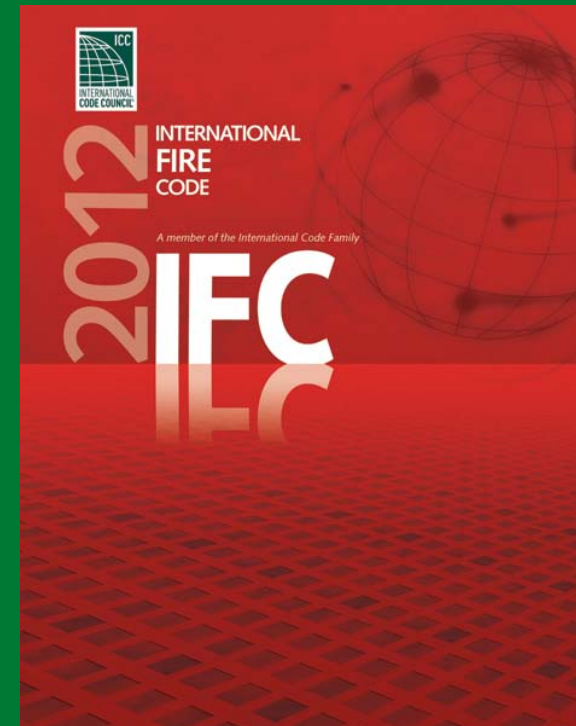




People Helping People Build a Safer World™

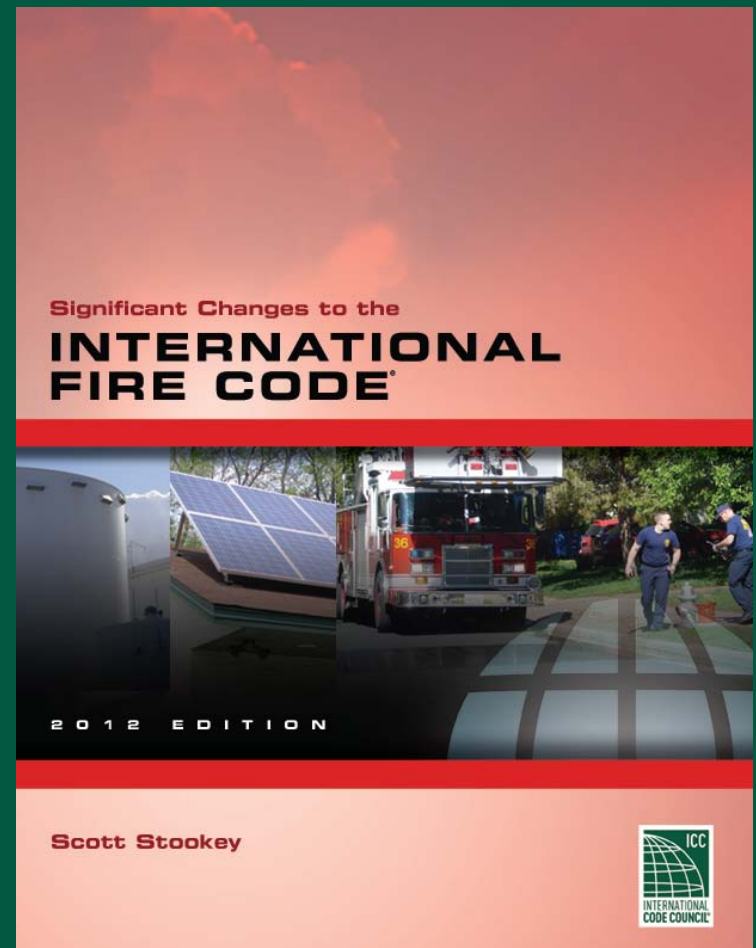
Significant Changes to the 2012 IFC – Semiconductor Fabrication Facilities

