



Committee Input No. 21-NFPA 318-2022 [Global Input]

[See attached Word doc to reflect new chapter 13 and associated definitions the committee is considering for large and stack fabrication buildings.]

Supplemental Information

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
318_CI_21_New_Chapter_13.docx	New chapter 13 and associated definitions for large and stack fabrication buildings.	

Submitter Information Verification

Committee: SCR-AAA
Submittal Date: Wed Nov 02 13:07:50 EDT 2022

Committee Statement

Committee Statement: The committee created a Task Group on Large and Stack Fabrication Buildings to consider a new chapter with requirements and supporting annex material for Large and Stack Fabrication Buildings. Public comments are welcome.
Response Message: CI-21-NFPA 318-2022

[Chapter 3 Definitions]

3.3.X Cleanroom Production Unit (CPU). A building area consisting of one or more levels and containing the following:

- a. (New) Return Air Plenum (RAP) usually located above the fab area
- b. (Existing) A fab area
- c. (New) Sub-Fab: An area used for production support equipment and services, located directly below the fabrication cleanroom level, and which is not separated from the cleanroom airflow. Also known as a “clean” sub-fab.
- d. (Existing) A Facility Sub-fab. A support area, used for facility equipment and services, located below the fabrication cleanroom level, but which is separated from the cleanroom airflow by a fire-rated barrier. Typically located one level below the Clean Sub-Fab, which is directly below the fabrication cleanroom, and is within the air return path. Also known as a “dirty” sub-fab
- e. For the purposes of this standard a facility sub-fab is not considered to be a story

3.3.X Story. The portion of a building located between the upper surface of a floor and the upper surface of the floor or roof next above. **[5000, 2021]**

3.3.X Floors. For the purposes of this standard a floor refers only to construction dividing one or more CPUs. Levels within a CPU, such as a perforated cleanroom access flooring or waffle slabs, or the fire-rated floor between a facility sub-fab and sub-fab do not possess the same meaning as set out in any other NFPA standard.

3.3.X Perforated Cleanroom Access Flooring (PCAF). A perforated flooring system, consisting of perforated tiles and supporting construction formed of non-combustible material which allows cleanroom airflow from the cleanroom level to the clean sub-fab. Production equipment may or may not be supported directly from this flooring system. A floor refers only to construction dividing one or more CPUs. The term floors within a CPU, such as a PCAF does not possess the same meaning as set out in any other NFPA standard.

3.3.X Waffle Slab. The structural supporting system between a cleanroom and clean sub-fab providing support for equipment and PCAF. The waffle slab is either formed primarily of concrete or steel construction and facilitates the movement of air and services between the clean-sub-fab and cleanroom. For the purposes of this standard waffle slabs do not possess the same meaning as set out in any other NFPA standard.

[New Chapter 13]

Chapter 13 Large and Stacked Fabrication Buildings

13.1 General.

13.1.1 Large and stacked fabrication buildings shall be designed and installed in accordance with Sections 13.2 through 13.4.

13.1.1.1 A large fabrication building contains semiconductor fabrication facilities and support facilities with length or width in excess of 300 ft (100 m).

13.1.1.2 A stacked fabrication building consists of more than one CPU stacked on top of each other.

13.1.2 For the purposes of this standard a CPU is demarcated by the presence of fire resistance rated construction, separating it from other CPUs above or below and is therefore considered to be a story.

13.1.2.1 Stacked CPUs shall be separated from each other by two (2)-hour fire resistance rated horizontal assemblies.

13.1.2.2 The sub-fab and facility sub-fab may be combined in one sub-fab in a three level CPU.

13.2 Building Planning.

13.2.1 Construction type, height and area in buildings containing CPUs shall meet the requirement of Section 13.2.

13.2.2 Construction type, height, stories, and areas shall be designed and installed in accordance with NFPA 5000.

13.2.3 Unlimited height and stories shall be permitted in buildings containing CPUs when constructed of Type 442.

13.2.4 Mixed construction types shall be permitted in buildings containing CPUs when the sum of the ratios is less than one.

13.2.5 Unlimited area of Hazardous Protection Level 2 shall be permitted in buildings containing CPUs when each area of Hazardous Protection Level 2 limited by the building code is separated from each other by a minimum of 30 meters vertically and horizontally.

13.3 Building Construction.

13.3.1 Building construction and related services shall be designed and installed in accordance with Chapter 4.

13.3.2 Building construction of buildings containing fabrication areas where the highest occupied floor of the CPU meets the threshold for high rise provisions of the building code, the area above this threshold shall meet provision of the building code.

