**PORTLAND FIRE & RESCUE**

**Fire Design Manual**

**Development Review Process – Scope of Manual**

September 1, 2007 edition

The purpose of this design manual is to assist the design professional in understanding and applying fire regulations related to development in the City of Portland. The manual summarizes the state and local regulations that are applicable in Portland. Though comprehensive, it does not contain all applicable regulations and interpretations.

The manual begins with a summary of fire regulations for development in the City. An overview of the submittal and review processes for land division, building permits and "trade permits" is the next topic. This is followed by requirements for water supply, fire apparatus access and wildland-urban interface issues applied at the time of land divisions and new projects. The final section relates to the regulations of fire protection systems, which are referred to as "Trade Permits."

The hierarchy of regulations is often questioned. In all cases, the following hierarchy is applied by Portland Fire & Rescue: State statutes (ORS); Portland City Code (including Title 31, Fire Regulations) – This includes the Portland Fire Code (adopted within Title 31); State Administrative Rules (OAR); Fire Marshal Policy; and finally the Fire Design Manual. Each of these documents is available for review at our Administrative Office at 55 SW Ash Street. Each document is also available on the Internet with the exception of the complete version of the Portland Fire Code and adopted copyrighted national standards. The Portland Fire Code is a modified version of the International Fire Code, which is a copyrighted document and must be purchased. Those portions that were modified by the State Fire Marshal's Office or the City of Portland are available on the Internet at www.portlandonline.com. A list of Internet sites and retail outlets selling the International Fire Code are listed in the resource list at the end of this document.

This document may be updated periodically. Our goal is to limit changes to twice each year, tentatively scheduled for April and October. Critical changes or interpretations may be released at other times. A posting on the Portland Fire & Rescue website will provide notice of the most recent changes.

Abbreviations used in this document:

| | |
|---|---|
| PCC | Portland City Code |
| PF&R | Portland Fire & Rescue |
| PFC | Portland Fire Code (Locally amended Oregon Fire Code based on International Fire Code) |

# I. Codes, Policies and Standards

## *A. Codes*

### 1. State Fire Laws:

**ORS 476.030 contains the rules for maintenance and regulations of structural fire safety features in existing occupied structures and directs the means and adequacy of exits in case of fire. Except in buildings declared an "Extreme hazard to life", State Fire Laws do not require structural changes in buildings that have been built, occupied and maintained in conformity with state building code regulations applicable at the time of construction. Fire system installations or upgrades may be required in existing buildings to meet minimum life safety criteria.**

**The City of Portland has specifically adopted the following State Laws (ORS) and Administrative Rules (OAR) to be administered under the City's authority:**

Oregon Revised Statutes (ORS):

162.225, 162.235, 162.375, - OBSTRUCTING GOVERNMENTAL ADMINISTRATION

476.005, 476.010, 476.150 through 476.290, 476.380, 476.715, State Fire Marshal; Protection From Fire Generally

478.960, 478.960 Burning of certain materials permitted only with permission of fire chief; burning schedules and restrictions (Outside the city in contract areas)

479.015 through 479.170, 479.190, 479.195, 479.210 through 479.300, 479.990(6), and Protection of Buildings From Fire; Electrical Safety Law

All of ORS 480 except 480.350, 480.355, 480.375(2), 480.432 through 480.440. Explosives; Flammable Materials; Pressure Vessels

State Fire Marshal Administrative rules (OAR) administered by PF&R:
OAR 837 - Division 12, Public Display of Fireworks in Oregon
OAR 837 - Division 20, Flammable and Combustible Liquids
OAR 837 - Division 30, Liquefied Petroleum Gas, Sections 837-30-0140 through 0180 and 837-030-0230
OAR 837 - Division 41, Fire Protection Regulations Relating to Institutional Care Facilities - Exitway Protection
OAR 837 - Division 45, Smoke Detectors

In the referenced ORS's and OAR's, where reference is made to the State Fire Marshal, the term "City Fire Marshal" shall be substituted for it.

**2. Fire Regulations – Portland City Code Title 31 (View at www.portlandonline.com; select "Charter, Code and Policy Documents," then select Portland City Code)**

**3. Portland Fire Code, effective 6/28/2006 – (Oregon Fire Code, 2004 edition with local amendments – see local amendments in Appendix A)**

**4. Building Codes**

**a) Commercial Building Code - Oregon Structural Specialty Code, Effective October 1, 2004 with mid-cycle amendments effective 2/1/2006.**

**b) Multi-family (1 – 3 story) – Oregon Residential Code, Effective April 1, 2005. (See especially Appendix AN 103.2.2 and AN109 for sprinkler requirements in apartments. City of Portland has adopted a state-approved local amendment AN109.4 that requires all R-2 (apartments and condominiums) to be sprinklered except buildings of 1 story with not more than 16 units (PCC 24.10.040 D).**

**5. Standards - SEE PFC Chapter 45 and PCC Fire Regulations Title 31.10.050(F) and (G).**

**PFC Chapter 45 specifies the standards and specific editions that**

**have been adopted. PCC 31.10.050 (F) allows an owner with the approval of the Fire Marshal to use a more current edition of an adopted standard. PCC 31.10.050 (G) allows the Fire Marshal to use other nationally-recognized standards as guidance in situations where adopted codes and standards do not specifically address an issue.**

6. **Policies:**

   **Policies that provide guidance in the development design and review process are approved by the Fire Marshal and are published on the City's website at www.portlandonline.com under the title of Portland Policy Documents. This webpage (http://www.portlandonline.com/index.cfm?c=27890) also includes links to the Oregon Revised Statutes (ORS) and Oregon Administrative Rules (OAR's) that are referenced above.**

# II. Review process and submittal criteria

## *A. Land use issues.*

**PF&R reviews most land division and some land use applications. Our review and comments highlight fire regulations applicable to the specific project. The comments are incorporated in the Planning staff and Hearings Officer reports produced by the City's Land Use Review staff. The focus of the PF&R review is fire apparatus roads (width, grade, turning radius, angles of attack and departure, surface material, parking, proximity to potential structures, dead ends and number of access points), water supply for firefighting purposes and in some portions of the city, Wildland Urban Interface fire protection issues. Design standards that apply to streets (public and private) and water systems are identified in the Hearing Officer's Final Land Use Decision. Generally road and water system requirements found in the PFC are specified in the report, however, in some cases Portland Department of Transportation street design standards are adopted in lieu of PFC requirements.**

