responding to a fuel emergency in Pittsburgh? Are there any proposed changes for fuel emergency prevention and/or responses in Pittsburgh?

The literature review was compiled from resources at the Learning Resource Center (LRC) at the National Fire Academy (NFA), reference library at the Pittsburgh International Airport, government and non-profit agency websites, and several emergency services trade journals. Information was also gathered from union, government, and fuel officials familiar with the aviation industry. Results include an overview of specific locations of fuel at PIT as possible sites for fuel emergencies. Furthermore, the current operating procedures in place for fuel-related emergencies were analyzed to determine if changes to the fuel response plan are necessary at PIT.

Results

A comprehensive inventory of fuel storage areas and locations for potential fuel-related emergencies at PIT uncovered astonishing quantities of fuel stored and used at PIT. The largest quantities of fuel were found to be stored at fuel farms, but other significant locations of fuel included fuel pipelines, aircrafts, fuel stations, vehicles, and temporary above-ground storage tanks.

Specifically, there are four fuel farms located at PIT. The main fuel farm, which is operated by Aircraft Service International Group (ASIG), provides service for most commercial airlines at Pittsburgh. The fuel farm is centrally located at the airport and is positioned within the perimeter fence for security purposes. The ASIG fuel farm consists of four fuel tanks that each holds 2.1 million gallons of Jet A fuel. The fuel farm also includes fuel pumps for filling trucks, a complex fuel pipeline, and a parking lot for fuel trucks.

The ASIG fuel farm is supplied with fuel from a large underground pipe that runs about 5.5 miles to the banks of the Ohio River in nearby Moon Township. The pipes are fed from Buckeye Pipeline, which receives fuel shipments from barges along the Ohio River. Different types of fuels are able to be transferred through the same pipeline by a process called batching. Batching is a process in which multiple products and grades of fuel are simultaneously transported through a single pipeline (Hildebrand and Noll, 2004). Batching may be done with or without a physical barrier separating the different products.

A second fuel farm is located at Atlantic Aviation, which provides services for general aviation, corporate, and private aircraft. This fuel farm contains four tanks that each holds 40,000 gallons of Jet A fuel, a tank that holds 12,000 gallons of Avgas, and two additional 2,000 gallon tanks, containing gasoline and diesel fuel. They also have fuel pumps for filling fuel trucks. Their fuel tanks are supplied with fuel that is delivered by fuel tankers (*Standards for the storage*, 2004).

The remaining two fuel farms at PIT are located on military bases. The Air Force Reserve 911th Base and the Pennsylvania Air National Guard 171st Base each have fuel farms on their bases for refueling military aircraft. The operation, maintenance, and spill response at these locations are handled primarily by the military. The Pittsburgh International Airport Fire Department would respond if requested by the military, but that would likely be in the event of a fire, significant vapor release, or contamination of a waterway.

The airport has a sophisticated underground fuel pipeline network. This network includes fuel pumped from the banks of the Ohio River to the ASIG fuel farm, which is then pumped to the various gates at the airside terminal for aircraft refueling. The flow of fuel is manually controlled by an operator in a control room at the ASIG fuel farm. Additionally, there are numerous safety devices incorporated into the system to ensure a safe operation: devices to check for excessive high pressures, devices to check for leaks throughout the system, and emergency fuel shutoff switches. Some of the devices, such as pressure switches, provide important data to the controller at the fuel farm. Other devices, such as the activation of a fuel shutoff, notify the fuel controller at the fuel farm, as well as the airport operations department and the airport fire department, of a possible emergency (*Standards for the storage*, 2004).

Another significant location of fuel at an airport is onboard aircrafts. The potential hazard of fuel on aircrafts can vary significantly, depending on the type and quantity of fuel. Some of the smaller general aviation aircrafts have fuel systems comparable to the passenger vehicles that are encountered on highways. On the contrary, there are some aircrafts at Pittsburgh that have very unique fuel systems and capacities. For example, the military have C-130 cargo aircraft and KC-135 tankers stationed at the airport. The Lockheed C-130 Hercules aircrafts operated at the 911th Air Force Reserve Base can hold fuel capacities of over 6,500 gallons. The Boeing KC-135 Stratotanker aircrafts operated at the 171st Pennsylvania Air National Guard Base can hold fuel capacities over 30,000 gallons (Burns & McDonnell, n.d.).