Scott Stookey
Senior Technical Staff
International Code Council, Austin TX



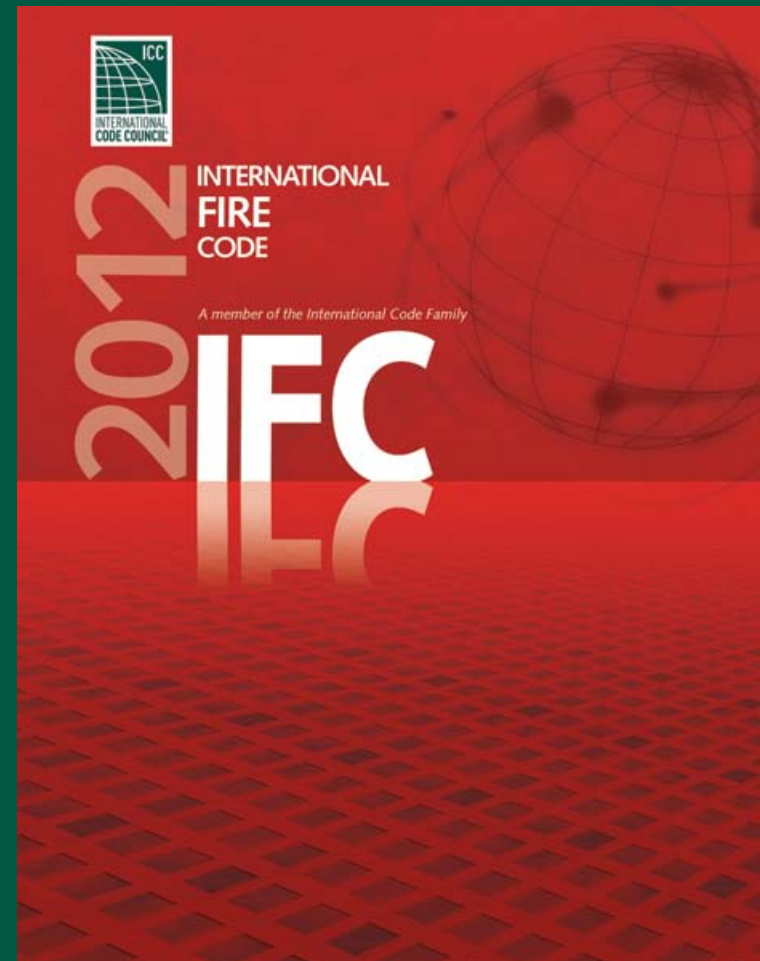
Introduction

- This presentation reviews the significant changes to Section 907 of the 2012 *International Fire Code*.
- These changes are explained in greater detail in the ICC publication *Significant Changes to the IFC – 2012 edition*.



Format of the 2012 IFC

- The 2012 IFC has been reorganized into seven parts.
- This new organization allows for flexibility when regulations for new technologies arise.
- The reorganization also aligns the IFC to certain IBC chapters.





Format of the 2012 IFC

- The IFC parts are:
 - Part 1 - Administration & Definitions (Chapters 1 & 2)
 - Part 2 - General Safety Provisions (Chapters 3 & 4)
 - Part 3 – Building & Equipment Design Features (Chapters 5-11)
 - Part 4 – Special Occupancies & Operations (Chapters 20 – 49)
 - Part 5 – Hazardous Materials (Chapters 50 – 79)
 - Part 6 – Adopted Standards (Chapter 80)
 - Part 7 – Appendices (Appendices A – J)

Congratulations SESHHA!

- In the 2012 IFC, all of your requirements are in Chapter 27.
- PS: Everything related to hazardous materials was in Chapter 27. That's now Chapter 50.



Combustible Tools – Section 2703.10.1.2

- Semiconductor manufacturing equipment constructed of polymeric materials no longer require an automatic fire-extinguishing system when they are constructed of listed flame-limiting plastics.



Combustible Tools – Section 2703.10.1.2

- Exception 2 allows the use of plastics listed as meeting UL 2360 *Test Methods for Determining the Combustibility Characteristics of Plastics Used in Semiconductor Tool Construction.*



Photograph courtesy of Amerimade
Technologies, Livermore CA

Combustible Tools – Section 2703.10.1.2

- UL 2360 evaluates two properties of polymeric materials and assigns them certain categories:
 - Flame Propagation Index (FPI)
 - Smoke Development Index (SDI)
- Listed materials are classified as Class 1 or Class 2.



