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 aviation hazards involve fuel, facilities and operations.

Due to increased concerns about air piracy and terrorism, there may be conflicts between airport security and fire code and life safety requirements. The Department of Homeland Security Transportation Security Administration (TSA) regulates airline security and operates airport security checkpoints. The Federal Aviation Administration (FAA) regulates airport and air carrier security operations. Fire code officials may have to learn to work with both agencies to achieve effective life safety and fire protection.

Federal 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.

Airport designs include large unconfined areas for the movement of people and their belongings. Because most contemporary passenger terminal buildings comprise fire and safety hazards similar to covered malls, *International Building Code*® (IBC®) Section 402 permits passenger transportation terminals to comply with the requirements for a covered mall building and includes them in the definition of "Covered mall building." (See IBC Section 202.)

Purpose

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

SECTION 2001—GENERAL

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

C Chapter 20 addresses fire and life safety hazards and controls for aircraft maintenance, aircraft refueling, aircraft hangars, helistops, and heliports. Terminals where passengers congregate while awaiting their travel and other ground operations are regulated by other code sections specific to their hazards: emergency planning and preparedness (Chapter 4) commercial cooking (Chapters 6 and 9), fire protection systems and equipment (Chapter 9), egress for places of assembly (Chapter 10), aircraft fueling (Chapters 20 and 23), flammable and combustible finishes (Chapter 24), hot work (Chapter 35) and hazardous materials that may be in storage or use (Chapters 50–67). Also see IBC Section 412 for construction requirements specific to aircraft-related occupancies.

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.

C If a regulation is not addressed in this chapter, one must refer to a recognized standard for guidance. Ground operations must be conducted in accordance with recognized standards. These may include standards by the International Air Transport Association (IATA), National Air Transportation Association (NATA), the FAA or similar organizations.

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

C Permits give 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 a spill or ignition source close to them would create a hazard. The operations must be reviewed for safety concerns and requirements. The fire code official is authorized to add conditions to permits to achieve public safety.

SECTION 2002—DEFINITIONS

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

AIRCRAFT OPERATION AREA (AOA).

AIRPORT.

HELIPORT.

HELISTOP.

C Definitions of terms can help in the understanding and application of the code requirements. Refer to Chapter 2 for the proper application of the listed terms used in this chapter. Terms may be defined in Chapter 2 or in another International Code® (I-Code®) as explained in Section 201.3, or the dictionary meaning may be all that is needed (see commentaries, Sections 201.1 through 201.4). Words that appear in italics are defined in Chapter 2.

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.

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

Most commercial aircraft are fueled with Jet-A that is a mix of extremely refined kerosene and other constituents. It has flash point from 95–143°F (35–62°C), making it a Class IB, II or IIIA liquid, depending on its blend. Kerosene-based fuel has a much higher flash point than gasoline-based fuel, meaning that it requires significantly higher temperatures to ignite. Aviation gasoline (AvGas) is the primary fuel for piston-powered aircraft. It is a Class IB flammable liquid (see Commentary Figure 2006.2 for fuel physical and flammability characteristics).

Electrical equipment on aircraft usually is not designed for use in hazardous (classified) locations (see Commentary Figure 5703.1.1) and disconnecting electrical devices often produces sparks that could ignite flammable vapor-air mixtures. Fueling operations must be discontinued before connecting or disconnecting electrical equipment.

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.

C An aircraft hangar provides weather protection and shop space for 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.

C The aircraft operation area (AOA) includes any area used for parking, taxiing, take-off, landing or ground-based activity. Housekeeping should be a daily practice or even more frequent if conditions dictate. Fire safety is greatly improved when areas are kept clean and neat. All waste must be removed from the AOA and safely disposed of each day. Additionally, keeping the areas in which aircraft operate free from debris reduces the likelihood that foreign objects are ingested into aircraft engines, which 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.