**Most requirements related to land use issues are found in Chapter 5 of the PFC (Fire Service Features) and further detailed in Appendix D of the Fire Code. Additional details are published in the "Fire Code Applications Guide, Portland edition." This document, amended by PF&R, is a compilation of interpretations of the fire code typically used by Portland-metro area fire agencies. This document is attached as Appendix B of this design guide. Another useful document for public streets is Portland Department of Transportations Design Guide for Public Streets, which may be found at: http://www.portlandonline.com/auditor/index.cfm?a=40389&c=27478.**

## *B. Alternate Methods - Appeals*

**Alternates to fire service requirements must be approved through the Fire Code Appeals process. (See Appendix C for a description of that process.) If an alternate involves installing a fire sprinkler system in a one-or two-family dwelling to be built on a new lot that requirement must be recorded on the property deed. Instructions for this requirement are contained in**

**the appeal result. This requirement must also be displayed on the final plat. If the requirement involves installing a public hydrant, proof of payment for the hydrant is required to satisfy the condition prior to final plate approval.**

**See also item E of this document for specific Policies relating to roads, water supply, hydrants and wildfire urban interface requirements. Questions regarding this process or the technical requirements may be directed to PF&R Fire Land Use Reviewer Dawn Krantz at 503.823.3718.**

## *C. Building Permits*

**PF&R reviews and approves fire code related issues during a building permit review process. The PF&R review is integrated in the building department's review process. PF&R staff will issue checksheets to the applicant if clarification or changes are required in the design or specifications. When all requirements are met, PF&R approval is recorded in the building departments permit system. The status of the review may be checked through the City's website, at www.portlandmaps.com. From the PortlandMaps screen, enter the property address and select "permit cases" option on the menu header to see the status of a permit.**

### *PF&R reviews permits for the following projects:*

1. **All commercial building permits.**
2. **Mechanical permits associated with fire related issues.**
3. **Certain new one-and two-family dwelling permits and other "R3" occupancies with three or more attached units (rowhouse and townhouse).**
4. **"R2" apartments permitted under the requirements of the Oregon Residential Code (alterations, additions and new).**
5. **Private streets serving residential or commercial properties are reviewed as a separate Site Development permit.**

***Fire protection design documents are not required to be submitted with the building permit. However, the building permit submittal shall include fire system type, design specifications and extent of all fire systems (either required or provided). Details that are integral to the building or occupancy shall be detailed on the building permit.***

**Examples of details (when applicable) to be included on building permit plans:**

- ✓ **Size of water tank providing secondary water supply (see Highrise design criteria for sizing requirements).**
- ✓ **Fire apparatus access roads.**
- ✓ **Hydrants (public and private).**
- ✓ **Warehouses with ceiling heights exceeding 14 feet shall specify the anticipated commodity to be stored in the building. If an "S" occupancy is to be considered to not have high-piled storage, the owner shall sign a statement acknowledging that storage of ordinary combustibles shall not exceed 12 feet in height, and some high hazard commodities may be limited to not more than 4 feet in height. Fire Marshal Forms "High-Piled Storage Statement of Understanding" (See Appendix E) can be used for this requirement.**
- ✓ **Summary of fire protection system type, design specification and extent of system.**
- ✓ **In buildings protected by sprinkler systems, specifications shall indicate how the requirement for monitoring of signals will be accomplished.**
- ✓ **For Residential permits, submittal of sprinkler plans shall accompany the building plans.**

**Fire systems plans and calculations including private underground mains and hydrants are a deferred submittal and processed as a PF&R**

**"Trade Permit." These systems require a separate permit from the Fire Marshal's Office. The system scope and design should be consistent with the general system specifications included in the building permit. The building permit is approved and issued with the condition that a separate permit is required from the Fire Marshal's Office for the systems. The filing and processing of the deferred permits is discussed below in the "Trade Permits" section.**

## *D. Trade Permits*

There are two distinct systems for applying and processing fire trade permits.

- **TRADITIONAL PERMITS**

  Traditional Fire Trade permits are processed at our Gideon Street Office, 1300 SE Gideon.

- **FACILITY PERMITS**

  Facility Program permits are processed through the 6th floor Facility Program Office at 1900 SW 4th.

Check with the General Contractor to determine which system you should use. High-rises, Business Parks, Hospitals, Campus and other buildings that have frequent tenant improvement work are typical buildings with permits processed in the "Facility Program." Buildings in the Facility Program are registered by the owner, and permit fees are normally based on actual time for review and inspection multiplied times the hourly rated.

Fee tables and instructions can be found at www.portlandonline.com/fire and then click on the SERVICES tab and select either the "Permits and Forms" or "Fee Schedule." The Fire Permit Techs at 503.823.3712 can also provide this information**.**

1. **Application and Fees (Applies to Trade Permits in both the Traditional and Facility Permit Programs)**

**When is a Trade Permit application needed?**

**Answer:** A trade permit is the process used by the Fire Marshal's Office to review and give approval to install fire systems. An approved Trade Permit is required before a fire protection or hazardous material piping or storage system is installed, altered, removed or replaced. Medical gas systems for use on humans are no longer reviewed by the PF&R but are permitted through the City's plumbing department. Similar systems for use on animals are reviewed and permitted through the Fire Marshal's Office.

**A Fire Trade Permit is required to install, alter, remove or replace the following fire systems:**

- Fire Sprinkler Systems
- Private Fire Hydrants
- Underground pipe supplying water-based extinguishing systems
- Fire Alarm Systems
- Fixed Extinguishing Systems
- Storage and piping supplying hazardous material systems including flammable and combustible liquids
- Medical Gas systems used on animals (non-human). Medical gas for humans is regulated through the Plumbing Code and requires a plumbing permit
- Pre-manufactured paint booths

**Who may submit applications?**

**Answer:** The property or business owner, developer, design professional, general contractor or sub-contractor may submit an application.