*Photograph courtesy of Factory Mutual
Global, Johnson RI*

Combustible Tools – Section 2703.10.1.2

- Class 1 materials do not propagate fire beyond the ignition zone.
 - $FDI \leq 6$ and $SDI \leq 0.4$
- Class 2 material limit a fire's propagation beyond the ignition zone.
 - Generates $< 40 \text{ kW/M}^2$ thermal flux and < 60 grams of smoke



*Photograph courtesy of Factory Mutual
Global, Johnson RI*

Sub-Atmospheric Pressure Gas Systems – Section 2703.16

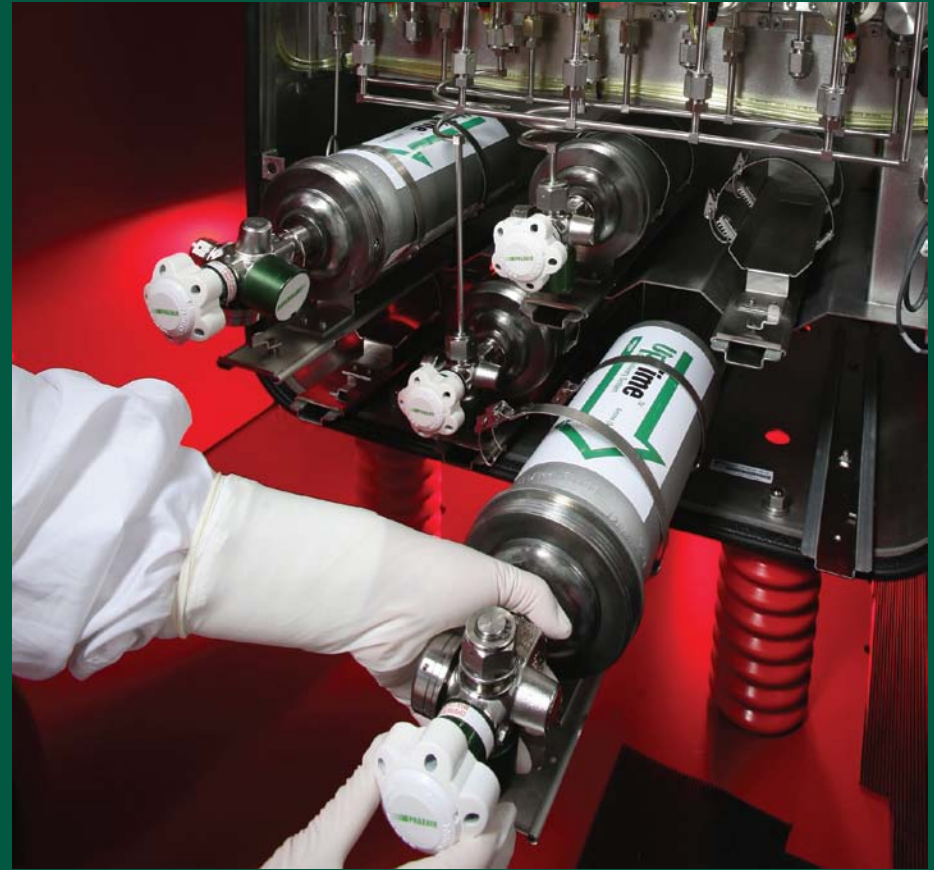
- Sub-Atmospheric Pressure Gas Systems (SAGS) are now recognized in the IFC.
- Section 2703.16 requires SAGS to comply with the requirement of NFPA 318, *Semiconductor Fabrication Facilities*.



Graphics courtesy of ATMI, Danbury CT

Sub-Atmospheric Pressure Gas Systems – Section 2703.16

- SAGS are most commonly used in ion implanting operations where compressed gas dopants are embedded or deposited.
- Dopants commonly present multiple physical and health hazards.



