Chapter 20: Aviation Facilities

General Comments

Safe and efficient operation of airports, heliports and aircraft service facilities requires a comprehensive understanding of fire safety and aviation activities. The principal nonflight operational hazards associated with aviation involve fuel, facilities and operations. Conflicts have developed in recent years between airport security and life safety requirements because of an increased concern about air piracy and terrorism. The Federal Aviation Administration (FAA) regulates airport and air carrier security operations. These regulations strictly limit access to the air operations area. Unauthorized individuals must be prevented from entering air operations areas during all operating conditions, including emergencies in the terminal building. Concurrently, airport designs have traditionally included large unconfined areas for the movement of people and their belongings. Because most contemporary passenger terminal buildings resemble covered malls, Section 402 of the *International Building Code*® (IBC®) permits passenger transportation terminals to comply with the requirements for a covered mall building and, in fact, includes them in the definition of "Covered mall building."

Purpose

Chapter 20 specifies minimum requirements for the fire-safe operation of airports, heliports and helistops. Safe use of flammable and combustible liquids during fueling and maintenance operations is emphasized. Availability of portable Class B:C-rated fire extinguishers for prompt control or suppression of incipient fires is required.

SECTION 2001 GENERAL

2001.1 Scope. Airports, heliports, helistops and aircraft hangars shall be in accordance with this chapter.

❖ This chapter discusses fire and life safety in the ground environment modes. These modes include aircraft maintenance, aircraft refueling, aircraft hangars, helistops and heliports.

2001.2 Regulations not covered. Regulations not specifically contained herein pertaining to airports, aircraft maintenance, aircraft hangars and appurtenant operations shall be in accordance with nationally recognized standards.

❖ If a regulation is not addressed in this chapter, one must go to a recognized standard for the regulation. Ground operations must be conducted in accordance with recognized standards.

2001.3 Permits. For permits to operate aircraft-refueling vehicles, application of flammable or combustible finishes and hot work, see Section 105.5.

❖ The process of issuing permits gives the fire code official an opportunity to carefully evaluate and regulate hazardous operations. Permit applicants should be required to demonstrate that their operations comply with the intent of the code before the permit is issued (see commentary, Section 105.5 for a general discussion of operations requiring a permit). The three operations listed in this section pose possible fire hazards because an ignition source close to them would create a hazardous situation. The operations must be reviewed for safety concerns and requirements.

SECTION 2002 DEFINITIONS

2002.1 Definitions. The following terms are defined in Chapter 2:

AIRCRAFT OPERATION AREA (AOA).

AIRPORT.

HELIPORT.

HELISTOP.

❖ Definitions of terms can help in the understanding and application of the code requirements. This section directs the code user to Chapter 2 for the proper application of the indicated terms used in this chapter. Terms may be defined in Chapter 2 or in another International Code® (I-Code®) as indicated in Section 201.3, or the dictionary meaning may be all that is needed (see also commentaries, Sections 201 through 201.4).

SECTION 2003 GENERAL PRECAUTIONS

2003.1 Sources of ignition. Open flames, flame-producing devices and other sources of ignition shall not be permitted in a hangar, except in *approved* locations or in any location within 50 feet (15 240 mm) of an aircraft-fueling operation.

❖ Smoking or carrying any open-flame device within 50 feet (15 240 mm) of any fueling operation is prohibited because of flammable vapors that are likely to be present during fueling operations. Electrical equipment on

aircraft is usually not approved for use in hazardous (classified) locations, and disconnection of electrical devices often produces sparks, possibly igniting flammable vapor-air mixtures. Consequently, fueling operations must be discontinued before connecting or disconnecting these devices.

2003.2 Smoking. Smoking shall be prohibited in aircraft-refueling vehicles, aircraft hangars and aircraft operation areas used for cleaning, paint removal, painting operations or fueling. "No Smoking" signs shall be provided in accordance with Section 310.

Exception: Designated and *approved* smoking areas.

❖ An aircraft hangar is simply a building that provides weather protection and shop space during aircraft maintenance and storage. In the maintenance process, many hazards are present. Smoking is prohibited in all areas where an aircraft is located because of the potential presence of fuel vapors. The exception gives the fire code official the authority to evaluate and approve designated smoking areas.

2003.3 Housekeeping. The aircraft operation area (AOA) and related areas shall be kept free from combustible debris at all times.

