NATIONAL FIRE PROTECTION ASSOCIATION
The leading information and knowledge resource on fire, electrical and related hazards

TECHNICAL COMMITTEE ON SEMICONDUCTOR AND RELATED FACILITIES
NFPA 318 Second Draft Meeting Agenda
April 2, 2020 10:00 AM – 1:00 PM ET
Teleconference

1. Call to Order. Rick Guevara, Chair
2. Introductions.
3. Approval of Meeting Minutes from NFPA 318 First Draft Meeting, May 9 and May 28, 2019. (Attachment A)
4. Staff Updates. Laura Moreno, NFPA Staff
   - Committee membership update. (Attachment B)
   - Fall 2020 revision cycle schedule. (Attachment C)
   - Overview of NFPA Process.
5. Review of Public Comments: NFPA 318. (Attachment D)
6. Review of First Draft Ballot Comments: NFPA 318. (Attachment E)
7. Task Group Report: Detection Task Group. Al Brown, Task Group Chair
8. New Business.
9. Next Meeting.
10. Adjourn.

AGENDA

ATTACHMENT A

NFPA 318 – Technical Committee on Semiconductor and Related Facilities

First Draft Meeting (F2020)

Adobe Connect Web Meeting and Teleconference

May 9, 2019 – 10AM-12PM EDT

Attendees

Principals	Alternates	Guests
Rick Guevara, Chair	Bruce Clarke	Chris Phillips
David Hague, Staff Liaison	Vincent DiGiorgio	Phillip Mazzurco
John Ronan	Jeffrey Grove	Eric Sandoval
Robert Ballard	Scott Lang	Elena Carroll – NFPA Staff
Jonathan Eisenberg	Jason McKeown	Baran Ozden – NFPA Staff
Scott Enides	Jeremy Wheeler	
Richard French		
Amanda Gonzalez		
Steven Joseph		
Randy Luckman		
Rodney Randall		
Mark Saucier		
Scott Swanson		
Derek White		
Matthew Wyman		

Attendance taken by David Hague

FD Meeting May 9, 2019

1. NFPA Chair, Rick Guevara, called the meeting to order at 10:04 AM EDT.
2. NFPA Staff Liaison, Dave Hague & Chairman Rick Guevara, discussed opportunities to improve the flow of discussions; and, the appropriate process for making motions.
3. NFPA Chair, Rick Guevara, presented public input: welcomed members, alternates and guests.
4. Staff briefly reviewed the key dates for the F2020 revision cycle. These dates are noted at the bottom of the Minutes.
5. The Second Draft Meeting Minutes for the 2017 revision cycle were approved as presented.
6. The committee reviewed and commented on Public Input for the F2020 revision cycle First Draft. For final actions, see the First Draft Report available at www.nfpa.org/318.
7. No new business was discussed. .
8. Meeting adjourned at 2:30 PM EDT with agreement to reconvene to complete acting on Public Input as agreed by polling the TC within the next three weeks.
9. Meeting reconvened on May 28, 2019 at 10:18 AM, EDT.

Attendees

Principals	Alternates	Guests
Rick Guevara, Chair	Denise Beach	Elena Carroll – NFPA Staff
David Hague, Staff Liaison	Bruce Clarke	Baran Ozden – NFPA Staff
Robert Ballard	Jeffrey Grove	
Jonathan Eisenberg	Scott Lang	
Scott Enides	Jeremy Wheeler	
Steven Joseph		
Rodney Randall		
Scott Swanson		
Derek White		
Matthew Wyman		

10. Committee completed action on Public Input and adjourned at 11:57 AM, EDT.

AGENDA

ATTACHMENT B

Address List No Phone

03/19/2020
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SCR-AAA

Semiconductor and Related Facilities

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Staff Liaison — **SCR-AAA**
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AGENDA

ATTACHMENT C

Fall 2020 Master Schedule

Process Stage	Process Step	Dates for TC	Dates for TC with CC
Public Input Stage (First Draft)	Public Input Closing Date*	1/03/2019	1/03/2019
	Final Date for TC First Draft Meeting	6/13/2019	3/14/2019
	Posting of First Draft and TC Ballot	8/01/2019	4/25/2019
	Final date for Receipt of TC First Draft ballot	8/22/2019	5/16/2019
	Final date for Receipt of TC First Draft ballot - recirc	8/29/2019	5/23/2019
	Posting of First Draft for CC Meeting		5/30/2019
	Final date for CC First Draft Meeting		7/11/2019
	Posting of First Draft and CC Ballot		8/01/2019
	Final date for Receipt of CC First Draft ballot		8/22/2019
	Final date for Receipt of CC First Draft ballot - recirc		8/29/2019
	Post First Draft Report for Public Comment	9/05/2019	9/05/2019
Comment Stage (Second Draft)	Public Comment Closing Date*	11/14/2019	11/14/2019
	Notice Published on Consent Standards (Standards that received no Comments) Note: Date varies and determined via TC ballot.		
	Appeal Closing Date for Consent Standards (Standards that received no Comments)		
	Final date for TC Second Draft Meeting	5/14/2020	2/06/2020
	Posting of Second Draft and TC Ballot	6/25/2020	3/19/2020
	Final date for Receipt of TC Second Draft ballot	7/16/2020	4/09/2020
	Final date for receipt of TC Second Draft ballot - recirc	7/23/2020	4/16/2020
	Posting of Second Draft for CC Meeting		4/23/2020
	Final date for CC Second Draft Meeting		6/04/2020
	Posting of Second Draft for CC Ballot		6/25/2020
	Final date for Receipt of CC Second Draft ballot		7/16/2020
	Final date for Receipt of CC Second Draft ballot - recirc		7/23/2020
	Post Second Draft Report for NITMAM Review	7/30/2020	7/30/2020
Tech Session Preparation (& Issuance)	**Notice of Intent to Make a Motion (NITMAM) Closing Date**	8/27/2020	8/27/2020
	Posting of Certified Amending Motions (CAMs) and Consent Standards	10/08/2020	10/08/2020
	Appeal Closing Date for Consent Standards	10/23/2020	10/23/2020
	SC Issuance Date for Consent Standards	11/02/2020	11/02/2020
Tech Session	Association Meeting for Standards with CAMs		
Appeals and	Appeal Closing Date for Standards with CAMs		

Issuance	SC Issuance Date for Standards with CAMs		

TC = Technical Committee or Panel
CC = Correlating Committee

As of 12/13/2017

AGENDA

ATTACHMENT D

Public Comment No. 6-NFPA 318-2019 [Section No. 2.3.2]

2.3.2 ASTM Publications.

ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, ~~2019a~~ 2019b .

ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, ~~2018ce1~~ 2019 .

ASTM E136, *Standard Test Method for Assessing Combustibility of Materials in Using a Vertical Tube Furnace at 750°C*, 2019.

Statement of Problem and Substantiation for Public Comment

date updates

Related Item

- FR18

Submitter Information Verification

Submitter Full Name:	Marcelo Hirschler
Organization:	GBH International
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Tue Oct 29 19:07:18 EDT 2019
Committee:	SCR-AAA

Public Comment No. 3-NFPA 318-2019 [Section No. 3.3.22]

3.3.22 Liquid.

~~A material that has a melting point that is equal to or less than 20°C (68°F) and a boiling point that is greater than 20°C (68°F) at 101.3 kPa (14.7 psia). When not otherwise identified, the term liquid shall mean both flammable and combustible liquids. [**1,** 2018]~~

(See 4.1.2.1)

3.3.22.1 Combustible Liquid.

~~A liquid that has a closed-cup flash point at or above 37.8°C (100°F).~~

~~**(see 4.1.2.2)**~~

~~**3.3.22.2** Flammable Liquid.~~

~~A liquid that has a closed-cup flash point that is below 37.8°C (100°F) and a maximum vapor pressure of 2068 mm Hg (absolute pressure of 40 psi) at 37.8°C (100°F).~~

~~**(see 4.1.2.3)**~~

Statement of Problem and Substantiation for Public Comment

I agree with the technical committee that the definitions being proposed for movement into the body of the standard contain requirements and are, thus, both not definitions and not in compliance with the manual of style. That is the reason they are proposed to be moved. At present they are contained in the section on definitions and that is inappropriate.

Related Item

- pi8

Submitter Information Verification

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Submittal Date: Tue Oct 29 18:56:31 EDT 2019

Committee:	SCR-AAA

Public Comment No. 4-NFPA 318-2019 [Section No. 3.3.23]

3.3.23 Noncombustible ~~.~~

~~In semiconductor fabrication facilities, 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. Materials that are reported as passing ASTM E136, *Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C* , shall be considered noncombustible materials.~~

material [see 4.1.1]

Statement of Problem and Substantiation for Public Comment

I agree with the technical committee that the definition proposed to be moved to the body of the standard contains requirements and is thus not a definition and in contravention with the manual of style. That is the reason that the inappropriate definition is proposed to be moved, to also be consistent with the location of the requirements for noncombustible materials in many other NFPA codes and standards, including NFPA 1, 101 and 5000.

Note also (in relation to other public comments) that compliance with ASTM E136 is what determines whether a material used in NFPA 318 environments is noncombustible.

Related Item

- pi9

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
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Submittal Date: Tue Oct 29 18:59:46 EDT 2019
Committee: SCR-AAA

Public Comment No. 5-NFPA 318-2019 [Section No. 4.1]

4. 1 General.

4. 1

– General. **4.1.1** –Occupied
.1 Noncombustible materials [NFPA 5000; 7.1.4.1]

A material that complies with any one of the following shall be considered a noncombustible material:

(1) The material, 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.

(2) The material is reported as passing ASTM E136, Standard Test Method for Assessing Combustibility of Materials using a Vertical Tube Furnace at 750 Degrees C.

(3) The material is reported as complying with the pass/fail criteria of ASTM E136 when tested in accordance with the test method and procedure in ASTM E2652, Standard

Test Method for Assessing Combustibility of Materials using a Tube Furnace with a Cone-shaped Airflow Stabilizer, at 750 Degrees C.

4.1.2 Liquids

4.1.2.1 Liquid [NFPA 30; 4.2.5]

Any material that has a fluidity greater than that of 300 penetration asphalt when tested in accordance with ASTM D5/D5M, Standard Test Method for Penetration of Bituminous Materials, or is a viscous substance for which a specific melting point cannot be determined but that is determined to be a liquid in accordance with ASTM D4359, Standard Test for Determining Whether a Material is a Liquid or a Solid.

4.1.2.2 Combustible liquid [NFPA 30; 4.2.2]

Any liquid that has a closed-cup flash point at or above 100°F (37.8°C), as determined by the test procedures and apparatus set forth in Section 4.4 of NFPA 30. Combustible liquids are classified according to Section 4.3 of NFPA 30.

4.1.2.3 Flammable liquid [NFPA 30; 4.2.3]

Any liquid that has a closed-cup flash point below 100°F (37.8°C), as determined by the test procedures and apparatus set forth in Section 4.4 of NFPA 30 and a Reid vapor pressure that does not exceed an absolute pressure of 40 psi (276 kPa) at 100°F (37.8°C), as determined by ASTM D323, Standard Test Method for Vapor Pressure of Petroleum Products (Reid Method). Flammable liquids are classified according to Section 4.3 of NFPA 30.

4.1.3 Occupied Levels of Fabrication Areas.

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

4.1.

2 Fabrication
4 Fabrication Areas.

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

(The newly referenced standards, namely AASTM D5/D5M, ASTM D323 and ASTM E2652, must be added into section 2)

Statement of Problem and Substantiation for Public Comment

This simply moves the requirements from the section on definitions (where they do not belong) to the body of the standard. Note that the newly referenced standards need to be added to section 2 on referenced standards.