Photograph courtesy of Praxair, Danbury CT

Common Dopant Gases and Hazard Classification

TABLE 2703.16-A Common Dopant Gases and Hazard Classification

Compressed Gas	Formula	IFC Hazard Classification
Arsenic Pentafluoride	AsF ₅	Highly Toxic; Corrosive; Class 1 Water Reactive
Arsine	AsH ₃	Flammable; Highly Toxic
Boron Trifluoride	BF ₃	Toxic; Corrosive
Germanium Tetrafluoride	GeF ₄	Toxic; Corrosive
Hydrogen Selenide	H ₂ Se	Flammable; Toxic
Phosphine	PH ₃	Flammable; Pyrophoric; Highly Toxic
Silicon Tetrafluoride	SiF ₄	Class 1 Water Reactive; Toxic; Corrosive

NFPA 318 Type 1 SAGS

- Under NFPA 318 a Type 1 SAGS uses a DOT approved container filled with activated carbon.
- Cylinders are loaded in which dopant molecules are adsorbed by the carbon.
- This process reduces the vapor pressure of the molecules.
- Vacuum is used to reverse the gas-solid equilibrium, which releases the molecules.



Photo courtesy of ATMI, Danbury CT

NFPA 318 Type 2 SAGS

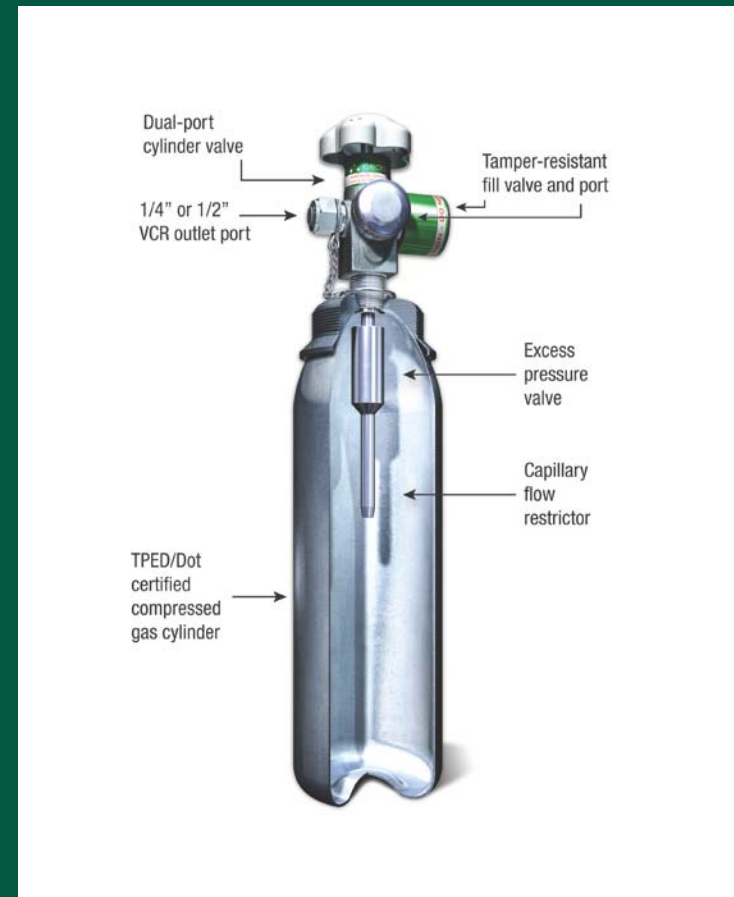
- A Type 2 SAGS uses DOT cylinder equipped with either an internal pressure regulator or check valve and excess flow valve.
- All gas flow control elements are internal to the cylinder.
- The cylinder contents are pressurized – however they can only be removed by vacuum pressure.



Photograph courtesy of Praxair, Danbury CT

Benefits of SAGS

- SAGS offer a much higher level of safety when compared to conventional gas systems.
- As a result, NFPA 318 does not require:
 - Automatic shutoff valves when supply pyrophoric gases
 - Post-release treatment systems
 - Dedicated purge gas system
 - Incompatible gases can be stored within the same gas cabinet or exhausted enclosure



Graphic courtesy of Praxair, Danbury CT

Corridors and Exit Enclosures – Section 2705.3.1

- Section 2705.3.1 was revised to now permit the transportation of HPM in means of egress (MOE) exit corridors and enclosure.
- The amount of HPM must be < MAQ.
- The transportation must occur using a cart complying with 5003.10.