**Can I begin work once a permit is submitted?**

**Answer:** No, except for "over the counter" permits, which require no plan review.

A Plan review is required for all trade permits, except for sprinkler permits, for the relocation of 10 or fewer heads when the following conditions apply:

1. Scope of work is limited to the addition or relocation of 10 or fewer sprinkler heads.
2. Area of work is described in the permit application in such detail that it can be located during future reviews.
3. Piping only involves branch lines or piping directly connected to sprinkler heads or connected through arm-overs. (Addition of flex-heads is not allowed without plan review.)
4. Area is currently protected.
5. Work does not create a new hydraulically-remote area.
6. No change in hazard classification or commodity configuration.

Sprinkler installation not requiring plans. When plans are not required, the installer assumes the responsibility for correct design. Work will be reviewed and verified at time of inspection. We reserve the right to require plans and calculations if any of the above items are questioned.

The permit fee will be doubled if work is initiated without obtaining a permit.

**How do I obtain an application?**

**Answer:** Trade Permit applications may be obtained from the Fire Marshal's permit office at 1900 SE Gideon or by calling 503.823.3712. They are also available on the **C**ity website at

http://www.portlandonline.com/fire. Select "Services" from the menu bar at the top and then select from the sidebar "Specific Permits and Downloadable Forms." Both Traditional and Facility Program permit applications are available on the website.

## 2. Submittal criteria

### Minimal Submittal Criteria are:

- Complete Application
- Permit and Plan Review payment
- Minimum of two sets of plans drawn to scale (maximum of three plans will be stamped and approved.). Plans shall be of a scale and clarity that they may be reproduced from microfiche.
- One set of supporting documents (product cut sheets, calculations, approved appeals).
- A copy of any building or fire appeal that affects the fire protection system design.
- A building code summary stamped by the architect or engineer of record for new buildings or change of occupancies.

In addition to the above, you may be asked to produce a bid document or cost estimate to verify the job value reported on the application.

Depending on the type of permit, the following supporting documents or calculations must accompany the application:

NOTE: As Built plans must be submitted prior to final inspection where the installation varied from the plans submitted for review.

### Additional Submittal Criteria based on type of fire protection system:

### Sprinkler:

- Plan sets shall include the following depending upon scope of work:
    - Site plan including the closest public fire hydrant for new systems

  - Reflected ceiling plan
  - Elevation
  - Riser detail
  - Details, as needed, to describe unusual situations
  - Areas of voids shall be described
  - Unheated areas shall be identified
  - Obstructions shall be drawn on plans
- Hydraulic calculation sheet for all new and additions. Unless otherwise approved by the Fire Marshal's Office, the calculations must be submitted in the format similar to that shown in Appendix D of this document. Calculations are not required for alterations that do not change the remote area, protect the same hazard class and utilize sprinkler heads with the same K factor and temperature rating.

- Portland Water Bureau flow test sheet must accompany all hydraulic calculations. All systems must be designed using 80% of the normal maximum static pressure unless otherwise approved by the Fire Marshal's Office. Tests must be less than five years old or be a "modeled" flow calculation.

### Underground Piping w\ or w\out Private Hydrants

- Plans shall detail all necessary features relating to the scope of the permit application, including fire department connection, hydrant, back flow prevention, thrust restraints, valves, pipe size and specifications, depth of bury, etc.
- Design parameters for piping such as design flow requirement for fire hydrants or sprinklers
- Calculations for thrust restraints shall be provided
- Closest public hydrant

### Fire Alarm

- Locations of alarm-initiating and notification appliances
- Manufacturers, model numbers and listing information for equipment, devices and materials
- Reflected ceiling plan
- Ceiling height

- Labels on each room identifying its use
- Location of inlet and outlet HVAC vents
- The fire protection objective, if full coverage system is not provided
- Building details affecting detector and notification placement
- Alarm control and trouble signaling equipment
- Annunciation
- Power connections
- Conductor types and sizes
- Battery calculations and voltage drop calculations shall be provided
- Age of the battery. Batteries over three years old shall either be replaced or a draw down test performed to validate sufficient battery capacity still exists
- Interface of fire safety control functions
- Types of building construction and occupancy

**Fixed Extinguishing Systems**

- Provide a "plan view" showing equipment layout, location of manual pull station and attachment to fire alarm panel if one exists

**Flammable and Combustible Liquids and Hazardous Material Systems**

- Details on plans shall include site plan and all adjacent property lines. Diagrams of tanks shall indicate their capacity. Specifications of relief valves shall be provided.

**Pre-manufactured Paint Booth**

- Plans shall show building floor plan and location of booth. Plans shall show vent outlet and property lines. Where required, the specifications of the extinguishing system that will be provided shall be shown.

## 3. Permit Issuance

Upon approval of the plan review, PF&R will issue a permit, which indicates work may be initiated. The approved permit and plans will be mailed to the applicant unless pick up is preferred. The permit shall be displayed at the job site. The set of approved plans shall be available at the job site. (Permit fee

will be doubled if work is initiated prior to issuance of the permit.)

### 4. Permit Duration

The permit shall remain valid as long as work is in progress. If there is a lapse in work for more than 180 days, the permit may be cancelled. A period of 180 days without a request for an inspection is considered a lapse in work progress. If a permit is cancelled, a new permit must be applied for and purchased. If the scope of work has not changed, a new plan review will not be required.

### 5. Work to be done by certified or qualified individuals.

A competent individual must do work authorized by a fire permit. A journeyman or low-energy electrician must install fire alarm systems. Sprinkler Systems, Underground Fire Mains and Fixed Systems must be installed by or under the direct on-site supervision of an individual with an appropriate certificate of fitness issued by PF&R.