Related Item

• pi7 • pi8 • pi9

Submitter Information Verification

Submitter Full Name:	Marcelo Hirschler
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Submittal Date:	Tue Oct 29 19:03:02 EDT 2019
Committee:	SCR-AAA

Public Comment No. 11-NFPA 318-2019 [Section No. 7.1.4]

7.1.4 Purge Panels.

7.1.4.1 *

Purge panels shall be provided at the cylinders for all hazardous production material gases when in use. *(See 7.6.2 for silane and silane mixes.)*

7.1.4.2

Purge panels shall be labeled with the type of gas, and the type of purge gas.

7.1.4.3 *

Purge panels shall be constructed of materials compatible with gases conveyed, minimize leakage potential, provide for control of excess flow, and be equipped with an appropriate emergency shutoff.

7.1.4.4

Purge panels shall be designed to prevent backflow and cross-contamination of purge gas or other process gases.

7.1.4.5

Check valves shall not be exposed to cylinder pressure if a cylinder has a pressure greater than 552 kPa (80 psi).

7.1.4.6

A manual isolation valve shall be provided on the process delivery line at the purge panel to permit removal of the purge panel for repair and maintenance.

7.1.4.7

Hazardous production material gas cylinder purge panels shall be provided with dedicated purge gas cylinders.

7.1.4.7.1

Only purge panels serving compatible gases shall be permitted to share a purge cylinder.

7.1.4.8

Bulk gas systems shall not be used as the purge source for hazardous production material gas cylinder purge panels.

7.1.4.8.1

In the case of hazardous production material gas cylinders no greater than 103 kPa (15 psi) cylinder pressure, bulk gas purge sources shall be permitted to be used in place of cylinders.

7.1.4.8.2

Regulation of cylinder pressure shall not be an acceptable means to meet the 103 kPa (15 psi) threshold.

7.1.4.9

Purge panels shall o nly be permitted to serve HPM cylinders containing compatible gases.

Statement of Problem and Substantiation for Public Comment

A new section 7.1.4.9 was added. This item is to ensure that incompatible gases are not serviced from the same purge gas panel. There are documented cases of back flowing incompatible gases into cylinders which had a common purge panel. There have also been fatalities as a result of this. Only allowing compatible gases on the same purge panel is not clearly spelled out in 7.1.4.

Related Item

- First draft report.

Submitter Information Verification

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Committee:	SCR-AAA

Public Comment No. 9-NFPA 318-2019 [Section No. 7.1.4.8.1]

7.1.4.8.1

~~In the case of hazardous production material gas cylinders no greater than 103 kPa (15 psi) cylinder pressure, bulk gas~~ Bulk gas purge sources shall be permitted to be used in place of purge cylinders , when the pressure at the HPM cylinder valve ourlet, is no greater than 103 kPa gauge (15 psig) at operating temperature .

Statement of Problem and Substantiation for Public Comment

Section 7.1.4.8.1 has four changes. The first change was to reword to add clarity. The second change was to add gauge pressure to “103 kPa gauge (15 psig)”. This change clarifies that the pressure is “gauge” NOT “absolute”. It is clear from the original proposal, that the author was talking about “gauge” pressure by stating 15 psiG in the proposed text and several times in the Statement of Problem and Substantiation. The “gauge” pressure was also added to section 7.1.4.8.2.

In section 7.1.4.8.1 the third change was adding the text “at the HPM cylinder valve outlet”. This addition was to clarify that the 103 kPa gauge (15 psig) would be measured at the valve outlet, when the cylinder valve is open. SAGS Type 2 may have an internal cylinder pressure greater than 15 psig; however, there is 0 psig at the valve outlet when the cylinder valve is open. SAGS Type 2 already allows bulk source purge gas in section 7.14.2.3 and should not be interpreted to exclude SAGS Type 2 from using bulk source purge gas in section 7.1.4.8.1.

In sections 7.1.4.8.1 the fourth change was to add “at operating temperature”. Most gases <15 psig will be liquified gases and the pressures can exceed 15 psig at higher temperatures. Some cylinders may be heated in order to increase the pressure for delivery to the use point. Some cylinders will operate at higher pressures due to higher ambient temperatures in a gas cabinet. The use of “at operating temperature” considers the variations in the design and operation of the system. The “at operating temperature” was also added to section 7.1.4.8.2.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 10-NFPA 318-2019 [Section No. 7.1.4.8.2]	

Related Item

• First draft report. This item first showed up in the first draft report.

Submitter Information Verification

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Committee:	SCR-AAA

Public Comment No. 10-NFPA 318-2019 [Section No. 7.1.4.8.2]

7.1.4.8.2

Regulation of cylinder pressure downstream of the cylinder vavle outlet shall not be an acceptable means to meet the 103 kPa gauge (15 ~~psi~~ psig) ~~threshold~~ at operating temperature threshold .

Statement of Problem and Substantiation for Public Comment

In section 7.1.4.8.2 “downstream of the cylinder valve outlet” was added to clarify that this section does not apply to SAGS Type 2 cylinder. Without this addition, it could be interpreted that SAGS Type 2 would not qualify for bulk source purge gas because of an internal device that controls pressure before the cylinder valve. SAGS Type 1 and Type 2 already allow bulk source purge gas in section 7.14.2.3. It was determined that bulk source purge gas was safe to use on both SAGS Type 1 and Type 2 HPM gases.

In addition, "gauge", psi"g" and "at operating temperature" were added as described in the PC for 7.1.4.8.1.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 9-NFPA 318-2019 [Section No. 7.1.4.8.1]	Some of the proposed changes are the same in 7.1.4.8.1 and 7.1.4.8.2.

Related Item

- First draft report.

Submitter Information Verification

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Submittal Date: Thu Nov 14 15:03:28 EST 2019
Committee: SCR-AAA

Public Comment No. 1-NFPA 318-2019 [Section No. 8.2.1.2]

8.2.1.2*

Materials listed in accordance with the requirements contained in ANSI/FM 4910, *Standard for Cleanroom Materials Flammability Test Protocol,* or with the requirements contained in UL 2360, *Test Method for Determining the Combustibility Characteristics of Plastics Used in Semiconductor Tool Construction*, for use without internal fire detection and suppression shall be permitted to be used as an acceptable alternative to noncombustible materials ~~only where process concerns or process chemicals require alternatives~~ .

Statement of Problem and Substantiation for Public Comment

As stated in the PI, the materials complying with FM 4910 or UL 2360 have a long history of being acceptable for the application and a separate analysis of their suitability should not be necessary. They perform virtually as well as noncombustible materials. Notice that materials complying with ASTM E136, which is the requirement for a material to be noncombustible, are permitted to ignite and to generate a flame (albeit a small one) and, thus, the difference between FM 4910/UL 2360 materials and noncombustible materials is minimal, at best.

Related Item

- PI17

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
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City:
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Zip:
Submittal Date: Tue Oct 29 18:45:32 EDT 2019
Committee: SCR-AAA

Public Comment No. 2-NFPA 318-2019 [Section No. 8.6.2]

8.6.2

Materials listed for use without internal fire detection and suppression, or materials listed per 8.2.1.2, shall be an acceptable alternative to noncombustible materials, where process concerns or process chemicals require alternatives.

Statement of Problem and Substantiation for Public Comment

As stated in the PI, the materials complying with FM 4910 or UL 2360 have a long history of being acceptable for the application and a separate analysis of their suitability should not be necessary. They perform virtually as well as noncombustible materials. Notice that materials complying with ASTM E136, which is the requirement for a material to be noncombustible, are permitted to ignite and to generate a flame (albeit a small one) and, thus, the difference between FM 4910/UL 2360 materials and noncombustible materials is minimal, at best.

Related Item

- PI18

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address:
City:
State:
Zip:
Submittal Date: Tue Oct 29 18:51:50 EDT 2019
Committee: SCR-AAA

Public Comment No. 12-NFPA 318-2019 [Chapter A [Excluding any Sub-Sections]]

Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs.

A.7.1.4.8.1

When using bulk source as a purge gas for HPM gas cylinders at pressures no greater than 103 kPa gauge (15 psig) at operating temperature, the bulk purge gas supply line should be protected against back flow of HPM gases into the bulk gas system and its branches. Once the purge gas inlet valve is opened, there is an opportunity for the HPM gas to migrate into the bulk purge gas distribution line. Methods to mitigate this potential hazard include:

- Bulk gas purge source pressure should have a significantly higher pressure than the HPM source.
- Bulk source gas should have back flow protection at **each** purge panel.
    - Check valves should not be the only back flow prevention device. If check valves are used, they should have a high enough cracking pressure to minimize the chance of HPM back flow. Check valves may not reseat when the flow stops and the pressure is equalized on the upstream and downstream sides. Low cracking pressure check valves may require a **higher** pressure on the **downstream** side to reseat the check valve properly, which could lead to reverse flow or migration of HPM gas upstream of the check valve.
    - A pressure sensing interlock loop may be used to ensure the purge gas pressure is always higher than the HPM manifold pressure and will shut the systems down if conditions are favorable to backflow.

Statement of Problem and Substantiation for Public Comment

The Annex item A.7.1.4.8.1 was added to provide guidance for bulk source gas panel design. There are several practices to help ensure that HPM gases do not migrate into the bulk source supply. Even though 15 psig is a low pressure, the residual HPM gas in the manifold will equalize with the bulk purge gas supply pressure, providing an opportunity for this HPM gas mixture to migrate into the bulk purge gas distribution line during the period that the purge gas inlet valve remains open. Several methods are provided to add protection from back flow of HPM gases.

• The bulk purge gas pressure should be “significantly higher” than the HPM gas. A minimum pressure value was not stated, so the system designer could decide what is appropriate. This was to emphasize that a “significant” pressure differential needs to be considered in the design.

• Check valves are a common back flow prevention device; however, check valves with low cracking pressure (low closing spring force) may not reseat properly unless there is a higher downstream pressure. Check valves may not reseat when the flow stops and the upstream and downstream pressures equalize. For example, some Swagelok check valves with 1/3 or 1 psi cracking pressure can require up to 6 psi “back” (downstream) pressure to reseat the valve properly. Some Swagelok check valves with 10 psi cracking pressure requires about 3 psi higher “inlet” (upstream) pressure to reseat the valve properly. As stated, check valves should not be the only back flow prevention device.

Related Item

- First draft report.

Submitter Information Verification

Submitter Full Name:	Ronald Fuhrhop
Organization:	Praxair, part of the Linde Group
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Thu Nov 14 15:17:43 EST 2019
Committee:	SCR-AAA

Public Comment No. 7-NFPA 318-2019 [Section No. D.1.2.2]

D.1.2.2 ASTM Publications.

ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM SI 10, *Standard for Use of the International System of Units (SI): The Modern Metric System*, 2016.

ASTM E1354, *Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter*, 2017.

ASTM E2058, *Standard Test Methods for Measurement of Synthetic Polymer Material Flammability Using a Fire Propagation Apparatus (FPA)*, ~~2013a~~ 2019 .

Statement of Problem and Substantiation for Public Comment

date update

Related Item

- fr7

Submitter Information Verification

Submitter Full Name: Marcelo Hirschler
Organization: GBH International
Street Address:
City:
State:
Zip:
Submittal Date: Thu Nov 07 08:16:08 EST 2019
Committee: SCR-AAA

AGENDA

ATTACHMENT E

MEMORANDUM

TO: Technical Committee on Semiconductor and Related Facilities

FROM: Yiu Lee, *Technical Committee Administrator*

DATE: August 8, 2019

SUBJECT: NFPA 318 First Draft Technical Committee FINAL Ballot Results (F2020)

According to the final ballot results, all ballot items received the necessary affirmative votes to pass ballot.