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

C Section 2003.5 provides generic guidance for dispensing, transferring, and storing flammable and combustible liquids. Section 2006 provides detailed requirements for dispensing fuel into an aircraft. Section 5706.6 also gives guidelines for tank vehicle construction and operations. Chapter 23 applies where small general aviation-type aircraft and airport service vehicles are brought to a fueling station instead of being fueled from a vehicle. See Commentary Section 202 for the definition of “Aircraft motor-vehicle fuel-dispensing facility" and Commentary Figure 2003.5 for a typical fueling operation.

Commentary Figure 2003.5—Private Aircraft Fueling Is Regulated by Chapter 23

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

C Combustibles must be stored in accordance with Section 315 and waste materials stored as required by Section 304. Oily waste must be kept in approved metal containers with tight-fitting, self-closing or automatic-closing lids to limit the exposed fuel load within a hangar. Approved containers for oily rags and similar wastes are to be provided throughout service areas and emptied every day. See Section 304.3.1. Unneeded 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.

C Chapter 50 contains the requirements for storing physical or health 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.

C Aviation fuel, cleaning solutions, paint and aircraft doping products (used to make fabric-covered aircraft airtight and weatherproof) are among the many flammable or combustible liquids found around aircraft operations. Due to hazards presented by aviation fuels (see Section 2006), all storage, transfer or dispensing of flammable and combustible liquids must be completed outside of and away from structures in locations approved by the fire code official.

Product transfer increases the likelihood of accidents and spills. The large, undivided areas of aircraft hangars coupled with the dollar value of a single aircraft present an unusually high-value environment at risk of loss from a single fire.

These concerns may require some operations to be moved outside and away from structures. This includes fuel tank emptying (defueling) and helicopter rooftop fueling. Dispensing systems generally involve liquid transfer from fixed piping systems, drums or 5-gallon (19 L) cans into smaller end-use containers. Because some vapor release is practically unavoidable, dispensing must take place in designated areas with adequate ventilation and where ignition sources can be controlled or reduced.

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.

C Flammable finish applications must comply with Chapter 24. See IBC Sections 412.3.5 and 412.3.6 for "doping" operations and fire protection requirements. "Doping" is the application of flammable lacquers to fabric-covered aircraft.

Most aircraft fuselage and wing painting is performed using spray apparatus, usually in aircraft hangars. IBC Section 412.5 regulates aircraft painting operations and requires painting to occur in an aircraft painting hangar. Ignition control, ventilation and the considerable volume of aircraft hangars minimize hazards typically associated with spraying in more confined areas where vapor-air mixtures can rapidly create an explosive mixture. Fuselage and wing painting should not be performed in aircraft hangars unless they are protected throughout by approved automatic fire suppression systems. If systems are inoperable, only painting using water-based products is permitted.

Small parts, removable interior components and subassemblies should be removed and painted in approved spray booths or areas complying with Chapter 24 requirements. 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.

C Class I flammable liquids with flash points below 100°F (38°C) must not be used for cleaning that typically emits 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. 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.

C The following procedures pertain in the event of a spill. 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.

C All ongoing activity must stop in the spill area 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.

C Moving vehicles may create an ignition source for spilled flammable liquids. Stopping all vehicle movement significantly reduces the fire or explosion chances.

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

C Any fuel spill, whatever the amount, must be reported to the proper authorities. The incident must be documented to record the spill details and what was done for cleanup. Section 5003.3.1 outlines additional information for spill management.

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

C 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 emission and noise hazards for nearby 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.

C No heat-producing, welding, cutting or blow-torch open-flame devices should be used inside hangars. Their use is restricted to areas that meet the requirements of a Group F-1 occupancy in the IBC. 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.

C 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. See the commentary to Section 102.7 for information on the proper application of referenced standards and Commentary Figure 2004.7 for an aircraft undergoing maintenance.

CHAPTER

24 FLAMMABLE FINISHES

General Comments

Chapter 24 regulates operations where flammable or combustible finishes are applied by spraying, dipping, powder coating or flow-coating processes. Like all operations involving flammable or combustible liquids and combustible dusts, ignition control and methods of reducing or eliminating flammable vapors or combustible dusts are emphasized. Since ample fuel and adequate oxygen are available in spraying and dipping operations, safeguards must be installed and maintained to prevent fires and manage their consequences. This underscores the importance of proper fire prevention and protection where flammable and combustible coatings are applied using spraying, dipping or flow-coating methods.