13.3.3 Construction type in buildings with CPUs shall be designed and installed in accordance with 13.2.

13.3.4 Fire resistance rating shall be permitted to accommodate the least fire resistive rating satisfying an unlimited area, or height in the area of the building with the desired occupancy.

13.3.4.1 Vertical openings within the CPU shall be permitted to penetrate catwalks, mezzanine, equipment platforms, piping racks, duct banks, systems of ductwork or equipment racks without consideration of these horizontal levels as floors.

13.3.4.2 Recirculation systems shall not be permitted to interconnect multiple CPUs.

13.3.4.3 Emergency power systems shall be permitted to provide localized automatic transfer switches in remote locations of the building through protected conveyance of emergency power system from normal power.

13.3.4.4 Means of egress shall be provided in rooms of Protection Level 2, Protection Level 3, Protection Level 4, and Protection Level 5 when service corridors are not available.

13.3.4.5 Buildings containing fabrication areas with a CPU shall have a travel distance of 295 ft (90 m) for the fabrication area when the ventilation system continues to operate for a minimum of 15 minutes after the detection of smoke.

13.3.4.6 Where travel distance is increased, the use of smoke detection systems for automatic shutoff of return air systems is not required where analysis demonstrates shutoff would create a greater hazard.

13.3.4.7 A smoke detection system with remote indication and manual shutoff capability at the emergency control station shall be required.

13.3.4.7.1 Egress modeling shall be conducted to determine the maximum amount of time it takes to reach the exit and how long it will take to exit the building.

13.3.4.7.1 For validation purposes, third party review of the modeling results shall be conducted.

13.4 Hazardous Materials.

13.4.1 Hazardous Materials General.

13.4.1.1 Hazardous materials storage and use shall be designed and installed in accordance with Chapter 5.

13.4.1.2 Stacked fab buildings containing multiple CPUs shall have 75% of the quantities of hazardous materials that are allowed per Table 5.5.2 for all CPUs above the first level CPU.

13.4.1.3* HPM usage at the upper fab level shall be minimized as much as the process allows.

A.13.4.1.3 Tools using large amounts of HPM should preferably be located at the lower Fab level.

13.4.1.4 HPM dispensing rooms at the sub fab level shall be located such that it does not influence the path of egress in the event of an HPM release.

13.4.1.5 Intermediate liquid chemical storage and dispensing rooms located above ground level shall be in accordance with Chapter 6 of this standard and Chapter 24 of NFPA 30.

13.4.1.6 Supply piping for hazardous chemical liquids and gases extending vertically more than one floor in stacked fabs shall be located external to the fabrication area in dedicated shafts, separated from other mechanical, utility, and duct shafts.

13.4.2 Liquid Chemical Storage and Handling.

13.4.2.1 Liquid chemical storage and handling shall be designed and installed in accordance with Chapter 6.

13.4.2.2 Looped, interconnected, or gridded hazardous material supply lines shall provide isolation methods to shut-off systems, areas, or equipment.

13.4.3 Gas Storage and Handling.

13.4.3.1 Gas storage and handling shall be designed and installed in accordance with Chapter 7.

13.4.3.2 Looped, interconnected, or gridded hazardous material supply lines shall provide isolation methods to shut-off systems, areas, or equipment.

13.4.4* Production and Support Equipment. Production and support equipment shall be designed and installed in accordance with Chapter 8.

A.13.4.4 Preferred locations of various processes.

Lower Fab Levels

- (1) Photolithography (vibration sensitivity)
- (2) Wet Process (large concentration HPM)
- (3) Implant (heavy equipment)

Upper Fab Levels:

- (1) CMP (i.e., many slurries are not technically HPMs)
- (2) PVD (Physical Vapor Deposition)

Both Lower and Upper Fab Levels:

- (1) Diffusion, Dry and CVD (primarily HPM gases)
- (2) Metrology / RDA – primarily quality steps with no HPOM

13.4.5 Exhaust Systems.

13.4.5.1 Exhaust systems shall be designed and installed in accordance with Chapter 9.

13.4.5.2 Buildings containing multiple CPUs shall be provided with independent exhaust systems from each individual CPU to independent abatement systems.

13.4.6 Waste Treatment. Waste treatment systems shall be designed and installed in accordance with Chapter 10.

13.4.7 Fire Protection. Fire protection systems shall be designed and installed in accordance with Chapter 11.

13.4.8 General Safety Precautions. General safety precautions shall be designed and installed in accordance with Chapter 12.