There are several fuel stations located at the airport that have fuel tanks and pumps for dispensing fuel into vehicles. These locations include a Sunoco gas station for the general public, the ground service equipment (GSE) fuel station for airline vehicles on the ramp, the Allegheny County Airport Authority fuel pumps for airport owned vehicles, and the fuel stations at the fuel farms.

Another source of fuel at the airport is the countless number of passenger and commercial vehicles that travel to the airport. Some of the vehicles are only at the airport for a short period of time, such as commercial vehicles making deliveries or passenger vehicles picking up or dropping off airline passengers. Other vehicles are at the airport for extended periods of time, such as airport owned vehicles, employee vehicles, passengers that park while on extended trips, and the hundreds of rental cars waiting to be rented. The airport parking has over 13,000 parking spaces, which includes: short-term, long-term, extended, and employee parking lots. Each of these vehicles contains various amounts of gasoline, diesel fuel, or some type of alternate fuel that could potentially be involved in a leak or fire.

Temporary above-ground fuel tanks are another source of fuel on the airport property. These fuel tanks are used to provide fuel to construction and service vehicles used at construction sites. They can either be owned by the construction company or leased from a fuel company. These tanks can vary in size, but are typically between 50 and 1,000 gallons. The tanks are designed to be portable so they can be transported as needed to various job sites. This means the tanks are subjected to significant use in often extreme conditions with a minimal priority on safety (G. Stouffer, personal communication, October 13, 2010). Since construction is constantly on-going at the Pittsburgh Airport, these temporary above-ground fuel tanks are a common occurrence.

The Allegheny County Fire Marshal’s Office is responsible for reviewing and issuing permits for all above and below ground fuel tanks in Allegheny County, including at PIT. The Airport Environmental, Planning, and Engineering Departments usually coordinate with the Fire Marshal’s Office to ensure proper documentation and permits for fuel tanks on the airport property (K. Gurchak, personal communication, November 15, 2010). Evidence has shown that construction contractors often use temporary above-ground fuel tanks at construction sites to have fuel more readily available for construction equipment. The problem with these temporary tanks is the contractor often fails to advise authorities, submit the appropriate documentation, obtain required permits, and observe safe work practices when working with these fuel tanks.

Given the number of fuel locations, standard operating guidelines have been adopted for fuel-related emergencies at PIT. Additionally, Pittsburgh has developed *Standards for the Storage, Handling, and Dispensing of Fuel* to outline the proper operating procedures for fuel dispensing, maintenance of fuel servicing equipment, fuel storage, and the general handling of fuel. The standard is divided into three sections: *Aircraft Fueling Procedures, Fueling Equipment and Storage Areas,* and *Required Reports and Documentation* (*Standards for the storage*, 2004).

Section 1, *Aircraft Fueling Procedures,* addresses fueling personnel, prevention and control measures, controlling static electricity, the operation of aircraft engines and ground service equipment, open flames on aircraft service ramps, and miscellaneous fuel servicing procedures. Section 2, *Fueling Equipment and Storage Areas*, covers fueling equipment general requirements, fuel farm and storage areas, mobile fueling vehicles, and required inspections and tests. Section 3, *Required Reports and Documentation*, includes copies of forms along with instructions for proper completion. These forms include fuel spill reports, verification of annual tenant fueling agent training, fueling personnel training records, and fuel operation inspection checklists (*Standards for the storage*, 2004).

This fuel documentation requires fuel vendors to notify the Airport Operations Department, who will in turn notify other interested parties such as the fire department and environmental department, when any of the following conditions exist: jet fuel is spread over 10 square feet or greater, the fuel is continuing to flow, any spills involving JP-4, Avgas, or automotive fuel, or the spill presents a hazard to persons or property (*Standards for the storage*, 2004).

The AEP for Pittsburgh International Airport, as recommended by the FAA, provides information for responding to fuel spills, fuel fires, and fires in close proximity to fuel storage. The AEP is readily available to airport employees, but departments are usually most familiar with their section (*Airport Emergency Plan*, 2004).