23 Members Eligible to Vote
6 Members Not Returned (*Davis, Gonzalez, Quadrini, Ronan, Sloan, Trammell)*

The attached report shows the number of affirmative, negative, and abstaining votes as well as the explanation of the vote for **each** revision**.**

To pass ballot, **each** revision requires: (1) a simple majority of those eligible to vote and (2) an affirmative vote of $^2/_3$ of ballots returned. See Sections 3.3.4.3.(c) and 4.3.10.1 of the ***Regulations Governing the Development of NFPA Standards***.

First Revision No. 19-NFPA 318-2019 [Global Input]

Show metric units first specifically in the following sections: 3.3.4, 3.3.5, 3.3.22, 9.3.7.1, 11.2.3.1, A.1.1 and, A.11.2.1(1)(a)

Submitter Information Verification

Committee:

Submittal Date: Fri Jun 07 13:15:26 EDT 2019

Committee Statement

Committee Statement: To be consistent throughout the standard including extracted text.

Response Message: FR-19-NFPA 318-2019

Ballot Results

✔ This item has passed ballot

23 Eligible Voters
6 Not Returned
15 Affirmative All
2 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Davis, Brett Jay
Gonzalez, Amanda
Quadrini, David A.
Ronan, John G.
Sloan, Dwayne E.
Trammell, Steven R.

Affirmative All

Ballard, Robert J.
Brown, Alastair R.
Clarke, Bruce H.
Eisenberg, Jonathan M.
Enides, Scott
Ffrench, Richard
Grove, Jeffrey S.
Guevara, Rick
Joo, Younghoon

Joseph, Steven W.

Luckman, Randy

Mazzurco, Phil

Randall, Rodney D.

Saucier, Mark

Swanson, Scott E.

Affirmative with Comment

Ngai, Eugene Y.

a

Wyman, Matthew T.

none

First Revision No. 3-NFPA 318-2019 [Global Input]

Remove ~~"ANSI?"~~ "ANSI/" and "Standard for" from all locations associated with UL Standards.

Submitter Information Verification

Committee: SCR-AAA
Submittal Date: Thu May 09 11:27:18 EDT 2019

Committee Statement

Committee Statement: Remove "Standard for" from the title. UL is no longer using that term. Remove ANSI because many years ago, UL preferred the ANSI/UL reference because there was a transition of traditional UL standards towards an ANSI standards development process.

Now, years later, a large majority of UL Standards are ANSI approved and follow the ANSI development and maintenance process. However, sometimes readers are confused because they don't understand the standards are UL standards, not developed by ANSI. There are many other references to standards promulgated by different standards development organizations where they are considered ANSI approved but do not include ANSI in the reference.

Response Message: FR-3-NFPA 318-2019

Public Input No. 19-NFPA 318-2018 [Global Input]

Ballot Results

✔ **This item has passed ballot**

23 Eligible Voters
6 Not Returned
15 Affirmative All
2 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Davis, Brett Jay
Gonzalez, Amanda
Quadrini, David A.
Ronan, John G.
Sloan, Dwayne E.
Trammell, Steven R.

Affirmative All

Ballard, Robert J.
Brown, Alastair R.

Clarke, Bruce H.
Eisenberg, Jonathan M.
Enides, Scott
Ffrench, Richard
Grove, Jeffrey S.
Guevara, Rick
Joo, Younghoon
Joseph, Steven W.
Luckman, Randy
Mazzurco, Phil
Randall, Rodney D.
Saucier, Mark
Swanson, Scott E.

Affirmative with Comment

Ngai, Eugene Y.
a
Wyman, Matthew T.
none

First Revision No. 18-NFPA 318-2019 [Chapter 2]

Chapter 2 Referenced Publications

2.1 General.

The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

2.2 NFPA Publications.

National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 1, *Fire Code,* 2018 edition.

NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems,* ~~2015~~ 2018 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems,* ~~2016~~ 2019 edition.

NFPA 30, *Flammable and Combustible Liquids Code,* 2018 edition.

NFPA 37, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines,* 2018 edition.

NFPA 55, *Compressed Gases and Cryogenic Fluids Code,* 2016 edition.

NFPA 70®, National Electrical Code®, 2017 edition.

NFPA 72®, National Fire Alarm and Signaling Code® , ~~2016~~ 2019 edition.

NFPA 79, *Electrical Standard for Industrial Machinery,* ~~2015~~ 2018 edition.

NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems,* 2018 edition.

NFPA 92, *Standard for Smoke Control Systems,* ~~2015~~ 2018 edition.

NFPA *101®, Life Safety Code®,* 2018 edition.

NFPA 385, *Standard for Tank Vehicles for Flammable and Combustible Liquids,* 2017 edition.

NFPA 400, *Hazardous Materials Code,* ~~2016~~ 2019 edition.

NFPA 497, *Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas,* 2017 edition.

NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response,* 2017 edition.

NFPA 750, *Standard on Water Mist Fire Protection Systems,* ~~2015~~ 2019 edition.

NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems,* ~~2015~~ 2018 edition.

NFPA 5000®, Building Construction and Safety Code®, 2018 edition.

2.3 Other Publications.

2.3.1 ASME Publications.

ASME International, Two Park Avenue, New York, NY 10016-5990.

ASME A.13.1, *Scheme for the Identifications of Piping Systems*, 2015.

ASME B31.3, *Process Piping*, ~~2014~~ 2018 .

ASME Boiler and Pressure Vessel Code, ~~2017~~ 2019 .

2.3.2 ASTM Publications.

ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, ~~2015b~~ 2019a .

ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials,* ~~2014~~ 2018ce1 .

ASTM E136, *Standard Test Method for ~~Behavior of~~ Assessing Combustibility of Materials in Using a Vertical Tube Furnace at 750°C*, ~~2016~~ 2019 .

2.3.3 CGA Publications.

Compressed Gas Association, 14501 George Carter Way, Suite 103, Chantilly, VA 20151-2923.

ANSI/CGA G-13, *Storage and Handling of Silane and Silane Mixtures*, ~~2016~~ 2015 .

2.3.4 FM Publications.

FM Global, 270 Central Avenue, P.O. Box 7500, Johnston, RI 02919.

ANSI/FM 4910, *Standard for Cleanroom Materials Flammability Test Protocol*, 2013.

2.3.5 ISO Publications.

International Organization for Standardization, ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland.

ISO 14644-1, *Cleanrooms and associated controlled environments — Part 1: Classification of air cleanliness by particle concentration*, 2nd edition, 2015.

2.3.6 SEMI Publications.

Semiconductor Equipment and Materials International, 3081 Zanker Road, San Jose, CA 95134.

SEMI F1, *Specification for Leak Integrity of High-Purity Gas Piping Systems and Components*, 1996.

SEMI S3, *Safety Guideline for Process Liquid Heating Systems*, 2011.

2.3.7 UL Publications.

Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

~~ANSI/~~ UL 263, ~~*Standard for*~~ *Fire Tests of Building Construction and Materials*, 2011, revised 2018 .

~~ANSI/~~ UL 723, ~~*Standard for*~~ *Test for Surface Burning Characteristics of Building Materials*, ~~2008, revised 2013~~ 2018 .

~~ANSI/~~ UL 900, ~~*Standard for*~~ *Air Filter Units*, 2015.

~~ANSI/~~ UL 2360, ~~*Standard*~~ *Test Method for Determining the Combustibility Characteristics of Plastics Used in Semiconductor Tool Construction*, ~~2013~~ 2000, revised 2017 .

2.3.8 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

2.4 References for Extracts in Mandatory Sections.

NFPA 1, *Fire Code,* 2018 edition.

NFPA 30, *Flammable and Combustible Liquids Code,* ~~2015~~ 2018 edition.

NFPA 55, *Compressed Gases and Cryogenic Fluids Code,* 2016 edition.

NFPA 69, *Standard on Explosion Prevention Systems,* ~~2014~~ 2019 edition.

NFPA 400, *Hazardous Materials Code,* ~~2016~~ 2019 edition.

NFPA 1670, *Standard on Operations and Training for Technical Search and Rescue Incidents,* 2017 edition.

NFPA 5000®, Building Construction and Safety Code®, 2018 edition.

Supplemental Information

File Name	Description Approved
318-2018_Chapter_2.docx	for staff use

Submitter Information Verification

Committee: SCR-AAA

Submittal Date: Mon Jun 03 10:34:22 EDT 2019

Committee Statement

Committee Statement: Referenced current national consensus standard editions.

Response Message: FR-18-NFPA 318-2019

Public Input No. 14-NFPA 318-2018 [Section No. 2.3]

Public Input No. 20-NFPA 318-2018 [Section No. 2.3.7]

Public Input No. 5-NFPA 318-2018 [Section No. 2.3.2]

Ballot Results

✔ **This item has passed ballot**

23 Eligible Voters
6 Not Returned
15 Affirmative All
2 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Davis, Brett Jay

Gonzalez, Amanda

Quadrini, David A.

Ronan, John G.

Sloan, Dwayne E.

Trammell, Steven R.

Affirmative All

Ballard, Robert J.

Brown, Alastair R.

Clarke, Bruce H.

Eisenberg, Jonathan M.

Enides, Scott

Ffrench, Richard

Grove, Jeffrey S.

Guevara, Rick

Joo, Younghoon

Joseph, Steven W.

Luckman, Randy

Mazzurco, Phil

Randall, Rodney D.

Saucier, Mark

Swanson, Scott E.

Affirmative with Comment

Ngai, Eugene Y.

a

Wyman, Matthew T.

none

First Revision No. 20-NFPA 318-2019 [Section No. 3.3.35]

3.3.35 Subatmospheric Gas Source (SAGS).

3.3.35.1 Subatmospheric Gas Storage and Delivery Source (Type 1 SAGS).

A gas source package that stores and delivers gas at subatmospheric pressure and includes a container (e.g., gas cylinder and outlet valve) that stores and delivers gas at a pressure of less than absolute pressure of ~~14.7 psi~~ 101.3 kPa (14.7 psi) at NTP.

3.3.35.2 Subatmospheric Gas Delivery Source (Type 2 SAGS).

A gas source package that stores compressed gas and delivers gas at subatmospheric pressure and includes a container (e.g., gas cylinder and outlet valve) that stores gas at a pressure greater than absolute pressure of ~~14.7~~ 101.3 kPa (14.7 psi) at NTP and delivers gas at a pressure of less than absolute pressure of ~~14.7 psi~~ 101.3 kPa (14.7 psi) at NTP.

Submitter Information Verification

Committee: SCR-AAA

Submittal Date: Fri Jun 07 13:39:45 EDT 2019

Committee Statement

Committee Statement: Adds metric equivalent.

Response Message: FR-20-NFPA 318-2019

Ballot Results

✔ **This item has passed ballot**

23 Eligible Voters
6 Not Returned
15 Affirmative All
2 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Davis, Brett Jay
Gonzalez, Amanda
Quadrini, David A.
Ronan, John G.
Sloan, Dwayne E.
Trammell, Steven R.

Affirmative All

Ballard, Robert J.
Brown, Alastair R.
Clarke, Bruce H.

Eisenberg, Jonathan M.

Enides, Scott

Ffrench, Richard

Grove, Jeffrey S.

Guevara, Rick

Joo, Younghoon

Joseph, Steven W.

Luckman, Randy

Mazzurco, Phil

Randall, Rodney D.

Saucier, Mark

Swanson, Scott E.