Gas Detection – Section 6004.2.2.10.1

- In Group H-4 occupancies storing or using Toxic or Highly Toxic gases, gas detectors and their control units must be approved or listed as meeting UL 2075, *Gas and Vapor Detectors and Sensors*.
- Section 6004.2.2.10.1 continues to permit the use of *approved* gas and vapor detectors.



Gas Detection – Section 6004.2.2.10.1

- A bigger change is the adoption of the 2010 edition of NFPA 72, *National Fire Alarm and Signaling Code*.
- NFPA 72 Section 17.10 now requires all detectors and equipment be listed for the specific gas or vapor.
- In addition, gas detection systems must comply with all of the applicable NFPA 72 requirements.





- How to contact Scott:

Telephone: 1-888-422-7233 X 3473 (FIRE)

Cellular: 512-716-9595

E-mail: sstookey@iccsafe.org

Snail Mail: 807 Sweetwater River Drive, Austin
Texas 78748-2238

Discontinuation or Change of Service

- Section 901.9 is a new provision addressing monitoring of fire protection systems.
- The 2012 IFC requires notification of the fire code official when alarm monitoring services are discontinued or changed.



Group A Occupancies

- Section 907.2.1 was revised to clarify when a fire alarm system is required in a building with two or more Group A occupancies.
- If Group A occupancies are not separated by fire barriers per IBC Section 707.3.9, the Group A occupant loads are summed.



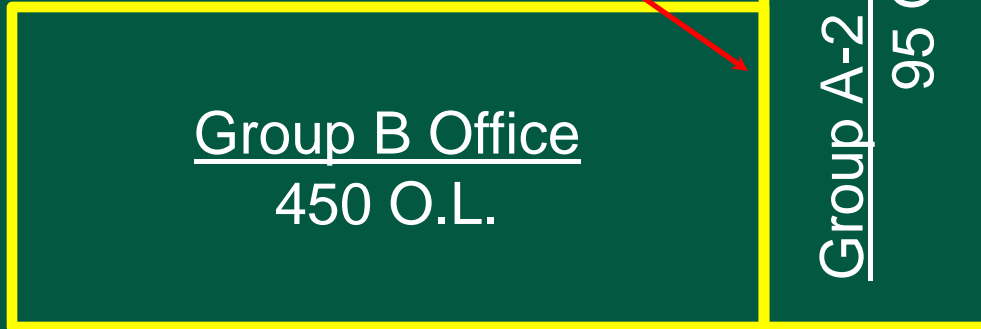
Example Application – Section 907.2.1



Minimum 2-hour fire-resistive barrier per IBC Section
707.3.9

Example Application – Section 907.2.1

No Fire-Resistive Separation is Required per IBC 508.2 for Accessory Occupancies



A manual fire alarm system is not required because the occupant load *due to the assembly occupancy* is less than 300.

Emergency Voice/Communications Alarm Captions

- Section 907.2.1.2 will require captioned messages in Group A stadiums, arenas and grandstands with more than 15,000 fixed seats.
- The messages are either recorded or generated real-time by the Emergency Voice/Communications Alarm System (EV/CAS).



Emergency Voice/Communications Alarm Captions

- The EV/CAS must comply with the 2010 NFPA 72 Mass Notification System (MNS) requirements.
- Section 907.6.2.2.4 requires messages be generated from an approved location and are selected based on the design risk assessment.