More detailed response guidelines are non-existent at PIT. Common procedures are instead promoted in the event of a fuel spill, which require the fire department to respond with at least one ARFF unit and coordinate the overall emergency effort. The responding unit is normally an ARFF crash truck for fuel spills on the Air Operations Area (AOA). The AOA refers to the area of an airport where aircraft are expected to operate such as taxiways, runways, and ramps. However, due to the large size of the crash trucks, for fuel spills outside of the AOA, such as on roadways and parking lots, the initial response is normally a standard fire engine. If the spill results in any personnel becoming contaminated or injured, a medical unit is dispatched. If the spill results in a fire, then a full response of all on-duty personnel can be expected.

Since most fuel emergencies are minor, such as a few gallons of fuel spilled onto the aircraft ramp, the situation can usually be handled with resources at the airport. Depending on the size and location of the spill, additional reports or notifications may be required. For example, a large spill may need to be reported to the Environmental Protection Agency (EPA), Department of Environmental Protection (DEP), or the local Department of Health (DOH). If fuel enters a waterway, there may be additional agencies that need notified, such as Public Works, Coast Guard, and the Fish Commission. At PIT, all necessary notifications are coordinated by the Manager of Environmental Compliance (K. Gurchak, personal communication, November 15, 2010).

Additionally, the Operations Department at the Pittsburgh International Airport currently conducts a number of fuel-related inspections. Daily inspections are randomly performed to check for safe fueling operations, such as vehicle placement, cones, flags, and deadman controls. A more thorough fuel inspection is performed on a quarterly basis. This inspection, which typically lasts several days, includes a check of all fuel delivery vehicles, carts, fuel farms, and emergency fuel shutoff devices located at the individual aircraft gates. The only aircraft fuel component that is not included in the quarterly inspections is the fuel at the military bases, which is handled exclusively by the military personnel. According to Operations personnel, the most common deficiencies are usually minor and include items such as markings and placards that start to lose their visibility due to the effects of weather (D. Niecgorski, personal communication, October 4, 2010). The Operations Department is not responsible for passenger vehicle fuel, such as fuel dispensed at pumps or stored in above-ground temporary tanks at construction sites.

Discussion

The data collection, which included identification of fuel locations at PIT and current fuel procedures in practice as well as a literature review of fuel procedures at other sites, led to an informed decision regarding the problem of minimizing the number of fuel emergencies at PIT. Fuel emergency procedures during events at other airports were considered, current operating procedures were reviewed, and suggestions were then made for best practice at PIT to reduce the number of annual fuel emergencies.

The fire that occurred in downtown Tampa after a collision between a car and tank truck provides a realization to the amount of equipment, personnel, and fire suppression agent needed to extinguish a large flammable liquid fire (Bradish, 1983). Many fire departments do not have these resources within their agency to commit to this type of incident. The fire in Tampa reinforces the importance of maintaining a current list of available mutual aid resources at PIT.

In more serious fuel emergencies, additional fire, medical, or hazardous material resources may need to be requested from agencies outside of the airport. An airport's AEP will contain a detailed list of mutual aid resources available within close proximity to the airport. Often, airports only train with mutual aid resources during their mandatory FAA airport triennial full scale disaster drill. PIT does conduct this FAA required triennial full scale disaster drill; however, this drill does not usually contain a fuel spill aspect. Instead, airports should be encouraged to communicate and train more frequently with mutual aid resources to improve interoperability. This can be accomplished through joint meetings, training, exercises, drills, and table-top scenarios conducted at PIT.

The mutual aid resources available around airports are typically trained and equipped to handle emergencies consistent with hazards within their communities. This means mutual aid resources may be better equipped to handle structural fires, rescue, and EMS, rather than large flammable liquid fires or aircraft emergencies. Therefore, PIT will need to be aware that structural fire fighting equipment may have to be adapted slightly to handle aircraft related emergencies. Furthermore, airport fire departments are often considered to be a regional asset when dealing with aircraft emergencies and large flammable liquid fires. The airport fire department may be requested to provide equipment, manpower, or technical advice when these emergencies occur beyond the confines of the airport. PIT must be prepared for this type of request and be able to modify their plan accordingly.

The large fuel fire at the Denver fuel farm serves as an excellent case study for PIT because of a number of similarities between the two airports (Isner, 1992). Both the Stapleton International Airport and Pittsburgh International Airport are Index “D” airports, according to FAA requirements. However, both airports have the equipment, personnel, and fire suppression agents that meet the requirements of an Index “E” airport.