❖ Housekeeping should be a daily practice. The level of fire safety is greatly improved when areas are kept clean and neat. Make sure that all generated waste is removed from the building and safely disposed of each day. Additionally, keeping the areas in which aircraft operate free from debris reduces the likelihood of foreign object damage (FOD) to aircraft engines that could result in engine damage or catastrophic engine failure.

2003.4 Fire department access. Fire apparatus access roads shall be provided and maintained in accordance with Chapter 5. Fire apparatus access roads and aircraft parking positions shall be designed in a manner so as to preclude the possibility of fire vehicles traveling under any portion of a parked aircraft.

❖ Access by emergency vehicles is an important factor. Fire apparatus access roads must be wide enough, well-marked and unobstructed in accordance with Section 503. The access roads should also be arranged so there is no confusion over where emergency vehicles are to go in the event of a fire or rescue emergency in a building, on a runway or in an aircraft. Space between aircraft must be large enough to allow emergency response equipment access to buildings and the aircraft.

2003.5 Dispensing of flammable and combustible liquids. The dispensing, transferring and storage of *flammable* and *combustible liquids* shall be in accordance with this chapter and Chapter 57. Aircraft motor vehicle fuel-dispensing facilities shall be in accordance with Chapter 23.

❖ Section 2006 gives guidelines for dispensing fuel into an aircraft. Section 5706 also gives guidelines for dispensing flammable and combustible liquids. Chapter 23 applies when small general aviation-type aircraft and airport service vehicles are brought to a fueling station instead of being fueled from a vehicle. See the commentary to Section 202 for the definition of "Aircraft motor-vehicle fuel-dispensing facility."

2003.6 Combustible storage. Combustible materials stored in aircraft hangars shall be stored in *approved* locations and containers.

❖ Combustible materials storage is to be confined to cut-off rooms or approved metal containers with tight-fitting, self-closing or automatic-closing lids to limit the fuel load readily exposed within the hangar. Approved containers provided for oily rags and similar wastes are to be supplied throughout service areas and emptied every day. Combustible materials should be removed from the building as soon as possible.

2003.7 Hazardous material storage. Hazardous materials shall be stored in accordance with Chapter 50.

❖ Chapter 50 contains the requirements for storing hazardous materials. Requirements in Chapters 51 through 67 also apply to specific materials.

SECTION 2004
AIRCRAFT MAINTENANCE

2004.1 Transferring flammable and combustible liquids. *Flammable* and *combustible liquids* shall not be dispensed into or removed from a container, tank, vehicle or aircraft except in *approved* locations.

❖ Due to hazards presented by aviation fuels, as discussed in Section 2006, it is necessary that all storage, transfer or dispensing of flammable and combustible liquids be completed outside of and away from structures. This includes the emptying of fuel tanks and the rooftop refueling of helicopters. The large, undivided areas of aircraft hangars coupled with the dollar value of a single aircraft present an unusually high value at risk of loss due to a single fire incident, thus reinforcing the need for the strict regulation of fuels. Dispensing systems generally involve the transfer of liquid from fixed piping systems, drums or 5-gallon (19 L) cans into smaller end-use containers. Because the release of some vapor is practically unavoidable, dispensing must take place in designated areas.

2004.2 Application of flammable and combustible liquid finishes. The application of *flammable* or Class II *combustible liquid* finishes is prohibited unless both of the following conditions are met:

1. The application of the liquid finish is accomplished in an *approved* location.
2. The application methods and procedures are in accordance with Chapter 24.

❖ Application of flammable finishes must comply with Chapter 24. Most exterior aircraft painting is performed using spray apparatus, frequently in aircraft hangars. Usually, control of ignition sources, ventilation and the considerable volume of aircraft hangars is relied on to minimize the hazards typically associated with spraying in more confined areas where vapor-air mixtures can rapidly create an explosive mixture. Small parts and subassemblies should be removed and painted in approved spray booths or areas complying with the requirements of Chapter 24. Exterior painting should not be performed in aircraft hangars not protected

throughout by approved automatic fire suppression systems. If systems are inoperable, exterior spray painting is not permitted; only interior painting using water-based products is permitted. Like small exterior parts and subassemblies, application of flammable finishes to removable interior components should be limited to approved spray booths or spray rooms. Note that the IBC regulates aircraft painting operations and requires such painting to occur in an aircraft painting hangar, in accordance with IBC Section 412.5.