Affirmative with Comment

Ngai, Eugene Y.

a

Wyman, Matthew T.

none

First Revision No. 17-NFPA 318-2019 [Section No. 5.5.2 [Excluding any Sub-Sections]]

Hazardous chemicals in the fabrication area shall be limited to those needed for operations and maintenance and as required by 5.5.2.1 through 5.5.2.3, with quantities not exceeding the limitations specified in Table 5.5.2. The limits of Table 5.5.2 shall be permitted to be exceeded, provided a submittal using alternative methods and materials is approved by the authority having jurisdiction (AHJ).

Table 5.5.2 Quantity Limits for Hazardous Materials in a Single Fabrication Area

Hazard Category	**Solids**		**Liquids**		**Gas**	
	kg/m^2	**lb/ft^2**	**L/m^2**	**gal/ft^2**	**m^3 @ NTP/m^2**	**ft^3 @ NTP/ft^2**
Physical Hazard Materials						
Combustible liquid						
Class II			0.8	0.02		
Class III-A			1.6	0.04		
Class III-B			Not limited	Not limited		
Combination Class I, II, and III-A			3.26	0.08		
Cryogenic						
Flammable					Note [b]	Note [b]
Oxidizing					0.76	2.5
Flammable gas						
Gaseous					Note [b]	Note [b]
Liquefied					Note [b]	Note [b]
Flammable liquid						
Class I-A			2.04	0.05		
Class I-B			2.04	0.05		
Class I-C			2.04	0.05		
Combination Class I-A, I-B, and I-C			2.04	0.05		
Combination Class I, II, and III-A			3.26	0.08		
Flammable solid	0.032	0.002				
Organic peroxide						
Unclassified detonable	Note [a]	Note [a]	Note [a]	Note [a]		
Class I	Note [a]	Note [a]	Note [a]	Note [a]		
Class II	0.8	0.05	0.1	0.0025		
Class III	3.2	0.2	0.8	0.02		
Class IV	Not limited	Not limited	Not limited	Not limited		
Class V	Not limited	Not limited	Not limited	Not limited		
Oxidizing gas						
Gaseous					0.76	2.5
Liquefied					0.76	2.5
Combination of gaseous and liquefied					0.76	2.5
Oxidizer						
Class 4	Note [a]	Note [a]	Note [a]	Note [a]		
Class 3	0.096	0.006	2.44	0.06		
Class 2	0.096	0.006	2.44	0.06		
Class 1	~~0.096~~ Not limited	~~0.006~~ Not limited	~~2.44~~ Not limited	~~0.06~~		

Hazard Category	Solids		Liquids		Gas	
	kg/m^2	lb/ft^2	L/m^2	gal/ft^2	m^3 @ NTP/m^2	ft^3 @ NTP/ft^2
Combination oxidizer Class ~~1,~~ 2, 3	0.096	0.006	2.44	0.06		
Pyrophoric	Note [a]	Note [a]	~~0.1~~ 0.3	~~0.0025~~ 0.0075	Notes [b] and [c]	Notes [b] and [c]
Unstable reactive						
Class 4	Note [a]	Note [a]	Note [a]	Note [a]	Note [a]	Note [a]
Class 3	0.8	0.05	0.2	0.005	Note [a]	Note [a]
Class 2	3.2	0.2	0.8	0.02	Note [a]	Note [a]
Class 1	Not limited	Not limited	Not limited	Not limited	Not limited	Not limited
Water reactive						
Class 3	Note [b]	Note [b]	~~0.1~~ 0.3	~~0.0025~~ 0.0075		
Class 2	8.0	0.5	2.04	0.05		
Class 1	Not limited	Not limited	Not limited	Not limited		
Health Hazard Materials						
Carcinogens	Not limited	Not limited	Not limited	Not limited	Not limited	Not limited
Corrosives	Not limited	Not limited	Not limited	Not limited	Not limited	Not limited
Highly toxics	Not limited	Not limited	Not limited	Not limited	Note [b]	Note [b]
Irritants	Not limited	Not limited	Not limited	Not limited	Not limited	Not limited
Sensitizers	Not limited	Not limited	Not limited	Not limited	Not limited	Not limited
Other health hazards	Not limited	Not limited	Not limited	Not limited	Not limited	Not limited
Toxics	Not limited	Not limited	Not limited	Not limited	Note [b]	Note [b]

Note: Hazardous materials within piping not to be included in the calculated quantities.

[a]Quantity of hazardous materials in a single fabrication area not to exceed ~~exempt amounts in NFPA 1~~ the maximum allowable quantities (MAQs) contained in NFPA 1, Table 60.4.2.1.1.3, including the 100 percent increases for sprinklers and/or approved cabinet increases where applicable .

[b]The aggregate quantity of flammable, pyrophoric, toxic, and highly toxic gases not to exceed a density limit of 0.66 m^3 per m^2 at NTP (0.2 ft^3 per ft^2 at NTP) .

[c]The aggregate quantity of pyrophoric gases in the building limited to the amounts for which detached storage is not required as set forth in NFPA 1.

Supplemental Information

File Name	Description	Approved
318_Table_5_5_2_CI_docx_w_je_edits_052819.docx	for staff use	

Submitter Information Verification

Committee: SCR-AAA

Submittal Date: Wed May 29 10:42:56 EDT 2019

Committee Statement

Committee Statement: Note a - Allowable increases are permitted but not recognized in NFPA 318, Table 5.5.2.2 and terminology was incorrect.

Class 1 Oxidizer was changed due to not increase the combustibility of other materials. The large operating quantities quickly use up the allowable quantity of oxidizers in the fab.

For Class 3 water reactive and pyrophoric liquids the best practice is to maintain the quantities as close to the tools as possible i.e. in the fab. The current quantity limits are close to the actual quantities utilized in manufacturing fabs. Also there are several liquids currently in R&D and these are expected in manufacturing quantities in the near future.

Response Message: FR-17-NFPA 318-2019

Ballot Results

✔ **This item has passed ballot**

23 Eligible Voters
6 Not Returned
14 Affirmative All
3 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Davis, Brett Jay
Gonzalez, Amanda
Quadrini, David A.
Ronan, John G.
Sloan, Dwayne E.
Trammell, Steven R.

Affirmative All

Ballard, Robert J.
Brown, Alastair R.
Clarke, Bruce H.
Eisenberg, Jonathan M.
Enides, Scott
Grove, Jeffrey S.
Guevara, Rick
Joo, Younghoon
Joseph, Steven W.
Luckman, Randy
Mazzurco, Phil
Randall, Rodney D.
Saucier, Mark
Swanson, Scott E.

Affirmative with Comment

Ffrench, Richard

The large fabs will lead to the possibility of very concentrated volumes of pyrophoric liquids on the order of 400 gallons.

Ngai, Eugene Y.

a

Wyman, Matthew T.

none

First Revision No. 12-NFPA 318-2019 [Section No. 5.5.2.2 [Excluding any Sub-Sections]]

Quantities of hazardous chemicals shall be limited to those in use within the tool or the daily (24-hour) supply of chemicals needed, with quantities not exceeding the limitations specified in Table 5.5.2.2 unless a risk assessment determines that a significant fire is unlikely to take place.

Table 5.5.2.2 Maximum Quantities of Hazardous Chemicals at a Workstation

Hazardous Chemical	State	Maximum Amount
Flammables, highly toxics, and pyrophorics and toxics combined[a]	Gas	Combined aggregate volume of all cylinders at a work station shall not exceed an internal cylinder volume of 150 L (39.6 gal, or 5.29 ft^3).
Hazardous chemical flammables	Liquid	56.8 L (15 gal)[a,b]
	Solid	2.3 kg (5 lb)[a,b]
Corrosives[a]	Gas	Combined aggregate volume of all cylinders at a work station shall not exceed an internal cylinder volume of 150 L (39.6 gal, or 5.29 ft^3).
	Liquid	378.5 L (100 gal)[a,b]
	Solid	9.1 kg (20 lb)
Highly toxics	Liquid	56.8 L (15 gal)[a]
	Solid	2.3 kg (5 lb)[a]
Oxidizers[a]	Gas	Combined aggregate volume of all cylinders at a work station shall not exceed an internal cylinder volume of 150 L (39.6 gal, or 5.29 ft^3).
	Liquid	45.4 L (12 gal)[a,b]
	Solid	9.1 kg (20 lb)[a,b]
Pyrophorics	Liquid	~~20 L (5.3 gal)~~ 2 L (0.5 gal) ~~[c,d]~~
	Solid	2 kg (4.4 lb)
Toxics	Liquid	56.8 L (15 gal)[a,b]
	Solid	2.3 kg (5 lb)[a,b]
Unstable reactives Class 3	Liquid	20 L (5.3 gal)[a,b,d]
	Solid	2.3 kg (5 lb)[a,b]
Water reactives Class 3	Liquid	1.9 L (0.5 gal)[c]

[a]Allowable quantities increased 100 percent for use-closed systems operations. When note b also applies, the increase for both requirements is allowed.

[b]Allowable quantities are allowed to be increased 100 percent when tools are constructed of materials that are listed or approved for use without internal fire extinguishing or suppression or internally protected with an approved automatic fire-extinguishing or suppression system. When note a also applies, the increase for both notes is allowed.

~~[c] Only in tools that are internally protected with an approved automatic fire-extinguishing or fire protection system compatible with the reactivity of materials in use at the workstation.~~

~~[d] 20 L is acceptable, it is more reflective of current practices for volumes of materials used at individual tools.~~

Supplemental Information

File Name	Description	Approved
318_Table_5.5.2.2_CI_.rev_5_28_2019.docx	Table 5.5.2.2 with changes - for staff use	

Submitter Information Verification

Committee: SCR-AAA

Submittal Date: Thu May 09 14:35:15 EDT 2019

Committee Statement

Committee Statement: Table 5.5.2.2 is identical to the IFC/ICC Table 2705.2.2 for Maximum Quantities of Hazardous Chemicals at a Workstation (with exception of reference to Pyrophoric Solids).

NOTE C – was moved to a new subsection since table notes cannot contain requirements per the NFPA Manual of Style. See new Section 5.5.2.2.2.

Appendix A.6.4.1 instructs all applications to integrate a fire control methodology to protect the cabinet and surrounding areas – referencing nitrogen inerting and vermiculite as acceptable medias. However, all of these methods have significant limitations in their ability to protect the equipment and surrounding fab areas from fire and particle damage. These methods also do not address personnel safety to exposure hazards associated with unreacted pyrophoric liquid or vapor within the cabinet when the cabinet door is open.

NEW SEMI S30 (as reference) has been approved by committee (April 5, 2019) and scheduled to be released in 2019:

Section 13.2.1 (bulk delivery cabinet) & 15.4.1 (tool delivery cabinet) – Require secondary exhaust ventilation that demonstrates effective (that is, meeting the criteria of SEMI S2 and S6) capture and containment of the energetic material and associated combustion byproducts from reaction with air from the source within the delivery cabinet.

13.4 Fire Risk Management — Based on the integrated risk assessment in accordance with SEMI S14, the equipment supplier should consult with a recognized fire risk management expert to ensure an appropriate fire risk management design is provided. Available fire risk management approaches for energetic materials include adsorption technologies and inerting of the cabinet.

NOTE 41: Designing appropriate fire risk management requires knowledge of both the properties of the relevant energetic materials and of fire risk management means.

NOTE 42: Guidance on inerting can be found in FM Global Property Loss Prevention Data Sheet 7-59, Inerting and Purging of Tanks, Process Vessels, and Equipment. However, there are several possible, undesirable consequences of inerting an energetic materials enclosure, including:

• creation of an asphyxiation hazard

• a leak into such a space might neither ignite nor react with the atmosphere, so it would not be detected by particle or flame detectors, and

• a reaction of the accumulated energetic material with air introduced when a door is opened could both be of greater power than a reaction limited by the rate of release and result in a sudden energy release to which a person is directly exposed.