The FAA Part 139.315, *Aircraft Rescue and Fire Fighting: Index Determination*, states that the index of an airport is determined by the length of the longest aircraft that makes an average of five or more daily departures from an airport. The FAA Part 139.319, *Aircraft Rescue and Fire Fighting: Operational Requirements*, identifies the number of ARFF vehicles and total fire fighting agent required based on the airport index. Although both “D” and “E” index airports are only required to have a minimum of three ARFF vehicles respond, the “E” index airports require their vehicles to respond with a greater total amount of fire fighting agent than a “D” index airport. For example, “D” index airports are only required to have vehicles respond with a total cumulative quantity of 4,000 gallons of water compared to the 6,000 gallons of water needed at “E” index airports (Federal Aviation Administration, n.d.; NFPA, 2009). The additional fire fighting agent helps to ensure a better response at PIT, though without a more detailed response plan these resources may not be utilized effectively.

The fuel farms at both Denver and Pittsburgh airports have fire protection equipment that includes portable fire extinguishers in the valve pit area and a manually operated fixed-foam injection system. The fixed system provided aqueous film-forming foam (AFFF) to the fuel tanks. In the event of a fire, an operator would select the tank to receive foam and then introduce pressurized water from the municipal water system. Then, a device called a foam proportioner would introduce AFFF concentrate into the flowing water, and the foam solution would be discharged onto the floating roof of the protected storage tanks (*Airport Emergency Plan*, 2004; Isner, 1992). At the fire in Denver, the fire fighters operated the fixed-foam system during the incident, but the system had little effect on the fire because it was burning outside the storage tanks (Isner, 1992).

This incident proves that fire departments responsible for protecting tank farms should periodically evaluate their skills and resources as well as likely fire scenarios that might involve flammable liquid tank farms. They should establish contingency plans to ensure that they can obtain needed extinguishing agents, equipment, or other resources to extinguish these fires. Additionally, it's imperative for fire fighters to be familiar with the facilities that store fuel and know the operation and limitations of their associated fire suppression systems.

The research has identified the lack of communication as a missing component to reducing fuel emergencies at PIT. There are several departments and agencies that are involved with various aspects of fueling at PIT, but there seems to be limited interaction among them. For example, the fuelers handle the fuel on a daily basis, the Operations Department conducts periodic inspections, the Fire Department responds to emergencies, and the Environmental Department is consulted when the environment is impacted. However, it is seldom that all parties work together, except at the time of a crisis.

The Pittsburgh International Airport should form a fuel committee that includes representatives from the airport, airlines, and fuel contractors. At a minimum, the following parties should be included: airlines, fuel contractors, airport operations, fire department, environmental department, field maintenance, planning and engineering, and safety. Although the Operations Department is responsible for conducting the fuel inspections, members of the fuel committee should assist with the inspections, offer suggestions for fuel safety improvements, and help ensure safe fueling practices on a daily basis.

The fuel committee should also conduct an investigation on fuel emergencies to determine the reason for the accident and develop an after action report to identify possible measures to prevent a similar incident. Members should also interpret the data collected from the Operations and Fire Departments to determine if any patterns are occurring with respect to fuel emergencies. For example, they could use the data collected to determine if a particular fuel truck or employee has been involved in a high frequency of fuel emergencies. These findings could be further investigated to determine if a piece of equipment may be defective or if an employee may need additional training. The data should also be used to determine the effectiveness of the fuel committee and the fuel safety program at PIT. The fuel committee could also identify additional equipment needs, the minimum equipment recommended for each type of fuel emergency, and better educate those involved with regard to resources available to mitigate situations.

The PIT Fire Department should provide the fire extinguisher and fuel safety training for the fuel committee and all employees of the fuel contractors operating at PIT, as they currently do for some of the other airport tenants. This would ensure that all of the fuel contractors at the airport are receiving accurate and consistent training. The training would be convenient since it could be offered on-site at the airport. Also, the training would be practical since it would include training on the actual fire detection and suppression equipment used at the airport. Furthermore, who better to deliver the fuel safety training than the agency that will be responding to the actual emergencies?