### 6. Inspection Test and Acceptance Criteria

The required inspections will be noted on the plans or approved permit. To assure an inspector is available, an inspection request should be requested 24 hours in advance of the desired schedule. The inspector will honor inspection requests received by 8am the day of the inspection if they have available time on their schedule. Requests should be cancelled by contacting the inspector if the project is not ready for the inspection. You may be charged a reinspection fee if you are not ready when the inspector arrives. For fire alarm systems, a copy of the "Record of Completion" must be received by the Inspector before they will schedule an appointment.

| GENERAL INSPECTION REQUIERMENTS | | | | | |
|---|---|---|---|---|---|
| Type of Fire Trade Permit | Inspect Restraints/Cover | Hydrostatic/ Integrity | Flush | Approved to cover | Final |
| Fire Sprinkler | | X | X | X | X |
| Underground and Private Hydrants | X | X | X | | X |
| Fire Alarm Systems | | | | X | X |
| Fixed Systems | | | | | X |
| Hazardous Material Piping and Storage | | X | | X | X |

**7. Fees – In most cases the fee is based on the value of work being performed.** For Fee tables visit our website at: http://www.portlandonline.com/auditor/index.cfm?a=128619&c=43028

# CALCULATION METHOD FOR TRADITIONAL FIRE PERMITS:

**SPRINKLER AND UNDERGROUND FIRE MAIN CALCULATION INSTRUCTIONS:**

1) Multiply Square Feet of sprinkler work times 1.33.

_____ Sq. Ft. X 1.33 = _____ (valuation)

2) Compare the valuation from step 1) with your contract valuation. Use the greater of the two to determine the Permit Fee.

3) PERMIT FEE CALCULATION (refer to Table 40-D)

$ _____ (Base fee for first $ _____ of valuation)
+ _____ ($ _____ per _____ beyond base fee)
= _____ (Subtotal A)
X 1.65 (Plan Review charge. If permit is to be doubled, use 2.65 as multiplier)
= _____ (Subtotal B)
+ _____ Add microfilm charges
+ _____ 8% Surcharge fee for State Building Codes Agency (Subtotal A x 8%)
= _____ TOTAL DUE FOR THIS PERMIT

**FIRE ALARM, FIXED SYSTEM AND FLAMMABLE\HAZARDSOUS MATERIAL PERMIT CALCULATION INSTRUCTIONS:**

PERMIT FEE CALCULATION (REFER TO TABLE 40–E FOR FIRE ALARM AND FIXED SYSTEM AND TABLE A FOR FLAMMABLE\HAZARDSOUS MATERIAL PERMIT)

$ _____ (base fee for first $ _____ of valuation)
+ _____ ($ _____ per $ _____ beyond base fee)
= _____ (subtotal a)
x 1.65 $1.65 (Plan review charge. If permit is to be doubled, use 2.65 as multiplier)
= _____ (subtotal b)
+ _____ (add microfilm charges)
= _____ Total due for this permit

**FACILITY PROGRAM FEES:** Plan review, inspection and consultation services are billed at the facility rate of $142 an hour for valuations of less than $600,000. Jobs exceeding $600,000 are charged based on traditional fee tables.

## *E. Policies – Requirements related to:*

### 1. Land Division and Site Development

#### a) Fire Department Apparatus Access

##### (1) *Design Standards Adopted*

Public Streets and Roads – Approved by Portland Department of Transportation with advice and consultation from PF&R. See "Design Guide for Public Streets." Available at: http://www.portlandonline.com/auditor/index.cfm?a=40389&c=27478.

Private Streets and Roads that are designated Fire Access Roads– See Section 503 and Appendix D of Portland Fire Code, 2006 edition.

Bridges (Private) – "Standard Specification for Highway Bridges, 16th edition-with 1997 through 2000 Interim Revisions."

Specific Portland Fire Apparatus design details:

| Design Feature | Engine | Ladder Truck |
|---|---|---|
| AASHTO Vehicle Design Standard | HS 25 | HS 25 |
| Turning Radius | | |
| Inside | 25' | 25' |
| Outside | 38' | 45' |
| Gross Vehicle Weight | 37,000 | 58,000 |
| Axle Weight | | |
| Front | 17,400 | 17,000 |
| Rear | 20,260 | 21,000 |
| Point Load | | <68 psi |
| Length | 30' | 54' |
| Angle of Approach and Departure | $9^{O}$ | $9^{O}$ |

PF&R comments for Land Use recommendations are based on Section 503 and Appendix D of Portland Fire Code. Where a public street is proposed, the specification is advisory to the Planning Bureau.

**(2)** ***Access to Structures***

**See Portland Fire Code Sections 503 and 504, Appendix D 104 -107 and Fire Code Applications Guide – Fire Apparatus Access.**

Section 503 requires a fire apparatus access road to be within 150 feet of all portions of a building. Where a building is protected with an approved fire sprinkler system, the maximum distance is increased to 250 feet.

**Additional Interpretation Regarding Access to Structures:**

When two apparatus access roads are required (D104.1, D104.2, D105.3, D106.1, D106.2 or D107.1), there must be at least two access paths from the fire station to the building or facility. A single access path may be approved through the Fire Code Appeals process when the Fire Marshal determines that adverse conditions are unlikely to exist. At the point of connection between the public or private street and the site or neighborhood served, the two connections must be separated by at least 1\2 the diagonal of the area being served.

**Multiple-Family Residential Developments** – Multiple-family residential buildings exceeding 30 feet in height are considered "Commercial" for the purpose of Appendix D, and the provisions of D104 shall apply. For example: If a fully sprinklered apartment complex has a 40' tall 4 story apartment building with 64 units and two / two-story apartment buildings with 17 units each, two access roads to the four-story building

will be required. A single fire access road may serve the two-story apartment buildings.

**b) Water for fire fighting**

**(1)** ***Fire Flow – Except as noted in (a) and (b) below, see Portland Fire Code Appendix B***

**The minimum fire flow is 1,000 gpm for R3 dwellings** where the entire structure is not more than 3,600 sq.ft. and **not** located in a Wildland Urban Interface Zone. The duration is a minimum of two hours. (This includes rowhouses with a combined structure area, cumulative of all attached houses, of not more than 3,600 sq.ft.).

**R3 dwellings in a Wildland Urban Interface Zone** where the entire structure is not more than 3,600 sq.ft., the minimum fire flow is 1,750 gpm for a duration of two hours. (This includes rowhouses with a combined structure area of not more than 3,600 sq.ft.).

(See Zone map in www.Portlandmaps.com to determine if a property is within Wildland Urban Interface Zone.)

**(2)** ***Hydrant location and number available –***

**Other than one-and two-family dwellings.** All portions of a building shall be within 400 feet (600 feet for buildings with complete sprinkler systems complying with NFPA 13 or 13R) of a hydrant on a fire access road. Where existing hydrants are not sufficient, additional hydrants shall be installed to comply with Portland Fire Code Appendix C.