2004.3 Cleaning parts. Class IA *flammable liquids* shall not be used to clean aircraft, aircraft parts or aircraft engines. Cleaning with other *flammable* and *combustible liquids* shall be in accordance with Section 5705.3.6.

❖ Class I flammable liquids with flash points below 100°F (38°C) must not be used for cleaning that typically liberates large quantities of flammable vapor and may leave a flammable residue that is easily ignited. Removable parts should be cleaned in approved parts-cleaning machines already tested and labeled for such a purpose. The hazards associated with cleaning an aircraft, aircraft parts and aircraft engines with Class IA flammable liquids are fires and explosions, potentially causing damaged property and loss of life. Section 5705.3.6 gives requirements for cleaning with Class I, II and IIIA liquids.

2004.4 Spills. Sections 2004.4.1 through 2004.4.3 shall apply to spills of *flammable* and *combustible liquids* and other hazardous materials. Fuel spill control shall also comply with Section 2006.11.

❖ The following procedures should be adhered to in the event a spill occurs. The specific requirements for fuel spill prevention are found in Section 2006.11.

2004.4.1 Cessation of work. Activities in the affected area not related to the mitigation of the spill shall cease until the spilled material has been removed or the hazard has been mitigated.

❖ All ongoing activity must stop in the area of a spill until the spill has been cleaned up and removed, since those ongoing activities may cause an ignition to occur. The area should be clear of all hazards before work is resumed.

2004.4.2 Vehicle movement. Aircraft or other vehicles shall not be moved through the spill area until the spilled material has been removed or the hazard has been mitigated.

❖ The movement of vehicles may create an ignition source for the flammable liquids that spilled. Stopping all movement of vehicles reduces the possibility of a fire or an explosion significantly.

2004.4.3 Mitigation. Spills shall be reported, documented and mitigated in accordance with the provisions of this chapter and Section 5003.3.

❖ Any fuel spill, whatever the amount, must be reported to the proper authorities and documented to record the spill details and what was done to clean up the spill. Chapter 50 gives specific procedures for handling a spill.

2004.5 Running engines. Aircraft engines shall not be run in aircraft hangars except in *approved* engine test areas.

❖ An approved engine test area should have proper ventilation, have engine noise control and be separated from other areas of operation. Running engines could create ignition sources that could cause fire or explosions, as well as ventilation and noise hazards for the surrounding employees.

2004.6 Open flame. Repairing of aircraft requiring the use of open flames, spark-producing devices or the heating of parts above 500°F (260°C) shall only be done outdoors or in an area complying with the provisions of the *International Building Code* for a Group F-1 occupancy.

❖ No heat-producing, welding, cutting or blow-torch devices should be used inside hangars. Their use is restricted to areas that meet the requirements of a Group F-1 occupancy in the *International Mechanical Code*® (IMC®). Flare pots and other open-flame lights are also included in this category.

2004.7 Other aircraft maintenance. Maintenance, repairs, modifications, or construction performed on aircraft not addressed elsewhere in this code shall be conducted in accordance with NFPA 410.

❖ Aircraft maintenance is often a hazardous procedure due to the inherent hazards of aircraft. NFPA 410 specifies minimum safety requirements to be performed during specific maintenance operations such as fuel or oxygen system maintenance, aircraft cleaning and hazardous operations such as defueling. It provides additional fire-safety requirements to supplement the procedures already regulated by this chapter, as well as additional fire protection requirements for other specified procedures not regulated by this chapter. See the commentary to Section 102.7 for information on the proper application of referenced standards.

SECTION 2005
PORTABLE FIRE EXTINGUISHERS

2005.1 General. Portable fire extinguishers suitable for *flammable* or *combustible liquid* and electrical-type fires shall be provided as specified in Sections 2005.2 through 2005.6 and Section 906. Extinguishers required by this section shall be inspected and maintained in accordance with Section 906.

❖ Portable fire extinguishers (PFEs) must be approved for use on Class B and C fires. Placement and distribution of PFEs should conform to NFPA 10, NFPA 407 and Section 906 of the code. Generally, PFEs are required in the immediate vicinity of all flammable and combustible liquid storage, use and dispensing; welding and cutting; spray finishing; and other maintenance operations; as well as on aircraft fueler and service vehicles.