Quarterly training exercises will be employed as a method to reinforce the fire extinguisher and fuel safety training provided to the fuel committee and the fuel contractor employees. These training exercises could be actual drills or tabletop discussions to prepare for fire, health, or environmental impacts resulting from fuel emergencies. These training sessions would be mutually beneficial for all parties participating. The fuel contractors could learn the actions to perform prior to the arrival of emergency responders and the resources available during emergencies. The emergency responders could ensure the fuel contractors are following safe fueling practices and provide training on tasks they could assist with during fuel emergencies. These training sessions would also be ideal opportunities for emergency responders to obtain information to update response pre-plans, contact information, and familiarization on the fuel equipment and facilities.

A partnership must be established between the Allegheny County Fire Department and the Allegheny County Fire Marshal's Office to develop a program to report, track, and inventory the temporary fuel tanks at the Pittsburgh International Airport. Although the Fire Marshal's Office is responsible for issuing permits for all fuel tanks within the county, not all of the temporary fuel tanks at the airport have the proper permits and safety devices.

According to Allegheny County Deputy Fire Marshal Stouffer, "no temporary tanks are permitted, except skid tanks, according to Labor & Industry" (G. Stouffer, personal communication, October 13, 2010). He further explained some safety requirements that include: digging a hole that is 110% of the capacity of the tank, the hole must be lined with a non-permeable liner, and a physical barrier must be present to protect the tank from impact. Since construction is a constant state at PIT, these temporary tanks are a common occurrence that must be properly monitored.

The airport fire department is a valuable asset that has resources to provide initial and routine safety inspections of temporary fuel tanks on airport property. The fire department is constantly visiting construction sites to perform other mandatory inspections; they could report any unauthorized temporary fuel tanks to the Fire Marshal's Office for enforcement purposes. Finally, fire fighter safety would be improved since they would be aware of the location of temporary fuel tanks when responding to emergencies as these tanks pose fire, health, and environmental dangers.

The Fire Department at PIT should begin to categorize spills based on the volume of the spill, similar to the categories in Orlando. For example a spill less than 50 gallons would be a Category A, a spill between 50 and 100 gallons would be a Category B, and a spill greater than 100 gallons would be a Category C. This reporting system would provide ranges for estimating spills and would provide common terminology among emergency responders. Additionally, this would provide a discreet method for reporting approximate spill levels during radio transmissions. Finally, flow charts should be prepared for the various categories to ensure appropriate departments and agencies are notified and adequate personnel and resources are dispatched based on the category of the spill.

The fuel spill standard operating guidelines will be updated to incorporate the three fuel spill categories, Category A, B, and C. The standard operating guideline will also standardize the number of personnel and specific vehicles that are required to initially respond to various fuel emergencies. For example, a fuel spill from a passenger vehicle in the airport long-term parking lot should not have the same initial response as a fuel spill from an aircraft or from a fuel farm storage tank.

It is essential that any quality improvement plan include a mode of evaluation. The primary reason for establishing the fuel committee, along with initiation of new training programs, is to reduce the number of fuel spills at PIT. An effective, and perhaps the most obvious, way of measuring the success of this new fuel plan and committee is to periodically measure the number of fuel incidents occurring at PIT. However, a more detailed evaluation may help PIT to better monitor the effects of the improvement plan and make changes as necessary. For example, if an integral component of the fuel puzzle changes, such as the number of operating fuel tanks or level of air traffic, then the number of fuel emergencies would be expected to change as well, but the change would be unrelated to the new fuel guidelines. Therefore, by better establishing an overarching aim statement and outcome, process, and balance measures to study, one can determine if the changes in fuel policy at PIT are having a positive result in fuel management.

An aim statement will identify the overarching goal of the improvement plan. Essentially, the aim will identify what is trying to be accomplished with the changes at PIT. In this case, the aim will be to minimize the number of fuel-related emergencies. Outcome, process, and balance measures are all ways to determine levels of improvement.

At PIT, the new plan is designed to improve fuel emergency responses in order to minimize and mitigate any future fuel-related problems. Outcome measures are identified based on the ultimate goal of the plan in order to determine if the changes that have been made are actually decreasing fuel-related emergency incidence at PIT. The outcome measures will illustrate the system performance level. Process measures, on the other hand, will indicate whether the recent changes are performing as planned. In an effort to affect the outcome measures, one must establish whether the new processes are working as designed. Balancing measures, conversely, determine if the changes made are negatively affecting any other part of existing systems (Institute for Healthcare Improvement, n.d.).