**One-and two-family dwellings.** All portions of dwellings shall be within 600 feet of an existing hydrant on a fire access road, or additional hydrants shall be installed to comply with Portland Fire Code Appendix C.

**Note regarding hydrant placement: Along public and**

**private streets, it is preferred to locate hydrants at intersections. Placement of hydrants at the end of dead streets should be avoided.**

## 2. Requirements related to: FIRE PROTECTION SYSTEMS GENERAL

### a) Who can design fire protections systems?

Pre-engineered Systems – Contractor shall have received training from the manufacturer.

Fire Alarm Systems – Engineers, Contracting Electrician, Technicians with NICET Level III or IV, or any individual that demonstrates specific knowledge of fire alarm systems and NFPA 72.

Sprinkler Systems and Underground Fire Mains – Engineers, Technicians with NICET Level III or IV, or any individual that demonstrates specific knowledge of sprinkler systems and Portland Fire Code Chapter 9, NFPA 13, 13R, NFPA 14, NFPA 20, NFPA 22 and NFPA 24.

Flammable Liquids and Hazardous Materials - Engineers, Technicians with NICET Level III or IV, or any individual with specific knowledge of flammable liquids, hazardous materials and Portland Fire Code Chapter 27 and other relevant Chapters.

### b) Who can install fire protection systems?

Installers of all permitted systems shall have specific training in the systems they are installing. Specifically installers shall have the following:

- Fire alarm systems installers shall be electrician journeyman or low energy license.
- Sprinkler Systems installers shall have a certificate of fitness from Portland Fire & Rescue or be certified at a NICET III or IV.

- Underground fire main installers shall have a certificate of fitness for sprinklers or underground fire mains or have appropriate NICET III or IV certification.
- Flammable Liquids or Hazardous Materials – demonstrate knowledge of codes and installation techniques.

**3. Requirements related to:**

**Water-Based Extinguishing systems (Sprinklers, Standpipes, Fire Pumps, Private Hydrants)**

**a) Standards**

**(1)** *Low Expansion Foam. NFPA 11, 2002*

**(2)** *Medium- and High- Expansion Foam. NFPA 11A, 1999*

**(3)** *Installation of Sprinkler Systems, NFPA 13, 2002*

**(4)** *Installation of Sprinkler Systems in One- and Two- Family Dwellings and Manufactured Homes, NFPA 13D, 2002*

**(5)** *Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height, 13R, 2002*

**(6)** *Installation of Standpipe, Private Hydrants and Hose Systems, NFPA 14, 2003*

**(7)** *Water Spray Fixed Systems for Fire Protection, NFPA 15, 2001*

**(8)** *Installation of Foam-Water Sprinkler and Foam-Water Spray Systems, NFPA 16, 2003*

**(9)** *Installation of Stationary Pumps for Fire Protection, NFPA 20, 2003*

**(10)** *Water Tanks for Private Fire Protection, NFPA 22, 2003*

**(11)** *Installation of Private Fire Service Mains and their Appurtenances, NFPA 24, 2002*

## b) FAQ Design questions about Water-Based Extinguishing Systems

### (1) *Are Plans required on all permits?*

Yes, except alteration of sprinkler systems that meet the following criteria do not require plans or a plan review.

1. Scope of work is limited to the addition or relocation of 10 or fewer sprinkler heads.
2. Area of work is described in the permit application in such detail that it can be located during future reviews.
3. Piping only involves branch lines or piping directly connected to sprinkler heads or connected through arm-overs. (Addition of flex-heads are not allowed without plan review.)
4. Area is currently protected.
5. Work does not create a new hydraulically-remote area.
6. No change in hazard classification or commodity configuration.

**Sprinkler installation not requiring plans.** When plans are not required, the installer assumes the responsibility for correct design. Work will be reviewed and verified at time of inspection. We reserve the right to require plans and calculations if any of the above items are questioned.

### (2) *When are hydraulic calculations required with plan submittals?*

Hydraulic calculations shall be submitted for new systems, additions or where design criteria requires a higher density than verified through previous calculations.

### (3) *What is required to document available water supply?*

For systems served by Portland Water Bureau, flow test results shall be submitted on their Flow Test Result form. Call 503.823-1408 to request Fire Flow information. Allow two days processing time for the Water Bureau. Tests that are over five years old must be re-validated by the Water Bureau. At the bottom of the form, it will specify the available pressure and flow that should be used in the design. Different results may only

be used with prior approval from the Plan Review Supervisor. The Plan Review Supervisor may grant variations if discussions with Water Bureau staff provide confidence that fluctuations in static pressure will be unlikely.

### (4) *Must the system demand requirement be a minimum amount below the system supply?*

The system demand including hose must be on or below the line representing the adjusted flow test provided by Portland Water Bureau. For systems not served by Portland Water Bureau, the available system pressure at the required flow demand including hose must be more than 10% or 5 psi more than the required system pressure.

### (5) *Where should the fire department connection be located?*

Where the backflow vault is located at the street, the fire department connection shall also be located in that vicinity unless otherwise approved by PF&R. In other cases, the FDC will be located as required by the Fire Marshal's Office. A public hydrant shall be located with 150 feet of the FDC except as allowed by the Fire Marshal's Office.

### (6) *Design and installations shall provide for acceptable means to tests backflow devices at system demand. (NFPA 13:515.4.6.1, 1999 ed. What are acceptable means to do this?*

Discharge to either an interior drain or to the outside is acceptable. Unless contract documents indicate otherwise, PF&R requires the Sprinkler Design professional to provide test capability for the backflow device in their design. If interior drains are utilized, they shall be designed to accommodate full design flow including hose. If FDC will be utilized, it must be sized to accommodate testing at full flow**.**

### (7) *When are floor control valves required?*

Where a combination standpipe and sprinkler system is installed, floor controls valves are required on the sprinkler system. NFPA 14:4-2.5 "Valves on Combined Systems."

### (8) *When are fire sprinklers required in residential properties?*

The answer varies depending upon the building code under which the project was permitted. The answer is dependent upon the requirements in the OSSC (Oregon Structural Specialty Code, based on IBC), the ORSC (Oregon Residential Specialty Code, based on the IRC), or the Appendix of ORSC.

