Table of Contents

Environmental Health & Safety

Hazardous Materials Management

This guide discusses various strategies to comply with fire code limits for hazardous materials. Understanding the potential chemical load for a building early in design will help facilitate a smoother transition from initial building permit application through operational permit review.

The information provided below is based on the 2018 International Fire Code (IFC) as the most currently adopted codes in Washington State. The City of Seattle uses the 2018 Seattle Fire Code (SFC) with local amendments to the IFC. Most Washington facilities outside of Seattle have adopted the IFC with little or no modifications. This includes buildings at UW Bothell and UW Tacoma campuses in addition to other UW owned facilities such as Friday Harbor Labs, Olympic Natural Resources Center, and Pack Forest.

Some buildings on the Seattle campus still use the 1997 Uniform Fire Code (UFC) for hazardous materials. In 2005 EH&S was granted permission by the City of Seattle to allow Bagley Hall and the AA, BB, RR, F, I, and J wings of the Magnuson Health Sciences Center to apply the UFC conditions for hazardous material control areas and exempt amounts. For assistance with these buildings contact EH&S for specific requirements.

A. Basic concepts

1. Maximum allowable quantities (MAQs)

The chemical load in all areas of a building must not exceed the Maximum Allowable Quantity (MAQ) in International Fire Code (IFC) tables 5003.1.1 (1) and (2) or the International Building Code (IBC) tables 307.1(1) and (2). This quantity can be doubled for most hazard classes when an automatic fire sprinkler system is installed and doubled again when all materials are stored within approved hazardous material storage cabinets.

2. Control areas

Control areas are ways to divide a building into fire rated compartments in order to increase the total quantity of hazardous materials in the building without increasing the potential risk for the building. The MAQ is applied to each control area, so additional control areas allow for higher quantities. The control areas should be established during the design phase so the fire resistive construction elements (including wall, floor ceiling assembly, supporting structure, floor and wall penetrations, etc.) can be planned for.

3. Hazardous (H) occupancies

If the chemical load is expected to exceed the MAQ, the space must be constructed as an H occupancy. Current code has five H occupancies corresponding to physical and health hazards stored, used, or manufactured within. The requirements vary by type, but all have

fire resistive construction elements above those found in standard building occupancies or control area separations.

a. H-1 occupancies

   Buildings and structures containing materials that pose a detonation hazard shall be classified as Group H-1. This includes explosives and other extremely volatile or reactive chemicals. This type of occupancy often requires explosion control measures, protected electrical system, mechanical ventilation, and secondary containment for sprinkler water. This level of protection is very rare, and we currently only have one H-1 occupancy on campus.

b. H-2 occupancies

   Buildings and structures containing materials that pose a deflagration hazard or a hazard from accelerated burning shall be classified as H-2. This includes flammable gases and flammable liquids in normally open containers or dispensing operations. This level of protection is less than an H-1 occupancy, but may still require some of the same elements, including a protected electrical system and mechanical ventilation.

c. H-3 occupancies

   Buildings and structures containing materials that readily support combustion or that pose a physical hazard shall be classified as Group H-3. This includes flammable liquids in normally closed containers and oxygen. This is the lowest level of protection against physical hazards, but still a greater level of protection than standard construction. It will still require mechanical ventilation and a protected electrical system.

d. H-4 occupancies

   Buildings and structures containing materials that are health hazards shall be classified as Group H-4. This includes corrosive, toxic, and highly toxic materials. H-4 occupancies emphasize containment and high ventilation to protect against exposure.

e. H-5 occupancies

   Semiconductor fabrication facilities and comparable research and development areas in which hazardous production materials are used above the MAQ shall be classified as Group H-5. This type of occupancy typically uses pyrophoric gases as well as toxic materials. There are very specific construction elements, as well as other operational requirements for this type of occupancy.

f. Combination occupancies

   Occupancies that are not classified as semi-conductor facilities may also have both physical and health hazard materials. For instance, if an occupancy exceeds the MAQ for flammable liquids and highly toxic materials it would be classed H-3/H-4 and must meet the design requirements for both H groups.