Code officials must have an understanding of a coating product's flammable or explosive range. The range is a measure of the percentage of flammable material in relation to air. If there is not enough flammable material, the mixture is too lean to burn; if there is an excess of flammable material, it is too rich. For example, if a match is dropped into a closed jar full of flammable liquids, the match is typically quenched because the fuel-to-air ratio does not allow flammable vapors to ignite; there is not enough oxygen and the mixture is too rich. If the same liquid is poured onto a large surface, such as the floor, the vapors in the air are diluted, so the mixture is too lean. To ignite, the product must fall within its flammable range as provided in the code and on the product's safety data sheet (SDS) (see Commentary Figure 24). The same phenomenon applies to atomization of flammable or combustible liquids where the liquid droplets have a greater surface area in relation to the surrounding air.

Open flames and smoking are prohibited near spray areas and dip tanks. Electrical installations must comply with the requirements of NFPA 70, especially in areas classified as spraying spaces and flammable vapor areas as defined in this chapter.

Good housekeeping and maintenance practices will significantly reduce fuel hazards. Additionally, care must be taken to control the accumulation and dissipation of static electricity. Managing the quantity of flammable and combustible liquids used and stored in and around spraying and dipping operations also discourages ignition.

In addition to this chapter, other chapters such as Chapters 50, 57 and 62 are applicable for additional requirements for storage and handling of hazardous materials that may be used in flammable finishing operations.

Purpose

Compliance with the requirements of this chapter is intended to reduce the likelihood of fires involving the application of flammable or combustible liquids/powders through spraying, dipping or flow-coating operations. Additionally, compliance with the requirements of this chapter will reduce the impact of a fire should one occur. Emphasis is placed on controlling ignition sources, managing the quantity and location of fuels/vapors/dust and maintaining fire protection features.

Commentary Figure 24—Flammable Ranges for Coating Product Examples

PRODUCT (LIQUID)	FLAMMABLE RANGE (%)
Methyl Ethyl Ketone (MEK)	1.4 to 11.4
Acetone	2.5 to 12.8
Denatured alcohol	3.3 to 19.0
Auto body paint (Example #1)	0.9 to 12.8
Auto body paint (Example #2)	1.0 to 19.0
Enamel reducer	1.1 to 12.8
PRODUCT (SOLID)	**FLAMMABLE RANGE (oz. ft^3)**
Electrostatic coating powder (Example #1)	0.2 to 0.7 (20-70 g/m^3)
Electrostatic coating powder (Example #2)	0.2 to 0.7 (20-70 g/m^3)

SECTION 2401—GENERAL

2401.1 Scope. This chapter shall apply to locations or areas where any of the following activities are conducted:

1. The application of flammable finishes to articles or materials by means of spray apparatus.
2. The application of flammable finishes by dipping or immersing articles or materials into the contents of tanks, vats or containers of *flammable* or *combustible liquids* for coating, finishing, treatment or similar processes.
3. The application of flammable finishes by applying combustible powders to articles or materials utilizing powder spray guns, electrostatic powder spray guns, fluidized beds or electrostatic fluidized beds.
4. Floor surfacing or finishing operations using Class I or II liquids in areas exceeding 350 square feet (32.5 m^2).
5. The application of flammable finishes consisting of dual-component coatings or Class I or II liquids where applied by brush or roller in quantities exceeding 1 gallon (4 L).

C This section establishes the applicability of this chapter to a variety of locations, areas, operations and activities involving the hazards of atomizing flammable and combustible liquids and spraying of combustible powders.

It is important to note that spray-finishing activities are not considered "use-open" or "use-closed" operations relative to the maximum allowable quantities (MAQ) per control area given in Chapters 50 and 57. However, storage related to spray-finishing supplies would be regulated by those chapters, which would require applying the MAQ. Code officials should obtain a Hazardous Materials Inventory Statement (HMIS) to establish the amount of hazardous materials stored on-site (refer to the commentary for Appendix H). See Commentary Figure 2401.1.