The general requirements are as follows:

- **OSSC** (apartments or condos more than three stories, mixed use, residential buildings within internal corridors): A Sprinkler system shall be installed throughout a building that contains a Group R fire area. If the building is of mixed use, the system shall meet NFPA 13 standard. The exception to this is if the Group R fire area qualifies for "separated occupancy" according to OSSC 508, and the dwelling area is within the scope of NFPA 13R.
- **OSRC** (apartments up to three stories without internal exits): All Group R2 occupancies (non-transient residential occupancies) shall be protected with an NFPA 13R sprinkler system (ORSC AN109.4.2). Single-story buildings not containing more than 16 units are exempt from this sprinkler requirement. Through adoption of PCC 24.10.40 D, the City of Portland has included the local option provided in the ORSC. (See below for sprinkler provisions for Rowhouse and Townhouse.)

### (9) *What Sprinkler standard is used for a Rowhouse IRC appendix AO 103.5.2 and 103.5.3?*

Row houses are individual attached dwellings with property lines between each unit. The sprinkler requirements vary depending on whether the structure is structurally dependant on the adjacent structure.

Structurally independent row houses are not required by the building code to be sprinkled. If sprinklers are provided, voluntarily or by appeal, NFPA 13D is the appropriate standard. Systems are permitted and reviewed through the City's Plumbing department.

A structurally dependent rowhouse shall be sprinkled to the NFPA 13R standard.

In Portland, the Water Bureau does not allow a water service to cross a property, therefore, each unit must have its own water service supplying the sprinkler system.

### (10) *What design information is required for Storage Occupancies (High-Piled Storage)?*

Storage occupancies with ceilings over 14 feet shall be designed for high piled storage unless accompanied by letter from the owner specifying how they will maintain storage

below 12 feet. (See Appendix E document.)

Hose and hose valves are required for all areas with high-piled storage larger than 2500 sq.ft. The hose may be omitted in Class 1 and 2 commodities. Hose station locations and rack storage layout shall be shown on sprinkler drawings. (NFPA 13:12.2)

All racking permits for areas larger than 2500 sq.ft. shall include a fire hose layout, which will demonstrate that all floor area can be reached with a 30-foot stream at the end of 100 feet of hose. The hose to be routed along aisles and cross-aisle, not through racks.

### (11) *Are standpipes required to go to the roof (PIFC 905.4)?*

Buildings requiring standpipes—top floors over 30 feet above fire access and with roof slopes less than four units in 12—are required to have at least one standpipe that terminates on the roof. The standpipe selected to service the roof shall:

- Be the most hydraulically remote, to facilitate periodic testing or as approved by the fire official.
- Equipped with a two-way hose connection, for testing purposes.
- Have a freeze proof valve operable from the roof (without entering a hatch or doorway that may be locked).
- Have a facility for draining the non-tempered portion of the standpipe piping.
- Have a facility for dealing with the 500 gallon per minutes of test flow.

### (12) *What about subsequent standpipes?*

Unless there are portions of structure or roof-mounted equipment further than 200 feet from the rooftop standpipe, other required standpipes may terminate at the top stair landing.

### (13) *Stair enclosure standpipe hose connection location, and valve installation?*

- We prefer that the hose connection be on the floor landings, not the intermediate landings outlined in 905.4-1.
- Hose connections shall be oriented to allow for ease of connecting and operating fire hose. Valve orientation that could cause kinking or undue stress on the hose will not be approved.
- An angled orientation (approximately 45o from the floor plain) works best.

### (14) *What is the standpipe design demand?*

The standpipe demand is 750 gpm for two-stair enclosures or 1,000 gpm for three or more stair enclosures. Residual pressure at the top outlet (normally the roof) shall be a minimum 100-psi.

### (15) *When multiple pumps are provided or required, are there sequencing requirements on pump starting?*

Yes. Sequencing of pumps is required by NFPA 20:10.5.2.5. "The controller for each unit of multiple pump units shall incorporate a sequential timing device to prevent any one driver from starting simultaneously with any other driver. " Where dry pipe systems are served by fire pumps, make sure the timer allowing a second pump to start is set to allow the dry pipe system to fill and the pressure to stabilize before a second pump is called to start.

### (16) *Where Gen-sets are provided, for secondary power to electrical driven fire pumps, are lock out mechanisms allowed or required?*

Where a Gen-set is sized to operate a single pump, which is sized to supply the maximum flow requirement and multiple pumps are provided for redundancy, it is acceptable to provide a "lockout" programming or relays within the controller to prevent the start of the second pump until the first pump is taken off line.

### (17) *When are decks and balconies required to have Sprinkler coverage?*

In buildings with sprinkler systems designed to NFPA 13R standards, the PFC adds an additional requirement for balconies and exterior decks. See below for criteria in buildings with systems designed to NFPA 13 standard and with decks where barbecues may be used.

> **NFPA 13R:** Sprinklers shall be provided for exterior balconies and decks and ground floor patios of dwelling units in buildings of Type V construction protected by NFPA 13R systems. (PFC 903.3.1.2)
>
> **NFPA 13:** Also, Sprinklers shall be provided for exterior balconies and decks of dwelling units in buildings protected by NFPA 13 systems, unless the area is small enough that in the opinion of the fire official it is deemed unusable for cooking. The basis of this requirement is that most decks are usable for barbequing, which is outside the scope of the sprinkler omission in NFPA 13.

### (18) *When are sprinklers in elevator shafts and elevator machine rooms required?*

The criteria for omissions, as well as special considerations for installation of sprinkler systems protecting elevator shafts and equipment rooms, are explicitly spelled out in NFPA 13: **8.14.5 Elevator Hoistways and Machine Rooms.** (See NFPA 13 Appendix for detailed explanation.)
Sprinklers shall be installed within two feet of the bottom of hydraulic elevators unless specific information is provided to assure that non-combustible hydraulic fluid will always be used. When a sprinkler is installed in an elevator pit, the pit is normally required by the Plumbing Code to have a drain sufficiently sized to accommodate the flow.

Sprinklers are not required in the top of passenger elevator shafts. They are required in machine rooms. The Fire Marshal retains the right for non-passenger elevators and other unusual circumstances to require sprinklers at the top of elevator shafts. When sprinklers are installed in either the top of the shaft or in machine rooms, the requirements of ASME A17.1 must be complied with. Generally, this requires homing the elevator and disconnecting power prior to water flow.

