FOCUS ARTICLE

Do I Operate a Group H Occupancy? How Hazardous Materials Use and Storage Impacts Your Facility's Occupancy Classification

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Many companies at the forefront of managing their hazardous material hazards follow the various codes and practices of the National Fire Protection Association (NFPA) such as NFPA 1, "Fire Code." However, compliance with the International Building Code (IBC) and International Fire Code (IFC) are often overlooked. The IBC and IFC are administered by the International Codes Council (ICC). The ICC is an association with over 64,000 members. It develops several codes and standards used for design, building and compliance. It has 377 chapters worldwide and is active in 55 countries. It maintains 15 codes related to building, energy, zoning, and other topics.

Many facilities do not recognize that the International Building Code has been adopted into law by all 50 states within the US and the International Fire Code has been adopted by 42 states. Maine, Vermont, Massachusetts, Rhode Island, Maryland, West Virginia, Florida and Hawaii are the only exceptions[1] . States that have adopted these codes, by law, expect compliance. The IFC contains significant differences from NFPA 1 and references the IBC in many places. One significant difference in the IFC and IBC are the methods used for Occupancy Classification[2] . Depending on the amount of hazardous materials stored and/or used in a control area, specific construction requirements may be required, along with specific restrictions. Unfortunately, these requirements are often discovered during the application for building and occupancy permits, where review by the local jurisdiction includes compliance with the IFC and IBC. This leaves facilities either scrambling to change the design or to address having a fully constructed facility that is not in compliance and cannot be occupied.

1 International Code Council, https://www.iccsafe.org/wp-content/uploads/Code_Adoption_Maps.pdf, accessed 8/26/19

2 International Fire Code, International Codes Council, 2018

Group H Occupancies

High hazard Group H is one of eight Occupancy Classifications used by the IFC. This occupancy includes the use of a building or structure that involves the manufacturing, processing, generation or storage of materials in quantities that exceed the maximum allowable quantity per control area. Group H occupancies are subdivided into five subcategories.

Five Subcategories of Group H Occupancies	
High hazard group H-1	Buildings or structures containing materials that pose a detonation hazard.
High hazard group H-2	Buildings or structures containing materials that pose a deflagration hazard.
High hazard group H-3	Buildings and structures containing materials that readily support combustion or that pose a physical hazard.
High hazard group H-4	Buildings and structures containing materials that are health hazards.
High hazard group H-5	Semiconductor fabrication facilities and comparable R&D areas.

For each of the group H subdivisions, the IFC contains special requirements in Chapter 50. Additional requirements based on the hazard posed by the material contained in Chapters 51 through 67. The International Building Code[3], in sections 414 and 415, also places restrictions on things such as allowable construction methods, process arrangements, building height and floor area. The allowable footprint of a Control Area decreases as the floor number of the occupancy increases. The separation distance from property lines also changes depending on which of the group H occupancies applies. Some H Occupancy Classes must be located in detached buildings. Other requirements may include room ventilation, explosion venting, leakage alarms and containment within the control areas.

Occupancy Classification Under the IFC

The IFC assigns High Hazard Occupancy Groups based on the Maximum Allowable Quantities (MAQs) of materials in different hazard categories. *Chapter 50 Hazardous Materials – General Provisions* lists the maximum allowable quantities for various types of **hazardous materials** posing physical hazards in Table 5 003.1.1 (1). Table 5 003.1.1 (2) provides the MAQs for materials posing a health hazard (i.e. corrosives, highly toxic, and toxic materials). The tables define MAQs per control area for storage, use in enclosed systems, and use in open systems. Applicable definitions for the use of this table include:

- **Control Area**: Spaces within the building where quantities of Hazardous materials not exceeding the maximum allowable quantity per control area are stored, dispensed, used or handled.
- **Storage:** The keeping, retention or leaving of hazardous materials in closed containers, tanks, cylinders or similar vessels.
- **Open System:** A system that is continuously open to the atmosphere during normal operations and where vapors are liberated, or the product is exposed to the atmosphere during normal operations. Examples would include dispensing from or into open containers, dip tanks and plating tank operations.
- **Closed System: A** system that remains closed during normal operations and vapors are not liberated outside of the vessel or system. One example would include transfer of the material from one vessel to another through a closed piping system, where the originating and destination vessels are closed to the atmosphere such that no vapors are emitted.