Commentary Figure 2401.1—Flammable Liquid Spray Application

2401.2 Nonapplicability. This chapter shall not apply to spray finishing utilizing *flammable* or *combustible liquids* that do not sustain combustion, including:

1. Liquids that do not have a fire point when tested in accordance with ASTM D92.
2. Liquids with a flashpoint greater than 95°F (35°C) in a water-miscible solution or dispersion with a water and inert (noncombustible) solids content of more than 80 percent by weight.

C Chapter 24 regulates spray finishing with any material defined as a flammable or combustible liquid by requiring that the spraying operation be confined to either a spray booth, spray room or spray area. Water-based paint products are available on the market that have a flashpoint temperature and meet the definition of a "flammable or combustible liquid" but cannot sustain combustion due to the quantity of inert solids (pigment) and water present in their composition. Many consumers latex paints fall into this category. Always refer to a product's safety data sheet (SDS) for guidance.

This section clarifies that Chapter 24 does not regulate liquids having no fire point and water-miscible liquids with a flash point greater than 95°F (35°C) having an aggregate water and inert solid content by weight of at least 80 percent. Materials meeting these same criteria are exempt from the storage and use requirements in Chapter 57 (see Section 5701.2, Exceptions 7 and 8).

2401.3 Permits. Permits shall be required as set forth in Sections 105.5 and 105.6.

C 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 the commentary to Section 105.5 for a general discussion of operations requiring an operational permit and Section 105.6 for construction permits. The permit process also notifies the fire department of the need for preincident planning for the hazardous property. Because of the extremely hazardous processes described in this chapter, multiple operational permits are required by Sections 105.5.18, 105.5.19 and 105.5.49. A construction permit is required by Section 105.6.22.

SECTION 2402—DEFINITIONS

2402.1 Definitions. The following terms are defined in Chapter 2:

DETEARING.

DIP TANK.

ELECTROSTATIC FLUIDIZED BED.

FLAMMABLE FINISHES.

FLAMMABLE VAPOR AREA.

FLUIDIZED BED.

LIMITED SPRAYING SPACE.

RESIN APPLICATION AREA.

ROLL COATING.

SPRAY BOOTH.

SPRAY ROOM.

SPRAYING SPACE.

C 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, (see also commentaries, Sections 201.1 through 201.4).

SECTION 2403—PROTECTION OF OPERATIONS

2403.1 General. Operations covered by this chapter shall be protected as required by Sections 2403.2 through 2403.4.4.

C This section states this chapter's protection requirements apply to all processes (spraying, dipping and powder coating) contained in this section. The regulation and mitigation of hazards common to all processes described in Section 2401.1 are here.

2403.2 Sources of ignition. Protection against sources of ignition shall be provided in accordance with Sections 2403.2.1 through 2403.2.8.

C Protection against sources of ignition is one of the most critical aspects of fire prevention in flammable finish operations. Flammable finish materials are finely divided or atomized during spraying operations making them much more volatile and subject to ignition. Controlling ignition sources is a preventive measure in a hazardous area where vapors/dusts can exist and potential ignition sources are readily available in the operations (ovens, electrical outlets, static electricity/welding, cutting, etc.).

2403.2.1 Electrical wiring and equipment. Electrical wiring and equipment shall comply with this chapter and NFPA 70.

C To control electrical wiring and equipment hazards, they must meet the requirements of NFPA 70. Those requirements are found in Article 516 of NFPA 70 for areas in and around the spraying equipment. The classification of specific areas within or near coating operations is based on the amount of flammable vapors, combustible mists, residues, dust or deposits present.