Emergency Voice/Communications Alarm Captions

- NFPA 72 Section 24.7 requires a performance design based on a risk assessment that considers:
 - Number of persons
 - Unique hazards and their rate of growth
 - Anticipated threats
 - Reliability, performance and security of the MNS
 - How will MNS be used by stakeholders (i.e., owner, fire service, law enforcement)



Emergency Voice/Communications Alarm Captions

- NFPA 72 requires textual visible notification appliances comply with Section 24.2.2.21.
- NFPA 72 requires:
 - Textual EV/CAS messages take precedence
 - Primary and secondary power
 - Unmonitored displays must indicate their operational status
 - Character size, display and fonts



Alertus LLC, Gaithersburg MD

Emergency Voice/Communications Alarm Captions

- Because EV/CAS commonly utilize software or firmware, NFPA 72 requires it to be functionally compatible with all alarm initiating and occupant notification appliances.
- NFPA 72 also requires the software and firmware be protected from unauthorized changes.



Group E Occupancies

- Section 907.2.3 was revised by lowering the fire alarm and detection system threshold in Group E occupancies from an occupant load of 50 to 30.
- Section 907.2.3 also requires the fire alarm system include an EV/CAS which activates upon sprinkler activation or manually from a normally occupied location.



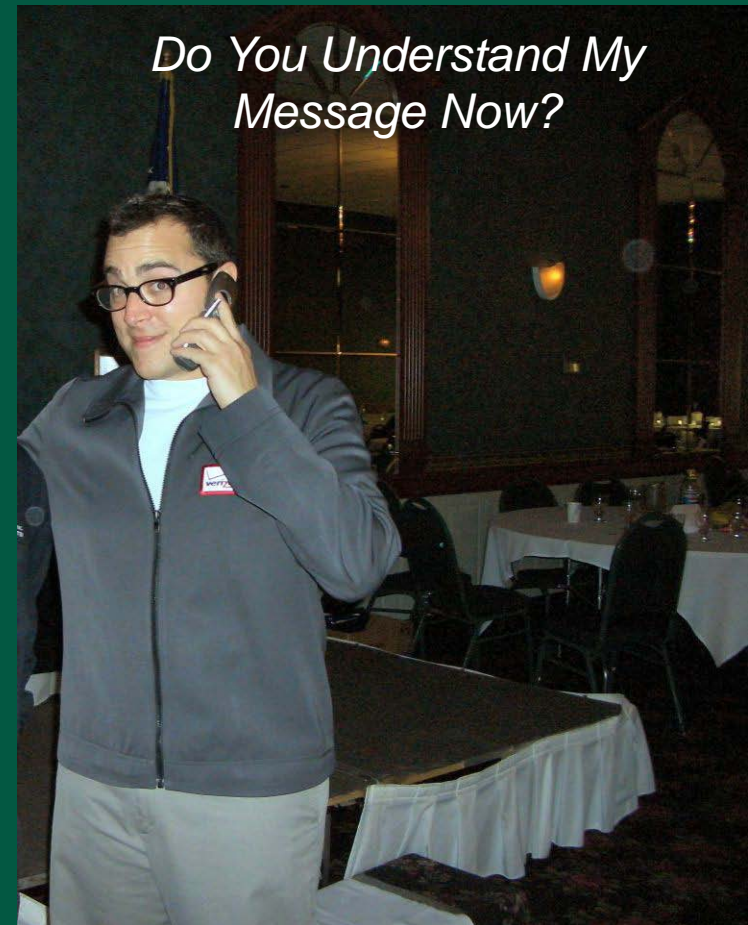
Group E Occupancies

- The reason for the change was the provisions added in the 09 IFC for building lockdown plans.
- Section 404.3.3.1 has no specific communications criterion.
- These provisions apply to any occupancy with a lockdown plan.



NFPA 72 EV/ACS Requirements in Group E Occupancies

- EV/CAS are required by NFPA 72 to provide speech intelligibility.
 - *An audible voice that is distinguishable and understandable.*
- It is an overall measure of the degree that building occupants understand the spoken language.
 - Speech intelligibility is not audibility.



Acoustically Distinguishable Spaces (ADS)

- An ADS is a physically defined space where speech intelligibility can be achieved or is exempted.
- NFPA does not establish prescriptive requirements for ADS because of many variables.



Armstrong Industries, Lancaster PA

Factors Influencing ADS

- The area of the space.
- The required audibility.
- Ceiling height.
- Changes to interior finish affecting acoustics.
- Function of the space.
- Unique architectural features.