Committee Input No. 8-NFPA 318-2022 [Chapter 4]

Chapter 4 Building Construction and Related Services

4.1 General.

4.1.1 Occupied Levels of Fabrication Areas.

Normally, occupied levels of fabrication areas handling HPM shall be located at or above grade.

4.1.2 Fabrication Areas.

Floors of fabrication areas separating fabrication areas from other uses shall be liquid-tight. [5000:34.3.7.2.1.4(B)]

4.2 Noncombustible materials.

In semiconductor fabrication facilities, a noncombustible material shall be a material that complies either with 4.2.1 or with 4.2.2.

4.2.1

A material that, in the form in which it is used and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat.

4.2.2

A material that is reported as passing ASTM E136, *Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C*.

4.3 Classification of Occupancy.

Semiconductor manufacturing facilities containing cleanrooms and associated support facilities shall be considered to be general- or special-purpose industrial occupancies as defined in NFPA 101.

4.3.4 * Noncombustible Construction Components.

Cleanrooms rated ISO Class 5 or cleaner in accordance with ISO 14644-1, *Cleanrooms and associated controlled environments — Part 1: Classification of air cleanliness by particle concentration*, or cleanrooms having clean zones rated ISO Class 5 or cleaner shall have approved, noncombustible components for walls, floors, ceilings, and partitions.

4.4.5 Fire Resistance Rating.

4.4.5.1

Fire resistance ratings shall be determined in accordance with ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, or UL 263, *Fire Tests of Building Construction and Materials*.

4.4.5.2

Fabrication areas shall be separated from each other by 1-hour fire resistance-rated construction.

4.4 5.3

Fabrication areas shall be separated from adjacent occupancies by not less than 1-hour fire resistance-rated construction and not less than the fire resistance rating required in *NFPA 5000*.

4.5 6 Pass-Throughs in Existing Exit Access Corridors.**4.5 6.1**

Self-closing doors having a fire protection rating of not less than 1 hour shall separate pass-throughs from existing exit access corridors.

4.5 6.2

Pass-throughs shall be constructed as required for exit access corridors.

4.6 7 Vertical Openings.**4.6 7.1**

Openings through floors of fabrication areas shall be permitted to be unprotected, in accordance with 4.5.2, where the interconnected levels are used solely for mechanical equipment directly related to the fabrication areas. [5000:34.3.7.2.1.5]

4.6 7.1.1

Mechanical, duct, and piping penetrations within a fabrication area shall not extend through more than two floors. [5000:34.3.7.2.1.5(A)]

4.6 7.1.2

The annular space around equipment passing through the penetrations shall be sealed at the floor level to restrict the movement of air. [5000:34.3.7.2.1.5(B)]

4.6 7.1.3

The fabrication area, including levels interconnected with ductwork and piping, shall be regulated as a single conditioned environment. [5000:34.3.7.2.1.5(C)]

4.6 7.2

Unenclosed vertical openings not contained within fire-rated construction shall be permitted as follows:

- (1) Such openings shall connect not more than two adjacent stories (one floor pierced only).
- (2) Such openings shall be separated from unprotected vertical openings serving other floors by a barrier.
- (3) Such openings shall be separated from corridors.
- (4) * Such openings shall be separated from other fire or smoke compartments on the same floor.
- (5) In new construction, the convenience opening shall be separated from the corridor referenced in 8.12.5.1(3) of *NFPA 5000* by a smoke partition, unless Chapters 15 through 31 and 33 through 34 of *NFPA 5000* require the corridor to have a fire resistance rating.
- (6) * Such openings shall not serve as a required means of egress.

4.7 8 Air Supply and Recirculation Systems.

4.7.8.1

The location of outside air intakes shall be chosen to avoid drawing in hazardous chemicals or products of combustion coming either from the building itself or from other structures and devices.

4.7.8.2

High-efficiency particulate air (HEPA) modules, ultra-low penetration air (ULPA) filter modules, and pre- or final filters in makeup and recirculation air-handling units shall meet UL 900, *Air Filter Units*.

4.7.8.3

Air supply and recirculation ducts shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or UL 723, *Test for Surface Burning Characteristics of Building Materials*.

4.7.8.4

A manually operated remote switch(es) to shut off the affected areas of the cleanroom air recirculation system(s) shall be provided at an approved location(s).

4.7.8.5 Testing.**4.7.8.5.1**

Testing of automatic detection devices shall be conducted in accordance with the requirements of Chapter 12.