Response Message: FR-12-NFPA 318-2019

Ballot Results

✔ **This item has passed ballot**

23 Eligible Voters

6 Not Returned
14 Affirmative All
2 Affirmative with Comments
1 Negative with Comments
0 Abstention

Not Returned

Davis, Brett Jay

Gonzalez, Amanda

Quadrini, David A.

Ronan, John G.

Sloan, Dwayne E.

Trammell, Steven R.

Affirmative All

Ballard, Robert J.

Brown, Alastair R.

Clarke, Bruce H.

Eisenberg, Jonathan M.

Enides, Scott

Grove, Jeffrey S.

Guevara, Rick

Joo, Younghoon

Joseph, Steven W.

Luckman, Randy

Mazzurco, Phil

Randall, Rodney D.

Saucier, Mark

Swanson, Scott E.

Affirmative with Comment

Ngai, Eugene Y.

a

Wyman, Matthew T.

none

Negative with Comment

Ffrench, Richard

The transfer and installation of containers of 20 L of pyrophoric liquids create a high likelihood of an uncontrollable event within a production fab. Also note that the table as 20 l for unstable reactive liquids and 2 L for pyrophoric and water reactive - should they be the same?

First Revision No. 26-NFPA 318-2019 [New Section after 5.5.2.2.1]

5.5.2.2.2

A maximum quantity of 20 L (5.3 gal) of liquid and 2 kg (4.4 lb) of total liquids and solids shall be allowed at a workstation where conditions are in accordance with Section 6.4 .

Submitter Information Verification

Committee: SCR-AAA

Submittal Date: Mon Jun 24 13:49:42 EDT 2019

Committee Statement

Committee Statement: Table footnotes cannot contain requirements, NOTE C as proposed was moved to a new subsection. Requires the use of approved automatic fire-extinguishing or fire protection system for any and all use of pyrophoric liquids within a workstation; however, it is well understood that “there is no way to practically suppress a fire involving pyrophoric liquids” as stated in A.6.4.1. This note is copy of IFC Chapter 2705.2.2 which clearly requires fire protection for pyrophoric liquids for all workstation application when added in 2006; however, Section 6.4 doesn’t address fire protection systems except in Appendix 6.4.1 and reference under 6.4.6 for valve closures.

Response Message: FR-26-NFPA 318-2019

Ballot Results

✔ **This item has passed ballot**

23 Eligible Voters
6 Not Returned
14 Affirmative All
1 Affirmative with Comments
2 Negative with Comments
0 Abstention

Not Returned

Davis, Brett Jay
Gonzalez, Amanda
Quadrini, David A.
Ronan, John G.
Sloan, Dwayne E.
Trammell, Steven R.

Affirmative All

Ballard, Robert J.
Brown, Alastair R.
Clarke, Bruce H.
Eisenberg, Jonathan M.

Enides, Scott

Grove, Jeffrey S.

Guevara, Rick

Joo, Younghoon

Joseph, Steven W.

Luckman, Randy

Mazzurco, Phil

Randall, Rodney D.

Saucier, Mark

Swanson, Scott E.

Affirmative with Comment

Ngai, Eugene Y.

a

Negative with Comment

Ffrench, Richard

The transfer and installation of containers of 20 L of pyrophoric liquids create a high likelihood of an uncontrollable event within a production fab. Okay with 20 L with proper safeguards outside the fab.

Wyman, Matthew T.

The committee agreed that this new text was to replace current NOTE C under the table 5.5.2.2. Instead it is listed as new line under 5.5.2.2.2. The intent of this change in text was to allow user to increase above the max 2L (new value in chart) to 20L if they meet all conditions of Section 6.4. Then if user wants to exceed 20L then must have AHJ approval per 5.5.2.2.1. Having this text as 5.5.2.2.2 under 5.5.2.2.1 contradicts and confuses user and intent. This should be changed to: Note C - A maximum of quantity of 20L (5.3 gal) of liquid and 20Kg (44 pounds) of total liquids and solids shall be allowed at a workstation where conditions are in accordance with Section 6.4. Note C references also need to be added back to table for Pyrophoric Liquids/Solids, and Class 3 water reactives.

First Revision No. 16-NFPA 318-2019 [Section No. 6.4.1]

6.4.1*

Pyrophoric liquids in containers greater than 2 L (0.5 gal) but not exceeding 20 L (5.3 gal) capacity shall be allowed at workstations when located inside cabinets that comply with the requirements of Section 6.4 .

A.6.4.1

~~There~~ Testing has shown that there is no practical way to ~~practically~~ suppress a fire involving pyrophoric liquids. ~~Nonetheless, a~~ A fire control ~~methodology~~ method should be designed to protect the cabinet and surrounding areas. Acceptable fire control ~~media include, but are not limited to, nitrogen inerting and vermiculite.~~ methods must be capable of performing the following:

(1) Detecting the leak

(2) Capturing, containing, and removing all leaked material and associated combustion by-products

(3) Supervising the removal process to ensure all leaked hazardous material has been fully reacted before allowing personnel to enter the cabinet so that reignition cannot occur when the delivery cabinet is opened

Testing has shown that nitrogen inerting is the only known method to prevent a flame should pyrophoric liquids leak.

Submitter Information Verification

Committee: SCR-AAA

Submittal Date: Wed May 29 10:31:59 EDT 2019

Committee Statement

Committee Statement: Table 5.5.2.2 is identical to the IFC/ICC Table 2705.2.2 for Maximum Quantities of Hazardous Chemicals at a Workstation (with exception of reference to Pyrophoric Solids).

NOTE C – Requires the use of approved automatic fire-extinguishing or fire protection system for any and all use of pyrophoric liquids within a workstation; however, it is well understood that “there is no way to practically suppress a fire involving pyrophoric liquids” as stated in A.6.4.1. This note is copy of IFC Chapter 2705.2.2 which clearly requires fire protection for pyrophoric liquids for all workstation application when added in 2006; however, Section 6.4 doesn’t address fire protection systems except in Appendix 6.4.1 and reference under 6.4.6 for valve closures.

Appendix A.6.4.1 instructs all applications to integrate a fire control methodology to protect the cabinet and surrounding areas – referencing nitrogen inerting and vermiculite as acceptable medias. However, all of these methods have significant limitations in their ability to protect the equipment and surrounding fab areas from fire and particle damage. These methods also do not address personnel safety to exposure hazards associated with unreacted pyrophoric liquid or vapor within the cabinet when the cabinet door is open.

NEW SEMI S30 (as reference) has been approved by committee (April 5, 2019) and scheduled to be released in 2019:

Section 13.2.1 (bulk delivery cabinet) & 15.4.1 (tool delivery cabinet) – Require secondary exhaust ventilation that demonstrates effective (that is, meeting the criteria of SEMI S2 and S6) capture and containment of the energetic material and associated combustion byproducts from reaction with air from the source within the delivery cabinet.

13.4 Fire Risk Management — Based on the integrated risk assessment in accordance with SEMI

S14, the equipment supplier should consult with a recognized fire risk management expert to ensure an appropriate fire risk management design is provided. Available fire risk management approaches for energetic materials include adsorption technologies and inerting of the cabinet.

NOTE 41: Designing appropriate fire risk management requires knowledge of both the properties of the relevant energetic materials and of fire risk management means.

NOTE 42: Guidance on inerting can be found in FM Global Property Loss Prevention Data Sheet 7-59, Inerting and Purging of Tanks, Process Vessels, and Equipment. However, there are several possible, undesirable consequences of inerting an energetic materials enclosure, including:

• creation of an asphyxiation hazard

• a leak into such a space might neither ignite nor react with the atmosphere, so it would not be detected by particle or flame detectors, and

• a reaction of the accumulated energetic material with air introduced when a door is opened could both be of greater power than a reaction limited by the rate of release and result in a sudden energy release to which a person is directly exposed.

Response Message: FR-16-NFPA 318-2019

Ballot Results

This item has passed ballot

23 Eligible Voters
6 Not Returned
14 Affirmative All
3 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Davis, Brett Jay
Gonzalez, Amanda
Quadrini, David A.
Ronan, John G.
Sloan, Dwayne E.
Trammell, Steven R.

Affirmative All

Ballard, Robert J.
Brown, Alastair R.
Clarke, Bruce H.
Eisenberg, Jonathan M.
Enides, Scott
Grove, Jeffrey S.
Guevara, Rick
Joo, Younghoon
Joseph, Steven W.
Luckman, Randy

Mazzurco, Phil

Randall, Rodney D.

Saucier, Mark

Swanson, Scott E.

Affirmative with Comment

Ffrench, Richard

These delivery systems safeguards are good for delivery systems outside the fab area.

Ngai, Eugene Y.

a

Wyman, Matthew T.

none

First Revision No. 15-NFPA 318-2019 [New Section after 6.4.7]

6.4.8 Fire Control System.

Cabinets shall be protected with an approved automatic fire control system that is capable of capturing, containing, and abating the pyrophoric material and associated combustion by-products from reaction with air should a leak occur within the cabinet.

Submitter Information Verification

Committee: SCR-AAA

Submittal Date: Tue May 28 11:06:12 EDT 2019

Committee Statement

Committee Statement: Table 5.5.2.2 is identical to the IFC/ICC Table 2705.2.2 for Maximum Quantities of Hazardous Chemicals at a Workstation (with exception of reference to Pyrophoric Solids).

NOTE C – Requires the use of approved automatic fire-extinguishing or fire protection system for any and all use of pyrophoric liquids within a workstation; however, it is well understood that “there is no way to practically suppress a fire involving pyrophoric liquids” as stated in A.6.4.1. This note is copy of IFC Chapter 2705.2.2 which clearly requires fire protection for pyrophoric liquids for all workstation application when added in 2006; however, Section 6.4 doesn’t address fire protection systems except in Appendix 6.4.1 and reference under 6.4.6 for valve closures.

Appendix A.6.4.1 instructs all applications to integrate a fire control methodology to protect the cabinet and surrounding areas – referencing nitrogen inerting and vermiculite as acceptable medias. However, all of these methods have significant limitations in their ability to protect the equipment and surrounding fab areas from fire and particle damage. These methods also do not address personnel safety to exposure hazards associated with unreacted pyrophoric liquid or vapor within the cabinet when the cabinet door is open.

NEW SEMI S30 (as reference) has been approved by committee (April 5, 2019) and scheduled to be released in 2019:

Section 13.2.1 (bulk delivery cabinet) & 15.4.1 (tool delivery cabinet) – Require secondary exhaust ventilation that demonstrates effective (that is, meeting the criteria of SEMI S2 and S6) capture and containment of the energetic material and associated combustion byproducts from reaction with air from the source within the delivery cabinet.

13.4 Fire Risk Management — Based on the integrated risk assessment in accordance with SEMI S14, the equipment supplier should consult with a recognized fire risk management expert to ensure an appropriate fire risk management design is provided. Available fire risk management approaches for energetic materials include adsorption technologies and inerting of the cabinet.

NOTE 41: Designing appropriate fire risk management requires knowledge of both the properties of the relevant energetic materials and of fire risk management means.

NOTE 42: Guidance on inerting can be found in FM Global Property Loss Prevention Data Sheet 7-59, Inerting and Purging of Tanks, Process Vessels, and Equipment. However, there are several possible, undesirable consequences of inerting an energetic materials enclosure, including:

- creation of an asphyxiation hazard
- a leak into such a space might neither ignite nor react with the atmosphere, so it would not be detected by particle or flame detectors, and
- a reaction of the accumulated energetic material with air introduced when a door is opened could both be of greater power than a reaction limited by the rate of release and result in a sudden energy

release to which a person is directly exposed.