### (19) *What Seismic issues are related to sprinkler systems?*

Unless otherwise determined by the building official, the site classification for all locations in Portland is D.

Holes in suspended ceilings shall allow 1" lateral movement without impacting the sprinkler head.

Exception:

1. Ceilings less than 144 sq. ft.
2. Rigid braced ceilings
3. Sprinkler head is provided with a listed flexible connector capable of accommodating 1" ceiling movement.

### (20) *Can a coupling on the FDC inlet be smaller than 2 ½" on a NFPA 13R system?*

No. All FDC inlets shall be standard 2 ½" couplings.

## *Highrise Buildings – Sprinklers and Standpipes*

### (21) *When will a single fire pump design be acceptable?*

In buildings 16 stories or less, where the pump takes suction from an onsite water supply tank a single pump may be used. When a single pump is provided, backup pump capacity shall be designed such that a single engine can deliver the design flow from the municipal supply.

### (22) *What is the design capacity for a single pump?*

The pump shall be sized to meet the greater of standpipe demand or maximum hazard class sprinkler design plus 100 gpm inside hose (at 100 psi), which ever is greater.

### (23) *If two pumps are required or provided, must their rated capacities be the same?*

No. At least one pump shall be sized to the greatest of standpipe demand or sprinkler demand plus 100 gpm inside hose. The second pump shall be sized to at least provide sprinkler demand plus 100 gpm inside hose (at 100 psi).

### (24) *Can one pump take suction from a tank and the other take suction from the public water supply?*

No. Both pumps must take suction from the onsite water supply.

### (25) *Can the maximum sprinkler demand be based on design densities of upper floors when calculating the size of onsite water supply?*

Normally, the design densities for upper floors are lower than the basement or first floors based on use of these areas. Onsite water supply shall serve all portions of the system, including parking and ground floor retail spaces. Therefore, the maximum system demand must be based on the maximum hazard class regardless of where it is located.

### (26) *When are PRV's required on hose outlets?*

PRV's are required on hose outlets whenever the static pressure exceeds 175 psi static. When PRV's are installed, the outlet residual pressure shall be set at between 125 and 150 psi. (NFPA 14: 7.2.1)

### (27) *What is the minimum size drain? Are there any special requirements associated with the drain?*

Where PRV's are installed the minimum drain size shall be 3". A 2" drain is sufficient in systems without PRV's. Discharge at the base of the drain shall accommodate the full flow required to test the system.

### (28) *Does the designer have the choice to specify a dry standpipe?*

No. The Oregon Structural Specialty Code specifically prohibits dry standpipes in highrise buildings unless allowed by the building official or fire marshal. In Portland, where areas served by standpipes are subject to freezing, an automatic dry system must be used.

### (29) *How is the minimum capacity of the tank determined?*

The tank shall supply the maximum sprinkler demand including 100 gpm inside hose. The minimum water supply shall be available for the duration specified in Table 11.2.3.1.1 of NFPA 13 based on the highest hazard protected by the system. Sufficient tank depth to meet the pump manufactures minimum submergence for pump impellers shall be considered in sizing the tank.

### (30) *Does the tank need to be connected to the public water supply?*

Yes, the public water supply connection shall be designed to refill the tank at a rate at least equal to the standpipe supply requirement.

### (31) *Are there changes in tank monitoring requirements?*

A low level alarm for the tank is frequently missed in the design. The standard (see NFPA 72) requires a supervisory alarm when the water level drops 12 inches from normal.

## Water Based System - INSPECTION Requirements

### c) Frequently Asked INSPECTION Questions regarding Water Based Systems

### (1) *When are Hydrostatic Pressure Tests required to be witnessed?*

All hydro-tests (underground and above ground) shall be witnessed by PF&R Inspector unless the inspector has approved other arrangements.

Piping serving alterations and additions shall be hydrostatically tested where more than 20 heads have been added or relocated. (NFPA 13:102.2.1)
Hydro tests for Underground piping - If a pipe cover inspection has been performed, the piping may be buried prior to the hydro-test subject to the contractor locating leaks if the system fails to hold pressure.

### (2) *What is required for restraints\thrust blocking for underground mains.*

All restraints must be provided with calculations based on NFPA 24. Calculations shall specify soil type.

### (3) *What tests are required for Private hydrants?*

Acceptance tests for private hydrants shall include a flow test that demonstrates that the specified fire flow demand is met or exceeded.

## Fire Alarm Systems – Frequently Asked Questions

### (1) *Are Plans required on all permits?*

Yes, except when prior approval has been given for the relocation of detectors that does not impact battery load.

### (2) *Requirements at Fire Control Unit (Panel) –*

**NFPA 72:6.8.5.1.2** For fire alarm systems employing automatic fire detectors or waterflow detection devices, at least one fire alarm box shall be provided to initiate a fire alarm signal. This fire alarm box shall be located where required by the authority having jurisdiction.
*Exception: Fire alarm systems dedicated to elevator recall control and supervisory service as permitted in NFPA 72:6.15.3.*

A detector shall be provided above all alarm panels even if only sprinkler monitoring is provided except where the ceiling height exceeds 20 feet (stratification potential for a 106 kw fire with ceiling temperature of 150 deg F) (NFPA 72:4.4.5.)

### (3) *What upgrades are required when adding ELEVATOR RECALL to an existing system.*

Detectors added to provide elevator recall shall report to a building's fire alarm panel if

one exists and shall be listed as compatible with the existing fire alarm equipment.

**(4)** ***What criteria are applied when an existing fire alarm panel is replaced?***

All equipment (detection, notification and system accessories) must be listed as compatible with the new panel. Existing equipment that is not compatible must be removed and new devices installed per current code requirements.