B. Design strategies

1. Standard occupancies

Construction of additional control areas is a simpler and more cost-effective way to increase the allowed chemical load for a building than the construction of H rooms.

There are ways to increase the quantity allowed by adding control areas and/or using alternative strategies found in the fire code. Construction of control area separations is much simpler and more cost effective than building an H occupancy.

Modern codes also limit the quantity of chemicals that can be stored on floors above and below grade level and prohibits chemical use on floors lower than two levels below grade.

a. Base code

Current code allows for the number of control areas per floor based on floor level above and below grade as follows:

Floor level	# of control areas allowed	Fire resistive rating required (in hours)
More than 3 below grade	Hazardous materials not generally allowed, with exceptions for generator tanks.	
-2 below grade	2	1
-1 below grade	3	1
Grade level	4	1
+1 level above grade	3	1
+2 levels above grade through +8 levels above	2	2
+9 levels above grade and higher	1	2

b. Higher education laboratories

Beginning in the 2018 codes, a new chapter was added to the fire/building codes to address chemical quantities in labs associated with universities and colleges. These codes recognize that these labs are generally under stricter administrative controls than for profit research labs. Using this chapter allows higher quantities on upper floors of a building than standard code. There are additional construction requirements, including

separating lab spaces from non-lab spaces and providing a liquid tight floor. Chemicals are not allowed above the 20th floor.

There are also operational tradeoffs, including limits on container size and density limits for flammable liquids. Before designing to this code provision, the future occupants should be informed of these to make sure the option is viable. This table shows the difference between the percentage of the MAQ allowed under base code and the increased level allowed when a building is newly constructed following the Chapter 38 lab suite designs.

Floor level	Percent of MAQ allowed – base code	Percent of MAQ allowed – lab suites
More than 3 below grade	Hazardous materials not generally allowed, with exceptions for emergency diesel generator fuel tanks.	
-2 below grade	50%	50%
-1 below grade	75%	75%
Grade level	100%	100%
+1 level above grade	75%	100%
+2 levels above grade	50%	100%
+3 levels above grade through +5 levels above	12.5%	75%
+6 levels above grade through +14 levels above	5%	50%
+15 levels above grade	5%	25%

The number of control areas and level of fire resistive construction is also eased using Chapter 38. This is most noticeable on levels -1 through +5.

Floor level	# of control areas allowed		Fire resistive rating (hours)	
	Base code	Chapter 38 lab suites	Base code	Chapter 38 lab suites
-2 below grade	2	2	1	1

-1 below grade	3	4	1	1
Grade level	4	6	1	1
+1 level above grade	3	6	1	1
+2 levels above grade through +5 above	2	4	2	1
+6 levels above grade through +8 above	2	2	2	2
+9 levels above grade	1	2	2	2
+10 levels above grade through +19 above	1	1	2	2

Chapter 38 also allows for existing buildings to increase the percentage of the MAQ on higher floors, but not as much as new construction designed to the chapter. Improvements and remodel projects should verify the existing control area strategy and consider re-establishing control areas if the building will no longer support the chemical load.

c. Non-production laboratories

The Seattle Fire Code has another provision for research labs even if not associated with higher education. This provision increases the percentage of MAQ over base code but has even stricter container size limits.

Floor level	Percent of MAQ allowed – base code	Percent of MAQ allowed – lab suites
More than 3 below grade	Hazardous materials not generally allowed, with exceptions for emergency diesel generator fuel tanks.	
-2 below grade	50%	50%
-1 below grade	75%	75%
Grade level	100%	100%
+1 level above grade	75%	100%
+2 levels above grade	50%	100%

+3 levels above grade through +5 levels above	12.5%	75%
+6 levels above grade through +14 levels above	5%	50%
+15 levels above grade	5%	25%

The primary advantage of using the non-production lab provisions over those for higher education laboratories is if the building height will exceed 20 floors above grade.