When determining the quantity used, material in solid, liquid and gas phases must be aggregated. Also, the aggregate quantity of material in storage, closed, and open systems must not exceed the MAQ permitted in storage.

One area many companies overlook is the potential for process modifications to change the Occupancy Group. Increasing inventories of hazardous materials could cause the MAQ to be exceeded, changing the Occupancy Classification. This may result from "stocking up" on raw materials, increased production rates or changes to formulations. A robust Management of Change process that considers Occupancy Classification can prevent overlooking this important consideration.

Combustible Dust

Although the IBC and IFC require an H-2 Occupancy Classification for Combustible dust, they do not list an MAQ. Instead, Table 5003.1.1(1) directs the reader to a footnote that states "Where manufactured, generated or used in such a manner that the

3 International Building Code, International Codes Council, 2018

concentration and conditions create a fire or explosion hazard based on information prepared in accordance with Section 104.7.2." Because there is no listed MAQ, one may choose (or be required by the local fire code official) to place any **combustible dust** storage or processing operation in an H-2 area.

Section 104.7.2 of the IFC, however, offers a viable alternative in most cases. This section describes a technical opinion and report that can be prepared by a qualified engineer, specialist, laboratory or fire safety specialty organization. *This report must analyze the fire safety properties of the design, operation and use of the building or premises and the facilities to recommend necessary change*[4]. The "fire code official" must approve the qualifications of the preparer of the report, and the content of the report itself. The stamp of a registered design professional may also be required.

In the case of combustible dust, the report should review the storage and processing of the material. The report should identify the hazards of the process and sufficient controls to reduce the life safety risk to an acceptable level. This could involve estimating both the consequence and likelihood of an incident. Compliance with relevant good practices, such as the **NFPA's various codes on combustible dust,** could also be referenced to demonstrate adequate control of the hazards.

Performance-Based Design Option

Section 5001.3 of the IFC describes an alternative to the use of MAQs and compliance with Chapters 51 through 67. Like the requirements of these chapters, the objective is to minimize the life safety risks of releases, fires or explosions involving hazardous materials, and to minimize the consequences of an unsafe condition. The resulting documentation of the Performance-Based Design must include consideration of topics specified by the code.

These aspects including the following:

- Properties of hazardous materials
- Reliability of equipment and operations
- Prevention of unintentional reaction or release
- Spill mitigation
- Ignition hazards
- Protection of hazardous materials
- Exposure hazards
- Detection of gas or vapor release
- Reliable power source
- Ventilation
- Process hazard analyses
- Pre-startup safety review
- Operating and emergency procedures
- Management of change
- Emergency plan
- Accident procedures
- Consequence analysis
- Safety audits

The fire code official must approve the use of the performance-based design option, as well as the final design of the process.

Conclusion

Many facilities and companies have failed to recognize their legal duty to comply with the International Fire and Building Codes. In addition to life safety risks, companies may find construction and startup activities suddenly stalled because a building or occupancy permit cannot be obtained. There are several methods available to safely manage inventories of Hazardous Materials. Inventories can be minimized, hazardous materials can be segregated into separate control areas in quantities below the MAQ, or hazardous materials may be relocated to minimize the footprint of the Group H Occupancy. Where prudent, the Performance-Based Design option may also be utilized, subject to the approval of the fire code official. A working knowledge of the limitations of and requirements for high-hazard occupancies is necessary to maintain compliance with the IFC/IBC over the lifecycle of the process.

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4 International Fire Code Section 104.7.2, International Codes Council, 2018

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