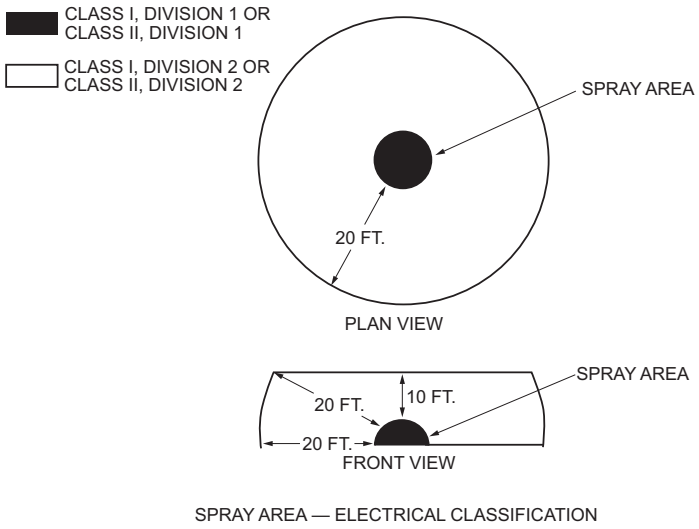
2403.2.1.1 Flammable vapor areas. Electrical wiring and equipment in flammable vapor areas shall be of an explosionproof type *approved* for use in such hazardous locations. Such areas shall be considered to be Class I, Division 1, or Class II, Division 1, hazardous locations in accordance with NFPA 70.

C The areas where flammable vapors [defined as flammable constituents in air that exceed 25 percent of the lower flammable limit (LFL")] are present must meet the requirements for Class I, Division 1 hazardous locations. The areas where com-

bustible residues (such as dusts or deposits) are present must meet the requirements for the Class II, Division 1 (for dusts and residue) electrical classification. This is a very critical aspect of ignition prevention.

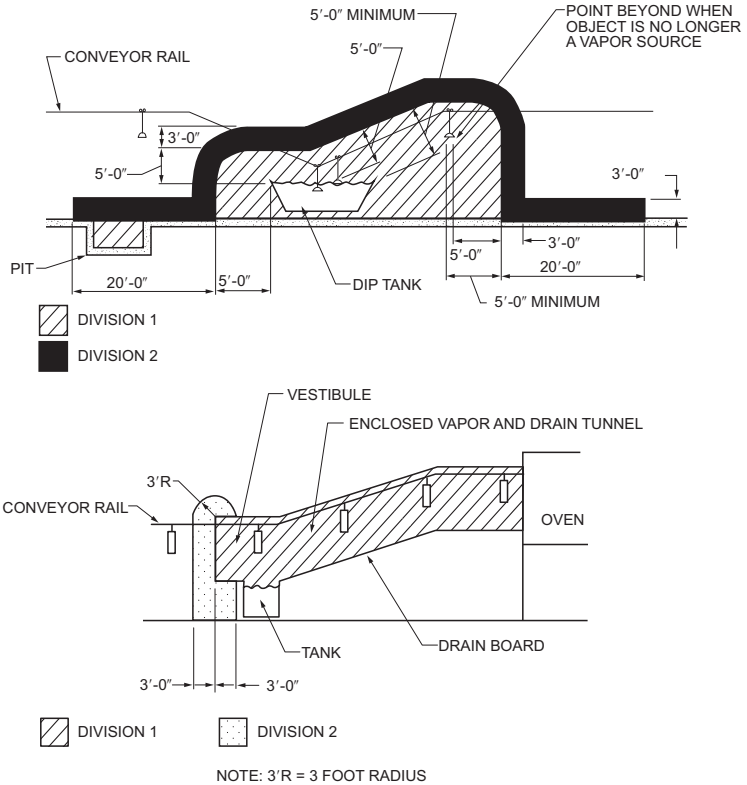
Based on the definition of "Flammable vapor area" (see Section 202), the fire code official is authorized to identify the extent of the flammable vapor area in any specific case. Otherwise, the areas described in the flammable vapor area definition—such as the interior of spray booths—are used for electrical classification. See Commentary Figures 2403.2.1.1(1) and 2403.2.1.1(2) for examples of locations classified according to NFPA 70, Section 516.

Commentary Figure 2403.2.1.1(1)—Flammable Vapor Area—Electrical Classification



For SI: 1 foot = 304.8 mm.

Commentary Figure 2403.2.1.1(2)—Extent of Class I, Divisions I and 2 Locations in Enclosed Coating Process



For SI: 1 foot = 304.8 mm.