Aim Statements:

- By December 31, 2011, PIT will reduce the number of fuel spills occurring at the airport by 25%.
- By March 31, 2011, 90% of the fuel committee members will have completed the fire extinguisher and fuel safety training.
- By June 30, 2011, 50% of the fuel contractors at PIT will have completed the fire extinguisher and fuel safety training.
- By September 30, 2011, 80% of the fuel contractors at PIT will have completed the fire extinguisher and fuel safety training.

Outcome Measures:

- Measure the number of fuel spills at PIT at the end of the 2011 calendar year
- Measure the number of fuel committee members that have completed the fire extinguisher and fuel safety training
- Measure the number of fuel contractors that have completed the fire extinguisher and fuel safety training

Process Measures:

- The number of fuel spills will be evaluated at PIT on a monthly basis
- The fuel committee will be established by December 31, 2010, and begin meeting monthly in January 2011
- The fuel committee will record the attendance and minutes at each meeting

- Representatives on the fuel committee will include those as referenced in the above recommendations
- The number of fuel committee members and fuel contractors completing the fire extinguisher and fuel safety training will be tabulated and reviewed monthly
- A comparison will be made between the total number of fueling operations and the number of fuel emergencies occurring monthly at PIT

Balance Measures:

- Evaluate costs associated with establishing a fuel committee and its effectiveness
- Measure employee’s productivity loss resulting from participation in the fuel committee

Given the complexity of fuel-related emergencies, these new guidelines will ensure all concerns of the responder are addressed before the incident occurs. In this way, safety, environmental, health, training, and procedural concerns have all been addressed prior to the onset of an emergency. Lessons learned from other responders have been considered and have been adapted to fit the unique fuel locations in Pittsburgh. The PIT Fire Department is then armed with the knowledge to lead a well-coordinated effort that emphasizes communication among response agencies, while working toward minimizing the number of annual fuel-related emergencies at the airport.

Recommendations

A review of current literature discussing fuel response plans at airports as well as a detailed analysis of current operating procedures at PIT indicates a lack of appropriate operating guidelines in the event of a fuel emergency. The analysis led to the recommendation of new standard operating guidelines at PIT that will include a number of aspects. The Fire Department will develop a more detailed list and become more familiar with available mutual aid resources.

As the primary responder, the Fire Department will also train to adapt its response plan to handle emergencies beyond the airport property and provide more training opportunities in fuel-related emergencies.

A fuel committee with representatives from all parties usually involved in a fuel response will be organized to assist with fuel inspections, offer suggestions for fuel safety improvements, ensure safe fueling practices, conduct investigations of fuel emergencies, review fuel emergency data for patterns, and develop an after action report on fuel incidents. The committee will also play a role in providing and completing fire extinguisher and fuel safety training as well as conducting training exercises, drills, and tabletops specific to fuel-related emergencies.

Recommendations also include an establishment of a partnership between the PIT Fire Department and the Allegheny County Fire Marshal's Office to better address handling and safety of temporary fuel tanks. A scale will also be employed to categorize fuel spills based on size, which will indicate the appropriate response and notifications necessary to address the problem. Evaluation techniques for this fuel emergency improvement plan are included. Adoption and implementation of these changes to the now minimal guidelines in place will reduce the number of fuel-related emergencies occurring at the Pittsburgh International Airport.