4.8.9* Electrical Classification.**4.8.9.1 General.**

The fabrication area or cleanroom shall be considered unclassified electrically with respect to Article 500 of *NFPA 70*, where all of the following requirements are met:

- (1) Chemical storage and handling meet the requirements of Chapters 5, 6, and 7 of this standard.
- (2) Ventilation and exhaust systems meet the requirements of this chapter and Chapter 9 of this standard.
- (3) The average ventilation flow rate is not less than $0.176 \text{ L/sec} \cdot \text{m}^2$ ($4 \text{ ft}^3/\text{min} \cdot \text{ft}^2$) of floor area, and the ventilation flow rate at any location is not less than $0.132 \text{ L/sec} \cdot \text{m}^2$ ($3 \text{ ft}^3/\text{min} \cdot \text{ft}^2$) of floor area. The use of recirculated air shall be allowed.

4.8.9.2 Workstations.

Workstations shall be in accordance with 8.4.2.

4.9.10 Emergency Power System.

An emergency power system shall be provided for electrically operated equipment and connected control circuits for the following systems:

- (1) Hazardous chemical exhaust ventilation systems
- (2) Hazardous chemical gas cabinet ventilation systems
- (3) Hazardous chemical exhausted enclosure ventilation systems
- (4) Hazardous chemical gas room ventilation systems
- (5) Hazardous chemical room ventilation systems
- (6) Hazardous chemical gas-detection systems
- (7) Emergency alarm systems
- (8) Manual fire alarm systems
- (9) Automatic fire sprinkler system monitoring and alarm systems
- (10) Electrically operated systems required elsewhere in this standard, NFPA 1, or *NFPA 5000* applicable to the use, storage, or handling of hazardous chemicals

4.9 ~~10~~ .1

Diesel generators shall be installed in accordance with the requirements of NFPA 37.

4.10 Means of Egress.

4.40 ~~11~~ .1

Means of egress shall be provided in accordance with NFPA 101.

4.40 ~~11~~ .2 Service Corridors.

4.40 ~~11~~ .2.1

Service corridors shall be provided with two or more exits, and not more than one-half of the required number of exits shall lead to the fabrication area.

4.40 ~~11~~ .2.2

The travel distance within a service corridor to an exit or to a door into a fabrication area shall not exceed 23 m (75 ft). Dead ends shall not exceed 1.22 m (4 ft).

4.40 ~~11~~ .2.3

Doors from service corridors shall swing in the direction of exit travel and shall be self-closing.

Submitter Information Verification

Committee: SCR-AAA

Submittal Date: Mon Aug 22 13:40:00 EDT 2022

Committee Statement

Committee Statement: The committee is considering new requirements in Chapter 4 for noncombustible materials. The committee created a task group to look at the uses of noncombustible throughout the document and review the definition and enforceable requirements so that they meet the proper intent. The task group will also review applicable international standards for inclusion.

Response Message: CI-8-NFPA 318-2022

[Public Input No. 8-NFPA 318-2022 \[Chapter 4\]](#)



Committee Input No. 12-NFPA 318-2022 [Section No. 11.1.3.5 [Excluding any Sub-Sections]]

~~Where smoke detection is installed below a waffle floor to detect smoke in the airstream passing from the cleanroom to the sub-fab, area of coverage of spot-type detector or sampling port shall be limited to 18.6 m² (200 ft²). The committee reconstituted the Task Group on Detection to continue the work to develop revised proposals for the smoke detection section based on the on computational fluid dynamics (CFD) modelling that has been completed .~~

Submitter Information Verification

Committee: SCR-AAA

Submittal Date: Tue Aug 23 11:45:55 EDT 2022

Committee Statement

Committee Statement: The committee reconstituted the Task Group on Detection to continue the work to develop revised proposals for the smoke detection section based on the on computational fluid dynamics (CFD) modelling that has been completed. The committee welcomes comments from industry and the public.

Response Message: CI-12-NFPA 318-2022

[Public Input No. 4-NFPA 318-2022 \[Section No. 11.1.3.5 \[Excluding any Sub-Sections\]\]](#)

[Public Input No. 9-NFPA 318-2022 \[Section No. 11.1.3.5.2\]](#)

[Public Input No. 10-NFPA 318-2022 \[Section No. 11.1.3.6\]](#)

[Public Input No. 3-NFPA 318-2022 \[Section No. 11.1.3.4.1\]](#)

[Public Input No. 12-NFPA 318-2022 \[Section No. A.11.1.3.1\]](#)

[Public Input No. 11-NFPA 318-2022 \[Section No. 11.1.3.6\]](#)