Response Message: FR-15-NFPA 318-2019

Ballot Results

✔ **This item has passed ballot**

23 Eligible Voters
6 Not Returned
14 Affirmative All
3 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Davis, Brett Jay
Gonzalez, Amanda
Quadrini, David A.
Ronan, John G.
Sloan, Dwayne E.
Trammell, Steven R.

Affirmative All

Ballard, Robert J.
Brown, Alastair R.
Clarke, Bruce H.
Eisenberg, Jonathan M.
Enides, Scott
Grove, Jeffrey S.
Guevara, Rick
Joo, Younghoon
Joseph, Steven W.
Luckman, Randy
Mazzurco, Phil
Randall, Rodney D.
Saucier, Mark
Swanson, Scott E.

Affirmative with Comment

Ffrench, Richard

The word abate needs a definition (it generally means removing a hazard by reacting to a safe state). We would recommend "safely removing", which would include abatement as an option.

Ngai, Eugene Y.

Other inert gases such as argon, helium or carbon dioxide x=can be used

Wyman, Matthew T.

none

First Revision No. 28-NFPA 318-2019 [Section No. 6.5.2.1]

6.5.2.1

Liquids having a hazard ranking of 3 when exceeding 20 L (5.3 gal), or liquids having a hazard ranking of 4 when exceeding 4 L (1.1 gal), shall be transferred by one of the following methods:

(1) From safety cans

(2) Through an approved closed-piping system

(3) From containers or tanks by an approved pump taking suction through an opening in the top of the container or tank

(4) For other than highly toxic liquids, from containers or tanks by gravity through an approved self-closing or automatic-closing valve where the container or tank and dispensing operations are provided with spill control and secondary containment complying with 6.3.1.4.1 through 6.3.1.4.2.10 of NFPA 400

(5) By the use of approved engineered liquid transfer systems

[**400:**6.3.1.7.2]

Submitter Information Verification

Committee: SCR-AAA

Submittal Date: Mon Jun 24 14:00:18 EDT 2019

Committee Statement

Committee Statement: Clarifies that referenced sections are referring to NFPA 400.

Response Message: FR-28-NFPA 318-2019

Ballot Results

✔ **This item has passed ballot**

23 Eligible Voters
6 Not Returned
14 Affirmative All
3 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Davis, Brett Jay

Gonzalez, Amanda

Quadrini, David A.

Ronan, John G.

Sloan, Dwayne E.

Trammell, Steven R.

Affirmative All

Ballard, Robert J.

Brown, Alastair R.

Clarke, Bruce H.

Eisenberg, Jonathan M.

Enides, Scott

Grove, Jeffrey S.

Guevara, Rick

Joo, Younghoon

Joseph, Steven W.

Luckman, Randy

Mazzurco, Phil

Randall, Rodney D.

Saucier, Mark

Swanson, Scott E.

Affirmative with Comment

Ffrench, Richard

Order in safest to least?

Ngai, Eugene Y.

a

Wyman, Matthew T.

none

First Revision No. 27-NFPA 318-2019 [Section No. 7.1.3.1 [Excluding any Sub-Sections]]

Piping, tubing, fittings, and related components shall be designed, fabricated, and tested in accordance with the requirements of the applicable parts in ~~ANSI/~~ ASME B31.3, *Process Piping*~~, or other approved standards~~ . [**55:**7.3.1.3]

Submitter Information Verification

Committee: SCR-AAA

Submittal Date: Mon Jun 24 13:57:52 EDT 2019

Committee Statement

Committee Statement: Updates extracted text.

Response Message: FR-27-NFPA 318-2019

Ballot Results

✔ **This item has passed ballot**

23 Eligible Voters
6 Not Returned
15 Affirmative All
2 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Davis, Brett Jay
Gonzalez, Amanda
Quadrini, David A.
Ronan, John G.
Sloan, Dwayne E.
Trammell, Steven R.

Affirmative All

Ballard, Robert J.
Brown, Alastair R.
Clarke, Bruce H.
Eisenberg, Jonathan M.
Enides, Scott
Ffrench, Richard
Grove, Jeffrey S.
Guevara, Rick
Joo, Younghoon

Joseph, Steven W.

Luckman, Randy

Mazzurco, Phil

Randall, Rodney D.

Saucier, Mark

Swanson, Scott E.

Affirmative with Comment

Ngai, Eugene Y.

a

Wyman, Matthew T.

none

First Revision No. 6-NFPA 318-2019 [New Section after 7.1.4.8]

7.1.4.8.1

In the case of hazardous production material gas cylinders no greater than 103 kPa (15 psi) cylinder pressure, bulk gas purge sources shall be permitted to be used in place of cylinders.

7.1.4.8.2

Regulation of cylinder pressure shall not be an acceptable means to meet the 103 kPa (15 psi) threshold.

Submitter Information Verification

Committee: SCR-AAA

Submittal Date: Thu May 09 12:31:24 EDT 2019

Committee Statement

Committee Statement: Current standard allows for bulk source for sub-atm gas cylinders. But there are many low pressure gases that have the same inherent safety of low pressure that does not have the risk of back feeding into a house purge system (such as house argon). The 15 psig criteria is used in a number of other areas. This includes the DOT criteria for an empty cylinder as well as HPM gases over 15 psig that requires excess flow control. This is to align with the 15 psig criteria and allow these low pressure gases to use a bulk source for a purge panel.

Response Message: FR-6-NFPA 318-2019

Public Input No. 2-NFPA 318-2018 [New Section after 7.1.4.8]

Ballot Results

✔ **This item has passed ballot**

23 Eligible Voters
6 Not Returned
15 Affirmative All
1 Affirmative with Comments
1 Negative with Comments
0 Abstention

Not Returned

Davis, Brett Jay

Gonzalez, Amanda

Quadrini, David A.

Ronan, John G.

Sloan, Dwayne E.

Trammell, Steven R.

Affirmative All

Ballard, Robert J.

Brown, Alastair R.

Clarke, Bruce H.

Eisenberg, Jonathan M.

Enides, Scott

Ffrench, Richard

Grove, Jeffrey S.

Guevara, Rick

Joo, Younghoon

Joseph, Steven W.

Luckman, Randy

Mazzurco, Phil

Randall, Rodney D.

Saucier, Mark

Swanson, Scott E.

Affirmative with Comment

Wyman, Matthew T.

none

Negative with Comment

Ngai, Eugene Y.

This will allow HPM such as Tungsten Hexafluoride, Boron Trichloride and Chlorine Trifuoride to be purged with house N2

First Revision No. 9-NFPA 318-2019 [Section No. 7.6.4]

7.6.4

Optical flame detection or high-sensitivity smoke detection for silane delivery systems shall be provided as described in 11.2.5.1.

Submitter Information Verification

Committee: SCR-AAA

Submittal Date: Thu May 09 13:28:57 EDT 2019

Committee Statement

Committee Statement: The reliable operation of optical flame detection has proven to be challenging based upon varying behavior of sliane to different leak scenarios and size/positioning limitations of semiconductor equipment (gas cabinets, VMB, and tool gas box/jungle as noted below.

1. A fast silane leak (> 2m/s) will result in delayed ignition upon closure of the pneumatic valves after hydride detection.

• The resulting flame scenarios is an instantaneous deflagration of the silane vapors present.

• Flame detection would require detection within 100 milli-seconds

2. A medium silane leak (< 2 m/s) may result in auto-ignition (i.e. through a VCR hole as result of hand tight fitting).

3. Flame detection is required to detect this leak as hydride sensors will not respond (all hydride is consumed during burning)

• Flame detection must be rated for silane

• Flame detection response is factor of fire size vs distance must be within detector specifications

• Flame detector UV sensor must not be absorbed by heavy smoke/SiO2 particle release (typically installed on ceiling of cabinet). This is also a function of flame detector alarm response time.

• Flame detector IR sensor can not be saturated when fire size too large too close. This is also a factor of flame detector response time.

4. Very slow silane leak (< ?? m/s) will result in no ignition – even after hydride detection.

• Silane released by “pin-hole 0.04”, through missing seals in VCR and surface mount equipment resulted in leak with no ignition.

The varying leak scenarios justifies the needs for reliable hydride detection and fire detection at all potential equipment leak points to:

1. Detect a leak of any scenario.

2. Determine the appropriate response for ERT (with ignition or without ignition).

In April 2019, ASM and KFPI recently completed second round of various silane leak scenario tests within an exhausted cylinder cabinet to validate the detection response to various optical flame detector technologies, high-sensitivity smoke detection, and various hydride gas detection. These results will be published at SESHA Symposium on May 2, 2019.

Currently the semiconductor industry requires flame and gas detection at every silane source and transfer point except within the tool gas box/jungle inside the fab where gas hydride detection is the only form of leak detection.

Response Message: FR-9-NFPA 318-2019

Ballot Results

This item has passed ballot

23 Eligible Voters
6 Not Returned
15 Affirmative All
2 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Davis, Brett Jay
Gonzalez, Amanda
Quadrini, David A.
Ronan, John G.
Sloan, Dwayne E.
Trammell, Steven R.

Affirmative All

Ballard, Robert J.
Brown, Alastair R.
Clarke, Bruce H.
Eisenberg, Jonathan M.
Enides, Scott
Ffrench, Richard
Grove, Jeffrey S.
Guevara, Rick
Joo, Younghoon
Joseph, Steven W.
Luckman, Randy
Mazzurco, Phil
Randall, Rodney D.
Saucier, Mark
Swanson, Scott E.

Affirmative with Comment

Ngai, Eugene Y.
Only effective with indoor systems
Wyman, Matthew T.
none

First Revision No. 21-NFPA 318-2019 [Section No. 8.5.5.3]

8.5.5.3

Liquid overtemperature protection shall be provided to prevent process liquids from reaching a point where the properties of the liquid create a potentially dangerous situation as shown in Table 8.5.5.3.

Table 8.5.5.3 Maximum Overtemperature Setpoint

Liquid Property	Maximum Overtemperature Setpoint
Noncombustible	Boiling point (bp)
Combustible	Lesser of boiling point (bp) or auto ignition temperature (AIT) less 50˚C (122˚F)
Flammable	Flashpoint (fp) less 10˚C (50˚F)

Submitter Information Verification

Committee: SCR-AAA

Submittal Date: Fri Jun 07 13:41:21 EDT 2019

Committee Statement

Committee Statement: Adds U.S. Customary units.

Response Message: FR-21-NFPA 318-2019

Ballot Results

✔ **This item has passed ballot**

23 Eligible Voters
6 Not Returned
15 Affirmative All
2 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Davis, Brett Jay

Gonzalez, Amanda

Quadrini, David A.

Ronan, John G.

Sloan, Dwayne E.

Trammell, Steven R.

Affirmative All

Ballard, Robert J.

Brown, Alastair R.

Clarke, Bruce H.

Eisenberg, Jonathan M.

Enides, Scott

Ffrench, Richard

Grove, Jeffrey S.

Guevara, Rick

Joo, Younghoon

Joseph, Steven W.

Luckman, Randy

Mazzurco, Phil

Randall, Rodney D.

Saucier, Mark

Swanson, Scott E.

Affirmative with Comment

Ngai, Eugene Y.

a

Wyman, Matthew T.

none

First Revision No. 1-NFPA 318-2019 [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 m^2 (200 ft^2)~~ 9.3 m^2 (100 ft^2) .