It should be noted that Sections 2005.2, 2005.4, 2005.5 and 2005.6 specifically require B:C-rated PFEs on vehicles and in locations that are in close proximity to aircraft. This is because it has been reported by the

National Safety Council that A:B:C-rated PFE chemicals pose a severe aircraft damage problem. While A:B:C-rated PFEs generally have an excellent fire-fighting capability and track record, the monoammonium-phosphate chemical extinguishing agent is highly corrosive to aluminum. This agent will melt and flow when it comes into contact with heated surfaces and, once it comes into contact with hot aluminum and works its way into the structural joints and crevices, it cannot be flushed out as the B:C dry-chemical agents can. Cleanup following use of an A:B:C-rated PFE on an aircraft could require disassembly of the aircraft to remove every remnant of the chemical to prevent hidden corrosion damage that could lead to structural failure.

2005.2 On towing vehicles. Vehicles used for towing aircraft shall be equipped with not less than one *listed* portable fire extinguisher complying with Section 906 and having a minimum rating of 20-B:C.

❖ Tow motors and other towing vehicles must be equipped with a PFE that is readily available if a fire occurs away from a service, maintenance or boarding area.

2005.3 On welding apparatus. Welding apparatus shall be equipped with not less than one *listed* portable fire extinguisher complying with Section 906 and having a minimum rating of 2-A:20-B:C.

❖ Consistent with Section 3504.2.6, a PFE is required on all welding apparatus so that it is readily available during welding or cutting operations outside a welding or cutting shop area.

2005.4 On aircraft fuel-servicing tank vehicles. Aircraft fuel-servicing tank vehicles shall be equipped with not less than two *listed* portable fire extinguishers complying with Section 906, each having a minimum rating of 20-B:C. A portable fire extinguisher shall be provided with *ready access* from either side of the vehicle.

❖ Fuel-servicing tank vehicles for aircraft must have a PFE on each side of the vehicle. Both extinguishers must be easily accessible and not be obstructed. Each PFE must be effective for the extinguishment of a flammable liquid fire and also be effective for energized electrical components (see Commentary Figure 2006.3—note the PFE on each side of the rear bumper).

2005.5 On hydrant fuel-servicing vehicles. Hydrant fuel-servicing vehicles shall be equipped with not less than one *listed* portable fire extinguisher complying with Section 906 and having a minimum rating of 20-B:C.

❖ Hydrant fuel-servicing vehicles must be equipped with one PFE that is effective for the extinguishment of a flammable liquid fire and is also effective for energized electrical components.

2005.6 At fuel-dispensing stations. Portable fire extinguishers at fuel-dispensing stations shall be located such that pumps or dispensers are not more than 75 feet (22 860 mm) from one such extinguisher. Fire extinguishers shall be provided as follows:

1. Where the open-hose discharge capacity of the fueling system is not more than 200 gallons per minute (13 L/s), not less than two *listed* portable fire extinguishers complying with Section 906 and having a minimum rating of 20-B:C shall be provided.
2. Where the open-hose discharge capacity of the fueling system is more than 200 gallons per minute (13 L/s) but not more than 350 gallons per minute (22 L/s), not less than one *listed* wheeled extinguisher complying with Section 906 and having a minimum extinguishing rating of 80-B:C, and a minimum agent capacity of 125 pounds (57 kg), shall be provided.
3. Where the open-hose discharge capacity of the fueling system is more than 350 gallons per minute (22 L/s), not less than two *listed* wheeled extinguishers complying with Section 906 and having a minimum rating of 80-B:C each, and a minimum capacity agent of 125 pounds (57 kg) each, shall be provided.

❖ This section requires PFEs with ratings based on the anticipated discharge rate of a broken or ruptured fuel hose. NFPA 407 contains requirements for the inspection and maintenance of an aircraft fueling hose, including daily pre-use inspection and removal from service of obviously defective hoses. Despite these inspections, however, hoses and fittings can and do fail for a variety of reasons (e.g., unnoticed physical damage, coupling and fitting failure, overpressure rupture, etc.), resulting in a flailing hose, "open butt" discharge of fuel under the full pressure of the fueling system. Such uncontrolled fuel discharge could flow under the aircraft; fueling vehicles; passenger stairs or ramps; baggage-handling equipment or in close proximity to building openings. If a hose were to rupture on top of an aircraft wing or a flailing hose were to spray fuel on vehicles, baggage carts, etc., the resulting hazard would increase beyond a simple spill fire. The large amount of property damage and potential for loss of life requires that sufficient PFEs of an adequate size be located in the fueling area. (Note: the PFEs required by this section are in addition to others required on vehicles that may be present in the fuel area.)