ADS Exemptions

- Certain spaces are exempt as being ADS because of their function or signal intelligibility cannot be achieved.
- When intelligibility cannot be achieved NFPA 72 requires compliance with Chapter 18.

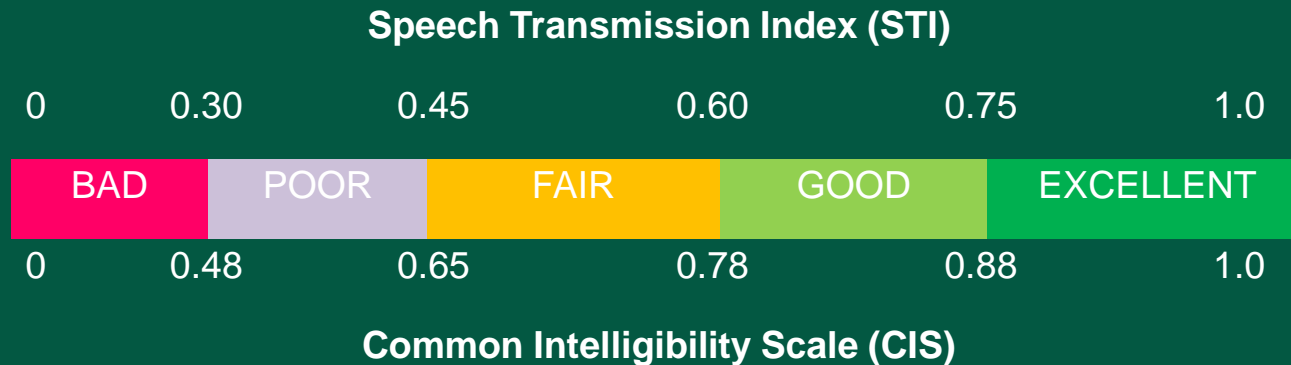


Measuring Speech Intelligibility

- Under NFPA 72, speech intelligibility is measured using Speech Transmission Index (STI).
- An acceptable alternate mechanism for measuring STI is the Common Intelligibility Scale (CIS).



NFPA 72 Signal Intelligibility Acceptance Criteria



- Speech intelligibility is acceptable when 90% of all measurements in the ADS has a minimum 0.45 STI (0.65 CIS) and an average 0.50 STI (0.65 CIS) for all measurements in the ADS. (NFPA 72, Annex D)

Plan Review Considerations

- Plans will require preparation under the supervision of a RDP.
- Design information will include:
 - Notification appliances part of the EV/CAS
 - Speaker wattage
 - Design sound pressure level
 - How occupant notification is accomplished
 - Is signal intelligibility achieved in each ADS



Wireless Smoke Alarms

- IRC Section 314.5 and IFC Sections 907.2.11.2 and 1103.7.2 recognize wireless smoke alarms.
- The smoke alarms are listed to UL 217 and installed in accordance with NFPA 72, Chapter 29 .



BRK Electronics, Aurora IL

Wireless Smoke Alarms

- In the 2012 IRC all smoke alarms require wiring to a *source of utility power*.
 - The IFC will allow battery-powered alarms in existing buildings.
- “Guest” alarms are supervised by a “host” alarm.
- Under the IFC & IRC, wiring can be eliminated between the guest and host smoke alarms.



BRK Electronics, Aurora IL

Wireless Smoke Alarms

- Wireless smoke alarms are classified as low-power systems in NFPA 72 Section 23.18.
- Specific low-power supervision provisions include:
 - Loss of battery power
 - Integrity of signal integrity and path interconnection
 - Maximum polling frequency and maximum response time



BRK Electronics, Aurora IL

Protection of Fire Alarm Control Unit

- Section 907.5.1 now requires a supervised smoke detector to protect Fire Alarm Control Units (FACUs).
- This change aligns the 2012 IFC with 2010 edition of NFPA 72.
- The IFC allows sprinkler protection to protect the FACU when the building climate do not satisfy NFPA 72.