Submitter Information Verification

Committee: SCR-AAA

Submittal Date: Thu May 09 11:17:38 EDT 2019

Committee Statement

Committee Statement: In fab areas, laminar air flow, from ceiling to floor, is usually well maintained by a significant number of FFUs. Smoke generated at an early (incipient) stage of a fire development, being highly buoyant, is easily pushed down through the perforated floor and is less likely of being dispersed widely in horizontal directions. It therefore stands to reason that if not adequately spaced spot-type detectors or sampling ports placed under the waffle ceiling of the sub-fab have less of an opportunity of intersecting smoke entrained within the air stream. In Asian countries, such as Taiwan, South Korea, etc., this is well understood, and it is common practice within cleanrooms to reduce spacing of spot-type detectors or sampling ports. Spacing of 9m2 (3x3m) has been widely adopted. Experimental results disclose that even under such reduced spacing parameters, an Air Sampling Detection System may still fail to capture smoke from hot-wire tests conducted within the fab.

Recently, CFD modelling was conducted to study smoke distribution characteristics under various fab airflow velocities, and to understand impacts on detection performance, considering differences in spot-type detector and port spacing scenarios. Images included below illustrate smoke dispersion at the sampling plane under a waffle ceiling, with smoke concentration above 0.65%/m, shown in red color. As can be seen, detectors with spacing more than 3x3m were only capable of recording smoke concentration levels of 0.65%/m at lower fab air velocities and an increased fire size (5kW).

Response Message: FR-1-NFPA 318-2019

Public Input No. 3-NFPA 318-2018 [Section No. 11.1.3.5 [Excluding any Sub-Sections]]

Ballot Results

✔ **This item has passed ballot**

23 Eligible Voters
6 Not Returned
14 Affirmative All
2 Affirmative with Comments
1 Negative with Comments
0 Abstention

Not Returned

Davis, Brett Jay

Gonzalez, Amanda

Quadrini, David A.

Ronan, John G.

Sloan, Dwayne E.

Trammell, Steven R.

Affirmative All

Ballard, Robert J.

Clarke, Bruce H.

Eisenberg, Jonathan M.

Enides, Scott

Ffrench, Richard

Grove, Jeffrey S.

Guevara, Rick

Joo, Younghoon

Joseph, Steven W.

Luckman, Randy

Mazzurco, Phil

Randall, Rodney D.

Saucier, Mark

Swanson, Scott E.

Affirmative with Comment

Ngai, Eugene Y.

a

Wyman, Matthew T.

none

Negative with Comment

Brown, Alastair R.

Lack of peer reviewed and publicly available validated data to substantiate the changes. Internal research by one manufacturer should not be sufficient for a change to the protection criteria, unless it can be demonstrated that the change is: 1) Technically correct; 2) Based on Peer Reviewed and publicly available research; and 3) Not product specific. Further I understood that the committee's plan was to put a place holder in to allow technical discussions to take place before the next round of ballots.

First Revision No. 2-NFPA 318-2019 [Section No. 11.1.3.6 [Excluding any Sub-Sections]]

In the absence of performance-based design criteria, where smoke detection is installed at the entry to the return air path, area coverage of spot-type detector or sampling port spacing shall be limited to ~~0.4 m ^{2} (4.3 ft ^{2})~~ 1 m ^{2} (10.8 ft ^{2}) for detecting vertically in front of cooling coils in the sub-fab, and 0.4 m ^{2} (4.3 ft ^{2}) for detecting horizontally in the entry of return air shafts and ducts .

Submitter Information Verification

Committee: SCR-AAA

Submittal Date: Thu May 09 11:20:19 EDT 2019

Committee Statement

Committee Statement: In cleanrooms with dry (cooling) coils vertically located in sub-fab, smoke detection systems normally have spot-type detectors or ports in front of the coils. While those dry coils generally have a large section area, typically occupying majority of a wall, laminar flow conditions are relatively well maintained on the air flow through the coils. It is therefore unnecessary to apply such restrictive coverage practices, which are more reasonably required for duct applications.

Furthermore, extensive tests have been conducted to test detection performance at increased spacing. Sufficient detection performance results were observed when conducting hot wire tests at various distances away from dry coils, i.e. detectors' responses were registered before the smoke concentration of 0.65%/m reached a single point. Guidelines with sampling coverage between 0.6 and 1.2m2 under various fab airflow velocities are developed from experimental and CFD modelling studies and accepted by all the parties as an industry practice. The 1m2 sampling coverage can deal with return air velocities of up to 4.7m/s, which covers relatively wide air re-circulation conditions. After decades of application experience, the 1m2 sampling coverage has recently been adopted in Taiwan local code for cleanroom fire protection.

Response Message: FR-2-NFPA 318-2019

Public Input No. 4-NFPA 318-2018 [Section No. 11.1.3.6 [Excluding any Sub-Sections]]

Ballot Results

✔ **This item has passed ballot**

23 Eligible Voters
6 Not Returned
14 Affirmative All
2 Affirmative with Comments
1 Negative with Comments
0 Abstention

Not Returned

Davis, Brett Jay

Gonzalez, Amanda

Quadrini, David A.

Ronan, John G.

Sloan, Dwayne E.

Trammell, Steven R.

Affirmative All

Ballard, Robert J.

Clarke, Bruce H.

Eisenberg, Jonathan M.

Enides, Scott

Ffrench, Richard

Grove, Jeffrey S.

Guevara, Rick

Joo, Younghoon

Joseph, Steven W.

Luckman, Randy

Mazzurco, Phil

Randall, Rodney D.

Saucier, Mark

Swanson, Scott E.

Affirmative with Comment

Ngai, Eugene Y.

a

Wyman, Matthew T.

none

Negative with Comment

Brown, Alastair R.

Lack of peer reviewed and publicly available validated data to substantiate the changes. Internal research by one manufacturer should not be sufficient for a change to the criteria, unless it can be demonstrated that the change is: 1) Technically correct; 2) Based on Peer Reviewed and publicly available research; and 3) Not product specific. Further I understood that the committee's plan was to put a place holder in to allow technical discussions to take place before the next round of ballots. Disclosure: I am aware from conversations last year with the Honeywell that they were planning FDS modelling of this issue and I offered to assist in the modelling and/or peer reviewing the output. No further discussions took place. I am not aware of any validation for FDS for this application, i.e. to model smoke generation from a fire in a large cleanroom with detection at large distances from the source. Apart from the issue of validation, this approach to detection makes assumptions about the nature of the fire which affect the outcome of the detection, and the size of the fire prior to detection. If the protection criteria is based on specific assumptions, then those should be clearly stated in the Standard, e.g. in the appendix or in publicly available documents as was done for NFPA 76, e.g. Fire Protection Research Foundation reports referenced in the appendix.

First Revision No. 10-NFPA 318-2019 [Section No. 11.2.5.1]

11.2.5.1

Optical flame detectors that will respond to the flame signature of silane or high-sensitivity smoke detection shall be provided to detect a fire at potential leak points on the silane delivery system. ~~Coverage shall be provided to address container connections, process gas and purge gas panels, and other potential leak points where unwelded fittings or connections are used.~~

11.2.5.1.1

Coverage shall be provided to address container connections, process gas and purge gas panels, and other potential leak points where unwelded fittings or connections are used.

11.2.5.1.2

~~An optical flame~~ A fire detection system shall be provided inside of ~~VMBs~~ all equipment as defined in 11.2.5.1.3 to detect a fire within the ~~VMB~~ equipment .

11.2.5.1.3

Activation of a fire detection system shall result in the closing of the following nearest isolation valve:

(1) At local gas boxes near the tool or in the tool gas jungle

(2) At VMBs, shut down individual sticks

(3) At the gas cylinder source

(4) At the bulk source

11.2.5.1.4

~~Flame~~ Fire detection shall result in an alarm transmission to the supervising station as well as a local alarm signal that is distinctive from the facility's audible alarm signal and any process equipment alarm signals.

Submitter Information Verification

Committee: SCR-AAA

Submittal Date: Thu May 09 13:52:08 EDT 2019

Committee Statement

Committee Statement: The reliable operation of optical flame detection has proven to be challenging based upon varying behavior of sliane to different leak scenarios and size/positioning limitations of semiconductor equipment (gas cabinets, VMB, and tool gas box/jungle as noted below.

1. A fast silane leak (> 2m/s) will result in delayed ignition upon closure of the pneumatic valves after hydride detection.

• The resulting flame scenarios is an instantaneous deflagration of the silane vapors present.

• Flame detection would require detection within 100 milli-seconds

2. A medium silane leak (< 2 m/s) may result in auto-ignition (i.e. through a VCR hole as result of hand tight fitting).

3. Flame detection is required to detect this leak as hydride sensors will not respond (all hydride is consumed during burning)

• Flame detection must be rated for silane

• Flame detection response is factor of fire size vs distance must be within detector specifications

• Flame detector UV sensor must not be absorbed by heavy smoke/SiO2 particle release (typically installed on ceiling of cabinet). This is also a function of flame detector alarm response time.

• Flame detector IR sensor can not be saturated when fire size too large too close. This is also a factor of flame detector response time.

4. Very slow silane leak (< ?? m/s) will result in no ignition – even after hydride detection.

• Silane released by "pin-hole 0.04", through missing seals in VCR and surface mount equipment resulted in leak with no ignition.

The varying leak scenarios justifies the needs for reliable hydride detection and fire detection at all potential equipment leak points to:

1. Detect a leak of any scenario.

2. Determine the appropriate response for ERT (with ignition or without ignition).

In April 2019, ASM and KFPI recently completed second round of various silane leak scenario tests within an exhausted cylinder cabinet to validate the detection response to various optical flame detector technologies, high-sensitivity smoke detection, and various hydride gas detection. These results will be published at SESHA Symposium on May 2, 2019.

Currently the semiconductor industry requires flame and gas detection at every silane source and transfer point except within the tool gas box/jungle inside the fab where gas hydride detection is the only form of leak detection.

Response Message: FR-10-NFPA 318-2019

Ballot Results

✔ **This item has passed ballot**

23 Eligible Voters
6 Not Returned
15 Affirmative All
2 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Davis, Brett Jay
Gonzalez, Amanda
Quadrini, David A.
Ronan, John G.
Sloan, Dwayne E.
Trammell, Steven R.

Affirmative All

Ballard, Robert J.
Brown, Alastair R.
Clarke, Bruce H.
Eisenberg, Jonathan M.
Enides, Scott
Ffrench, Richard

Grove, Jeffrey S.

Guevara, Rick

Joo, Younghoon

Joseph, Steven W.

Luckman, Randy

Mazzurco, Phil

Randall, Rodney D.

Saucier, Mark

Swanson, Scott E.

Affirmative with Comment

Ngai, Eugene Y.

a

Wyman, Matthew T.

none

First Revision No. 8-NFPA 318-2019 [Section No. 11.2.6.1]

11.2.6.1 Fire Detection System.

Each cabinet shall be equipped with an automatic fire detection system that complies with the following conditions:

(1) *Automatic detection system*: ~~A UV/IR,~~ Optical flame detection that will respond to the flame signature of the chemical or high-sensitivity smoke detection ~~(HSSD) or other approved detection system~~ shall be provided inside each cabinet to detect a fire at potential leak points on the delivery system. Coverage shall be provided to address container connections, process gas, and purge gas panels, and other potential leak points where unwelded fittings or connections are used .

(2) *Automatic shutoff*: Activation of the detection system shall automatically close the shutoff valve(s) on the liquid supply.

Submitter Information Verification

Committee: SCR-AAA

Submittal Date: Thu May 09 13:22:04 EDT 2019

Committee Statement

Committee Statement: The term “UV/IR” for “optical flame detector” is technically a specific requirement for light spectrum combination that could prevent the use of other flame detector technologies with varying combinations of light spectrums which are also effective for the chemicals requiring the fire detection.