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Appendix A

Abbreviations

AEP – Airport Emergency Plan

AFFF – Aqueous Film-Forming Foam

AOA – Air Operations Area

ARFF – Aircraft Rescue Fire Fighting

ASIG – Aircraft Service International Group

Avgas – Aviation Gasoline

CFR – Code of Federal Regulations

DEP – Department of Environmental Protection

DOH – Department of Health

EPA – Environmental Protection Agency

ERG – Emergency Response Guidebook

FAA – Federal Aviation Administration

GSE – Ground Service Equipment

IAFF – International Association of Fire Fighters

LRC – Learning Resource Center

MSDA – Material Safety Data Sheet

NFA – National Fire Academy

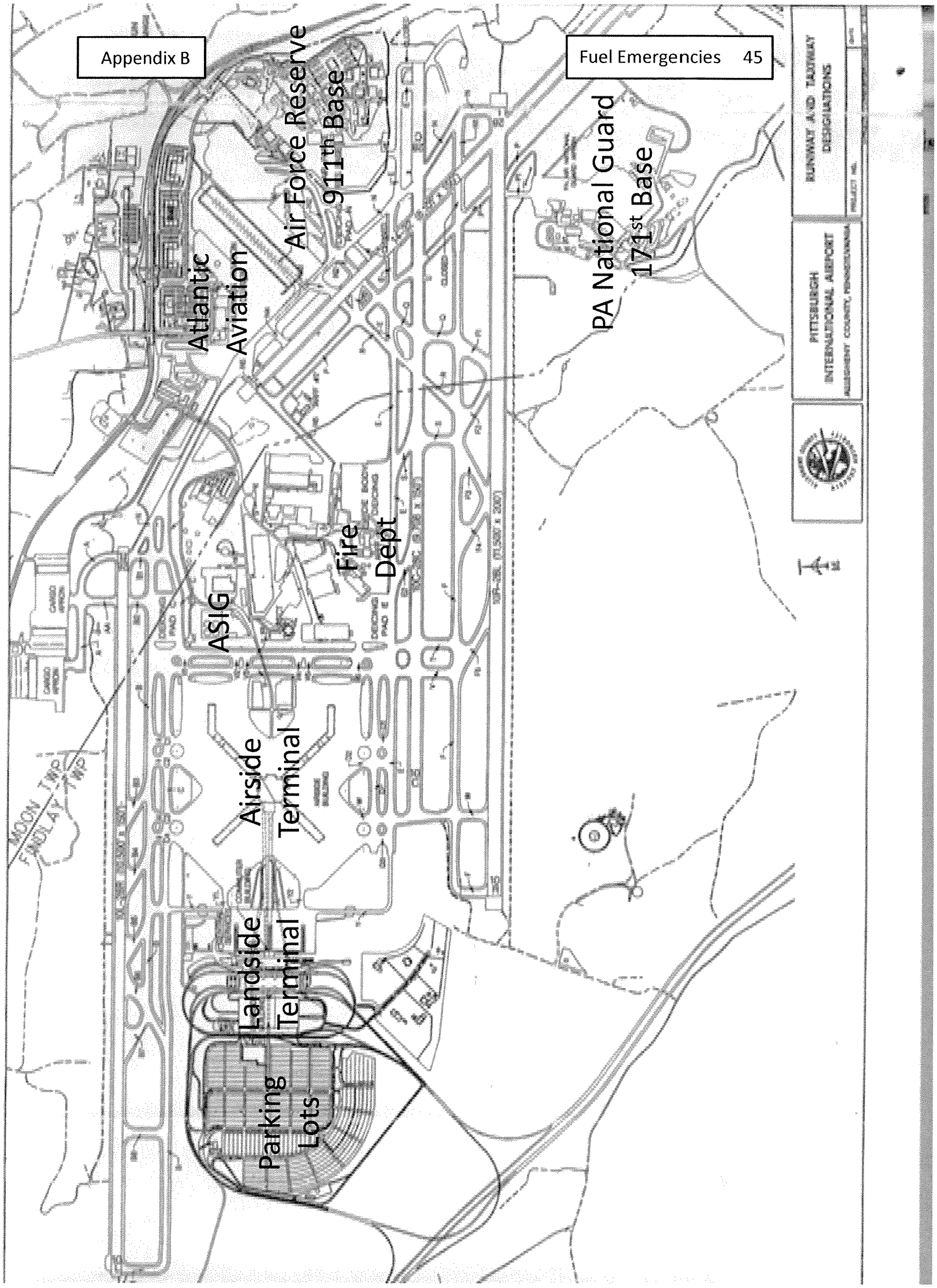
NFPA – National Fire Protection Association

PIT – Pittsburgh International Airport

PPE – Personal Protective Equipment

SCBA – Self-Contained Breathing Apparatus

SOG – Standard Operating Guidelines


Appendix B
Fuel Emergencies 45
Atlantic Aviation
Air Force Reserve 911th Base
PA National Guard 171st Base
Fire Dept
ASIG
Airside Terminal
Landside Terminal
Parking Lots
MOON TWP
FINDLAY TWP
PITTSBURGH INTERNATIONAL AIRPORT
ALLEGHENY COUNTY, PENNSYLVANIA
RUNWAY AND TAXIWAY DESIGNATIONS