Considerations in locating PFEs during fueling operations include placing them out and upwind of the fuel-dispensing site and potential spill area, as well as within the access travel distance specified in NFPA 10 for extra-hazard locations. When two PFEs are required, they should be located close enough to each other so NFPA 10 access travel distances are not exceeded and a spill incident does not prevent access to or use of both appliances.

FAA regulations and NFPA 407 require refueling personnel to receive PFE and fire safety training. Annex A of NFPA 407 recommends that such training include live-fire exercises. Training should be ade-

quately detailed so that supervisors are capable of properly indoctrinating their subordinates in fire safety essentials. Topics covered in the training program should include electrical bonding and grounding; maintenance of aircraft egress; emergency shutdown of fuel-servicing equipment; notification of emergency forces; and supporting emergency operations.

The low flow rate in Item 1 requires that at least two 20-B:C hand-held PFEs are provided. It also assumes that the trained personnel available will be able to handle the relatively small anticipated spill. Such PFEs typically discharge for up to approximately 25 seconds for distances up to approximately 20 feet (approximately 6096 mm).

Item 2 states that a ruptured hose discharging up to 350 gallons per minute (gpm) (1325 L/m) creates a potentially larger spill area and a more challenging fire for first-aid appliances. The higher "B" rating requires a quantity of extinguishing agent, usually dry chemical, that likely exceeds 50 pounds (28 kg), depending on the agent. Accordingly, a wheeled PFE will enable a single operator more mobility in moving the PFE for fire attack. The size of the wheeled unit, in addition to its longer discharge hose, allows the operator a greater agent discharge time, a higher agent flow rate, a greater agent discharge distance and more mobility in the hazardous area. The potential for such large fuel discharges increases the extinguishing requirements. For the same reasons discussed under Item 2, a minimum of two wheeled units are required to allow a more aggressive fire attack.

2005.7 Fire extinguisher access. Access to portable fire extinguishers required by this chapter shall be maintained at all times. Where necessary, provisions shall be made to clear accumulations of snow, ice and other forms of weather-induced obstructions.

❖ Unobstructed access to PFEs is essential. In colder climates, snow and ice may block access and must be removed because fire can occur at any time.

2005.7.1 Cabinets. Cabinets and enclosed compartments used to house portable fire extinguishers shall be clearly marked with the words "FIRE EXTINGUISHER" in letters not less than 2 inches (51 mm) high. Cabinets and compartments shall be provided with *ready access* at all times.

❖ In an emergency, people can panic and become confused. Labeling cabinets where PFEs are housed with letters 2 inches high (51 mm) (often in red) makes the PFEs easier to locate.

2005.8 Reporting use. Use of a fire extinguisher under any circumstances shall be immediately reported to the manager of the airport and the *fire code official*.

❖ The fire code official is responsible for the investigation of fires within the jurisdiction and for maintaining records thereof. Likewise, the airport manager is responsible for all activities and events within the airport. Both persons must be notified of extinguisher use so the circumstances of the event can be investigated and appropriate follow-up procedures initiated to mitigate the hazard that resulted in the incident. Discharged PFEs must be promptly replaced with serviceable units.

SECTION 2006
AIRCRAFT FUELING

2006.1 Aircraft motor vehicle fuel-dispensing facilities. Aircraft motor vehicle fuel-dispensing facilities shall be in accordance with Chapter 23.

❖ Requirements for fuel-dispensing stations for aircraft motor vehicles are found in Chapter 23. This provision addresses the dispensing of fuel into small general aviation-type aircraft at stationary fuel-dispensing facilities that use equipment similar to that used at automotive service stations rather than fuel hydrants or fuel tanker trucks that are used on larger aircraft. See the commentary to Section 202 for the definition of "Aircraft motor vehicle fuel-dispensing facility."

2006.2 Airport fuel systems. Airport fuel systems shall be designed and constructed in accordance with NFPA 407.

❖ Aviation fuels present a wide range of hazards. The fuel, ambient temperature, control of ignition sources, drainage, availability of fire protection equipment and the experience and training of fuel-service personnel have the greatest influence over the outcome of fueling accidents. Consequently, this section references NFPA 407, specifying requirements for the design and operation of fueling installations, vehicles and procedures.

At normal ambient temperatures, the kerosene-grade fuels are not readily ignitable, which may explain their popularity. When spilled on a warm aircraft apron, however, kerosene-grade fuels can be readily heated above their flash points. Once ignited, most aviation fuels exhibit relatively similar burning characteristics (see Commentary Figure 2006.2 for information on common aviation fuels).