We should use the appropriate terminology of “optical flame detector” as NFPA 318 already does for Silane Gas Systems (11.2.5.1).

Response Message: FR-8-NFPA 318-2019

Ballot Results

✔ **This item has passed ballot**

23 Eligible Voters
6 Not Returned
15 Affirmative All
2 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Davis, Brett Jay

Gonzalez, Amanda

Quadrini, David A.

Ronan, John G.

Sloan, Dwayne E.

Trammell, Steven R.

Affirmative All

Ballard, Robert J.

Brown, Alastair R.

Clarke, Bruce H.

Eisenberg, Jonathan M.

Enides, Scott

Ffrench, Richard

Grove, Jeffrey S.

Guevara, Rick

Joo, Younghoon

Joseph, Steven W.

Luckman, Randy

Mazzurco, Phil

Randall, Rodney D.

Saucier, Mark

Swanson, Scott E.

Affirmative with Comment

Ngai, Eugene Y.

a

Wyman, Matthew T.

none

First Revision No. 22-NFPA 318-2019 [Section No. A.6.4.2]

A.6.4.2

Careful consideration should be given to the amount of liquid pyrophoric material needed for operations. Many times the 20 L (5.3 gal) quantity is not needed to sustain production.

Submitter Information Verification

Committee: SCR-AAA

Submittal Date: Fri Jun 07 13:43:01 EDT 2019

Committee Statement

Committee Statement: Adds U.S. Customary units.

Response Message: FR-22-NFPA 318-2019

Ballot Results

✔ **This item has passed ballot**

23 Eligible Voters
6 Not Returned
15 Affirmative All
2 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Davis, Brett Jay
Gonzalez, Amanda
Quadrini, David A.
Ronan, John G.
Sloan, Dwayne E.
Trammell, Steven R.

Affirmative All

Ballard, Robert J.
Brown, Alastair R.
Clarke, Bruce H.
Eisenberg, Jonathan M.
Enides, Scott
Ffrench, Richard
Grove, Jeffrey S.
Guevara, Rick
Joo, Younghoon

Joseph, Steven W.

Luckman, Randy

Mazzurco, Phil

Randall, Rodney D.

Saucier, Mark

Swanson, Scott E.

Affirmative with Comment

Ngai, Eugene Y.

a

Wyman, Matthew T.

none

First Revision No. 23-NFPA 318-2019 [Section No. A.7.6.2]

A.7.6.2

The use of two single-stage regulators in series will help reduce liquefaction during pressure reduction. Replaceable metal gaskets in DISS connections are preferred over PTFE gaskets that can cold flow and leak at pressures higher than ~~500 psi.~~ 3448 kPa (500 psi) . The use of solid stainless steel pigtail lines is preferred over flexible steel lines. The use of a Venturi eductor to evacuate the gas panel during system purge is strongly recommended. The dome of the pressure regulator should also be vented to a safe location.

Submitter Information Verification

Committee: SCR-AAA

Submittal Date: Fri Jun 07 13:43:55 EDT 2019

Committee Statement

Committee Statement: Adds Metric unit.

Response Message: FR-23-NFPA 318-2019

Ballot Results

✔ **This item has passed ballot**

23 Eligible Voters
6 Not Returned
15 Affirmative All
2 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Davis, Brett Jay
Gonzalez, Amanda
Quadrini, David A.
Ronan, John G.
Sloan, Dwayne E.
Trammell, Steven R.

Affirmative All

Ballard, Robert J.
Brown, Alastair R.
Clarke, Bruce H.
Eisenberg, Jonathan M.
Enides, Scott
Ffrench, Richard

Grove, Jeffrey S.
Guevara, Rick
Joo, Younghoon
Joseph, Steven W.
Luckman, Randy
Mazzurco, Phil
Randall, Rodney D.
Saucier, Mark
Swanson, Scott E.

Affirmative with Comment

Ngai, Eugene Y.
a
Wyman, Matthew T.
none

First Revision No. 24-NFPA 318-2019 [Section No. A.8.5.5.1]

A.8.5.5.1

Some organometallic liquids or solids can undergo violent decomposition if overheated, in some cases heating for an extended period below the initiation temperature can also cause the decomposition reaction to occur. These include trimethylaluminum, dimethylzinc, diethylzinc, trimethylindium, and trimethylgallium. Maximum temperatures of 100°C–120°C (212°F–248°F) are recommended.

Submitter Information Verification

Committee: SCR-AAA

Submittal Date: Fri Jun 07 13:44:50 EDT 2019

Committee Statement

Committee Statement: Adds U.S. Customary units.

Response Message: FR-24-NFPA 318-2019

Ballot Results

✔ **This item has passed ballot**

23 Eligible Voters
6 Not Returned
15 Affirmative All
2 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Davis, Brett Jay
Gonzalez, Amanda
Quadrini, David A.
Ronan, John G.
Sloan, Dwayne E.
Trammell, Steven R.

Affirmative All

Ballard, Robert J.
Brown, Alastair R.
Clarke, Bruce H.
Eisenberg, Jonathan M.
Enides, Scott
Ffrench, Richard
Grove, Jeffrey S.
Guevara, Rick

Joo, Younghoon

Joseph, Steven W.

Luckman, Randy

Mazzurco, Phil

Randall, Rodney D.

Saucier, Mark

Swanson, Scott E.

Affirmative with Comment

Ngai, Eugene Y.

a

Wyman, Matthew T.

none

First Revision No. 7-NFPA 318-2019 [Chapter D]

Annex D Informational References

D.1 Referenced Publications.

The documents or portions thereof listed in this annex are referenced within the informational sections of this standard and are not part of the requirements of this document unless also listed in Chapter 2 for other reasons.

D.1.1 NFPA Publications.

National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 1, *Fire Code*, 2018 edition.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 2017 edition.

NFPA 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work*, ~~2014~~ 2019 edition.

NFPA 55, *Compressed Gases and Cryogenic Fluids Code*, 2016 edition.

NFPA 68, *Standard on Explosion Protection by Deflagration Venting*, ~~2013~~ 2018 edition.

NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, 2018 edition.

NFPA 287, *Standard Test Methods for Measurement of Flammability of Materials in Cleanrooms Using a Fire Propagation Apparatus (FPA)*, 2017 edition.

NFPA 329, *Recommended Practice for Handling Releases of Flammable and Combustible Liquids and Gases*, ~~2015~~ 2020 edition.

NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response*, 2017 edition.

Fire Protection Handbook, 20th edition, 2008.

D.1.2 Other Publications.

~~**D.1.2.1** ANSI Publications.~~

~~American National Standards Institute, Inc., 25 West 43rd Street, 4th floor, New York, NY 10036.~~

~~ANSI B31.3, *Chemical Plant and Petroleum Refinery Piping* , 2004.~~

~~ANSI/ISA S84.01, *Application of Safety Instrumented Systems for the Process Industries* , 1996.~~

D.1.2.1 ASME Publications.

American Society of Mechanical Engineers, Two Park Avenue, New York, NY 10016-5990.

ASME B31.3, *Process Piping* , 2018.

D.1.2.2 ASTM Publications.

ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

~~IEEE/~~ ASTM SI 10, *Standard for Use of the International System of Units (SI): The Modern Metric System*, ~~2002~~ 2016 .

ASTM E1354, *Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter*, ~~2015a~~ 2017 .

ASTM E2058, *Standard Test Methods for Measurement of Synthetic Polymer Material Flammability Using a Fire Propagation Apparatus (FPA)*, 2013a.

D.1.2.3 CGA Publications.

Compressed Gas Association, 14501 George Carter Way, Suite 103, Chantilly, VA 20151-1770.

ANSI/ CGA G-13, *Storage and Handling of Silane and Silane Mixtures*, ~~2006~~ 2015 .

D.1.2.4 FM Publications.

FM Global, 270 Central Avenue, P.O. Box 7500, Johnston, RI 02919.

ANSI/ FM 4910, *Clean Room Materials Flammability Test Protocol*, ~~September 1997~~ 2013 .

FM 4922, *Fume Exhaust Ducts or Fume and Smoke Exhaust Ducts*, April 2001.

D.1.2.5 ISA Publications.

International Society of Automation, 67 T. W. Alexander Drive, PO Box 12277, Research Triangle Park, NC 27709.

ANSI/ISA S84.00.01 P1, *Functional Safety: Safety Instrumented Systems for the Process Industry Sector — Part 1: Framework, Definitions, System, Hardware and Software Requirements* , 2004.

ANSI/ISA S84.00.02 P2, *Functional Safety: Safety Instrumented Systems for the Process Industry Sector — Part 2: Guidelines for the Application of ANSI/ISA S84.00.01-2004 Part 1: Informative* , 2004.

ANSI/ISA S84.00.03 P3, *Functional Safety: Safety Instrumented Systems for the Process Industry Sector — Part 3: Guidance for the Determination of the Required Integrity Levels — Informative* , 2004.

D.1.2.6 SEMI Publications.

Semiconductor Equipment and Materials International, 3081 Zanker Road, San Jose, CA 95134.

SEMI S2~~-0703a~~ , *Environmental, Health, and Safety Guideline for Semiconductor Manufacturing Equipment*, ~~2002~~ 2010 .

SEMI S14, *Safety Guidelines for Fire Risk Assessment and Mitigation for Semiconductor Manufacturing Equipment*, ~~2000~~ 2009 .

D.1.2.7 UL Publications.

Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

~~ANSI/~~ UL 2360, ~~*Standard*~~ *Test Method for Determining the Combustibility Characteristics of Plastics Used in Semiconductor Tool Construction*, 2000, revised ~~2013~~ 2017 .

D.1.2.8 US Government Publications.

US Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401-0001.

Title 29, Code of Federal Regulations, Part 1910.1000, “Air Contaminants.”

Title 49, Code of Federal Regulations, Part 173, Appendix A, “Transportation.”

D.2 Informational References. (Reserved)

~~The following documents or portions thereof are listed here as informational resources only. They are not a part of the requirements of this document.~~

D.3 References for Extracts in Informational Sections.

NFPA 1, *Fire Code*, 2018 edition.

NFPA 5000®, *Building Construction and Safety Code®*, 2018 edition.

Supplemental Information

File Name	Description	Approved
318-2018_Annex_D.docx	for staff use	

Submitter Information Verification

Committee: SCR-AAA

Submittal Date: Thu May 09 13:12:59 EDT 2019

Committee Statement

Committee Statement: Referenced current national consensus editions. Update titles in Sections A.8.3 and A.10.4.3.

Response Message: FR-7-NFPA 318-2019

Public Input No. 13-NFPA 318-2018 [Section No. D.1.2.5]

[Public Input No. 6-NFPA 318-2018 [Section No. D.1.2.2]]

[Public Input No. 15-NFPA 318-2018 [Chapter D]]

Ballot Results

✔ This item has passed ballot

23 Eligible Voters
6 Not Returned
15 Affirmative All
2 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Davis, Brett Jay

Gonzalez, Amanda

Quadrini, David A.

Ronan, John G.

Sloan, Dwayne E.

Trammell, Steven R.

Affirmative All

Ballard, Robert J.

Brown, Alastair R.

Clarke, Bruce H.

Eisenberg, Jonathan M.

Enides, Scott

Ffrench, Richard

Grove, Jeffrey S.

Guevara, Rick

Joo, Younghoon

Joseph, Steven W.

Luckman, Randy

Mazzurco, Phil

Randall, Rodney D.

Saucier, Mark

Swanson, Scott E.

Affirmative with Comment

Ngai, Eugene Y.

a

Wyman, Matthew T.

none