**(5)** ***Is private mode notification allowed?***

Yes with prior approval from the Fire Marshal's Office. Private Mode in other than an "I" or Medical Clinic with nursing staff will be unusual. Where an evacuation plan approved by this office relies on private mode to initiate evacuation, the notification system shall comply with provisions of NFPA 72 for Private Mode. Notification equipment at the constantly attended location shall either be through a fire alarm panel, remote annunciator or a combination of limited remote annunciation and reliance on the nurse call system (or equivalent) to identify the room of origin of the alarm signal. The limited remote annunciator shall consist of at least an audible and visual alarm signal at the constantly attended location and the nurse call station equipment must be listed for fire alarm use. Private mode systems shall meet the "survivability" requirements of NFPA 72 (see 72:6.9.10 and 72:4.4.1.9.3.1). In Private Mode notification, devices (audible and visual) shall be provided in common spaces such as corridors, hallways, employee break rooms, waiting areas and kitchens.

**(6)** ***May "system" detectors be used within dwelling units in multi-family dwellings and condo's?***

Yes. The detectors must only initiate alarm notification within the unit and may send a supervisory signal to an attended location. However, these detectors are subject to the same inspection, test and maintenance schedule as all other detectors on the system. Discussion: Some buildings with multi-family dwellings, especially condominiums with on-site staff, have found it valuable to send a staff member to check on units where the detector has gone into alarm. System detectors allow for this added level of service and safety.

## Highrise fire alarm systems

**(1)** ***Are alarm, notification communication and power supply circuits required to meet the survivability requirements of NFPA 72?***

Yes, except where total evacuation strategy is approved.

### (2) *What supervisory signals are required for water tanks?*

Two distinct signals are required. One, when the water level increases or decreases from normal, and the second, when the water level is at normal. (NFPA 72: 5.13.3). Also a low water level signal shall be initiated when the water level falls 12 inches. (NFPA 72:5.13.3.3)

### (3) *Where are speakers required for Emergency voice/alarm communication.? IFC 907.2.12.2*

Provide speakers throughout buildings (PFC 907.2.12.2) with a floor used for human occupancy more than 75 feet above the lowest level of fire department vehicle access. (See limited exceptions in Fire Code 907.2.12) Automatically activated zones are to be coordinated with fire safety evacuation plan and as a minimum be floor of alarm and floors above and below. Strobes shall also be provided except in stairways.

Speakers in stairways shall be on a separate channel that can be manually activated from Fire Command Center. These shall not be activated by the automatic alarm notification process. Speakers shall be installed every third floor beginning at the first floor landing.

Open parking garages do not require alarm systems. Audible notification in other parking floors of high-rises may be provided by horns and strobes since speakers do not provide intelligibility.

### (4) *Fire Department Communication System (for FD use) IFC 907.2.12.3*

Provide phone outlets per IFC. No credit given for FD radio systems provided by PF&R.

### (5) *Stairway Communication System IBC 403.12.1*

Two-way communication that is required in buildings where stairways are locked. Phone every five floors that rings in a constantly attended location. PF&R also will require these phones to be answered in Fire Command Center where one is provided. Manual release of stair locks shall be available both at constantly attended location and at Fire Command Center.

### (6) *Detector coverage*

Minimum coverage as listed in 907.2.12.1 (building equipment rooms without sprinklers, elevator machine rooms and elevator lobbies, return and exhaust air plenums in systems with > 2,000 cfm capacity, at vertical risers in air-conditioning systems serving two or more floors).

### (7) *Detectors in Elevator shafts*

None are required.

### (8) *Detectors at stair enclosure doors IBC 1019.1.8.2 and 909.20.5*

Smoke-proof stair enclosures designed without vestibules require smoke detectors on the room/corridor side of each stairwell access doors. When alarmed, these detectors signal the stairwell pressurization fans to come on.

The stairwell smoke detectors should be located as close as possible to the stairwell doors, but no further than five feet. (NFPA 72:5.6.6).

### (9) *Fire Command Center*

Status and control from the fire command center of dampers for pressurization of stairs and elevator shafts is not normally required. These are automatic systems. Dampers in elevator and stair shafts shall fail open upon failure of the pressurization fan. OSSC 3004.3, 2007 edition requires a manual override of damper. This manual override may be in the general HVAC control room and not in the fire command center.

## Fixed Extinguishing Systems Frequently Asked Questions

### (1) *Is an appliance layout required with a fixed system permit protecting cooking equipment?*

Yes. A one-page document that shows fryer separation, alarm requirements, fuel shut off, etc.

### (2) *Is a signal required to be sent to a fire control panel if one exists*

Yes, per NFPA 72 6.8.5.6.1. Where the fire alarm panel services multiple occupancies, a supervisory signal shall be sent upon activation of the extinguishing system. Activation of the pull station shall initiate a general evacuation notification. In a single tenant

restaurant, a general alarm shall be activated upon discharge of the extinguishing system.

**4. Paint Booths. For** future use.

**5. Tanks for Flammable or Combustible Liquids or Hazardous Materials.** For future use.

### (1) *RESOURCE LIST*

Included in this document:

Appendix A – Local Fire code Amendments

Appendix B - Fire Code Applications Guide, Portland edition

Appendix C – Appeal Process

Appendix D – format for sprinkler calculations

Appendix E - High Piled Storage Statement of Understanding and High Piled Storage Design Information Sheet

WHERE TO FIND OR PURCHASE REFERENCE DOCUMENTS

Oregon Fire Code (without Portland amendments) may be purchased at:

- International Code Council - www.iccsafe.org
- Fire Service Bookstore - www.firefightersbooks.com
- Building Tech Bookstore –8020 SW Cirrus Dr, Beaverton; 503.641.8020; www.buildingtechbooks.com

Documents available on the Internet

Portland Fire Regulations; Portland City Code Title 31

http://www.portlandonline.com/auditor/index.cfm?c=28195

Portland Fire Code Amendments (including adopted State Amendments):

http://www.portlandonline.com/auditor/index.cfm?c=29174

Oregon Revised Statutes (ORS): http://www.leg.state.or.us/ors/

ORS 455 – Building Code

ORS 476 – State Fire Marshal Protection from Fire Generally

ORS 479 – Protection of Buildings from Fire, Electrical Safety

Oregon Administrative Rules (OAR):

OAR 837 – Office of State Fire Marshal

Development and Design guidelines; http://www.portlandonline.com/fire/index.cfm?c=45290

Portland Design Guide

Fire Code Applications Guide, Portland edition

Format for sprinkler calculations

High Piled Storage Statement of Understanding and High Piled Storage Design Information Sheet