Fuel spills are relatively uncommon occurrences given the daily number of refuelings that occur. Most fuel spills occur as the result of a slow or faulty internal shutoff valve that causes overfilling of the tank, resulting in fuel escaping through the tank vent point. To prevent or minimize such accidents, fuel shutoffs and fail-safe, self-closing valves should be exercised and inspected regularly. In addition, faulty valves and equipment should be removed from service and repaired or replaced immediately. All spills must be promptly reported to airport fire-fighting personnel and investigated to determine their cause. The most common ignition source in liquid fuel spills is static electricity. The kerosene and kerosene-gasoline blends are more electrostatically active than AVGAS, and transfer operations may generate considerable amounts of static electricity; therefore, prior to most fueling operations both the aircraft and refueler shall be independently grounded and then bonded to one another either by the filling hose or a separate bonding line (see commentary, Section 2006.5.2 and its subsections for further information).

2006.3 Construction of aircraft-fueling vehicles and accessories. Aircraft-fueling vehicles shall comply with this section and shall be designed and constructed in accordance with NFPA 407.

❖ The following sections apply to vehicles operated for refueling aircraft. The sections address transfer appa-

ratus, pumps, dispensing, electrical equipment, venting and smoking. The design and construction of the vehicle tanks, trailers, piping, exhaust system, lighting, venting and safe operating procedures parallel those in NFPA 407, Chapter 2 (see Commentary Figure 2006.3).

2006.3.1 Transfer apparatus. Aircraft-fueling vehicles shall be equipped and maintained with an *approved* transfer apparatus.

❖ The transfer apparatus installed on the fuel-servicing vehicle must be approved and tested for transferring fuel into an aircraft. All sections involved in a flammable liquid feed system should be constructed and located to minimize a fire hazard.

2006.3.1.1 Internal combustion type. Where such transfer apparatus is operated by an individual unit of the internal-combustion-motor type, such power unit shall be located as remotely as practicable from pumps, piping, meters, air eliminators, water separators, hose reels and similar equipment, and shall be housed in a separate compartment from any of the aforementioned items. The fuel tank in connection therewith shall be suitably designed and installed, and the maximum fuel capacity shall not exceed 5 gallons (19 L) where the tank is installed on the engine. The exhaust pipe, muffler and tail pipe shall be shielded.

❖ Isolation of an internal combustion engine from the fuel transfer system helps to control possible ignition sources. The ignition sources need to be shielded and equipment should be housed in separate compartments.

Commentary Figure 2006.3
AIRCRAFT-FUELING VEHICLE

2006.3.1.2 Gear operated. Where operated by gears or chains, the gears, chains, shafts, bearings, housing and all parts thereof shall be of an *approved* design and shall be installed and maintained in an *approved* manner.

❖ The gears and other associated parts should be covered and protected from damage, whether the damage comes from environmental or mechanical sources. The design must be approved for the function. Maintenance should be scheduled to provide consistent and proper operation.

	Gasoline	Kerosene Grades	Blends of Kerosene and Gasoline
Commercial Designation	AVGAS	JET A, JET A-1	JET B
Military Designation		JP-5, JP-6, JP-8	JP-4
Characteristics			
Freezing Point	-76°F	-49 to -58°F	-60°F
Vapor Pressure	5.5 to 7.0 psi	0.1 psi	2.0 to 3.0 psi
Flash Point (Closed-cup Method @ MSL)	-50°F	95 to 145°F	-10 to +30°F
Flash Point (Air-saturation Method)	-75 to -85°F	None	-60°F
Flammable Range Lower Upper Temperature Range	 1.5% 7.6% -50 to +30°F	 0.74% 5.32% 95 to 165°F	 1.16% 7.63% -10 to +100°F
Autoignition Temperature	825 to 960°F	440 to 475°F	470 to 480°F
Boiling Points Initial End	 110°F 325°F	 325°F 450°F	 135°F 485°F
Pool Rate of Flame Spread	700 to 800 feet per minute	≤ 100 feet per minute	700 to 800 feet per minute

Source: Brenneman, J.J. *Industrial Fire Hazards Handbook*.
For SI; 1 foot per minute = 0.00508 m/s, °C = [(°F) - 32]/1.8.

Commentary Figure 2006.2
PHYSICAL AND FLAMMABILITY CHARACTERISTICS OF AVIATION FUELS