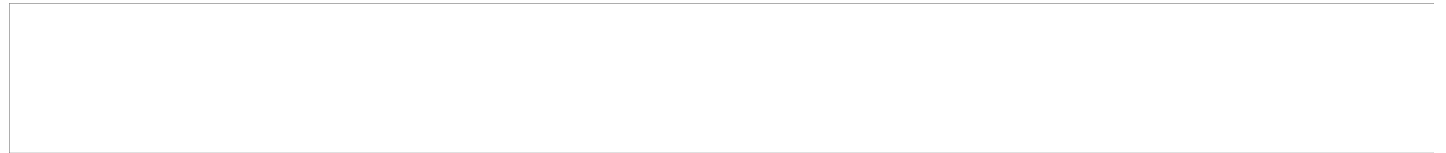
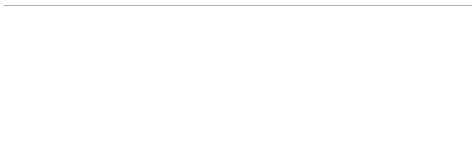


HEALTHCARE INFRASTRUCTURE CODE ISSUES

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ASHRAE Technical Conference

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Agenda

- Applicable Codes and AHJs
- Fire/Life Safety Codes
- NFPA 99
- FGI Guidelines
- ASHRAE 170
- Common areas of confusion

POV of Speaker

- Always check with the Authorities Having Jurisdiction (AHJ).
 - Confirm codes adopted and amendments
 - Multiple AHJ in Healthcare
- Be aware of liability of ignoring the code, even if the AHJ “lets” you.
- This presentation based on what the code says, not any specific AHJ interpretation.
 - mostly
- Existing building vs. new?
- AHJs have different ways of looking at the code>>>

CODES AND AHJs

- Colorado Department of Public Safety, Division of Fire Prevention and Control
- For healthcare facilities licensed by the State Health Department.
 - ▣ 2012 International Codes
 - ▣ 2011 NEC
 - ▣ 2010 FGI Guidelines, including 2008 ASHRAE 170 with addenda issued as of July 1, 2013
 - ▣ 2012 NFPA 101 and referenced codes.
 - ▣ 2012 NFPA 99

CODES AND AHJs

- Centers for Medicare and Medicaid Services (CMS)
- Healthcare Facilities seeking reimbursement for Medicare and Medicaid
 - 2000 NFPA 101 (Life Safety Code) and associated referenced codes/standards.
 - Proposed adopting 2012 NFPA 101
 - ✦ Public Review Comment Period NOW!

CODES AND AHJs

- The Joint Commission (TJC)
- Formerly known as JCAHO – private accreditation agency, used by insurance companies to qualify healthcare facilities.
 - 2000 NFPA 101
 - ✦ Expected to follow CMS to the 2012
 - 2010 FGI Guidelines
 - ✦ Expected to adopt 2014 “shortly”

CODES AND AHJs

- Local Building/Fire Departments
- All Buildings
 - 2009 – 2012 International Codes

CODES AND AHJs

- Healthcare must observe the “worst case” of I-Codes and NFPA 101
- 2000 NFPA 101 supersedes 2012 version in conflicts where CMS is an AHJ
- Multiple versions of referenced standards
 - NFPA 99 – 1999, 2005, 2012
 - NFPA 13 – 1999, 2007, 2010
 - NFPA 70 (NEC) – 1999, 2008, 2011, 2014

OCCUPANCY TYPES

□ I CODES (Local AHJs)

- B (Business) – Typical Dr. Office. Can include treatment and fancy imaging.
- B, plus Ambulatory Healthcare – “...provide ...care on a less than 24-hour basis to individuals who are rendered incapable of self-preservation by the services provided.”

OCCUPANCY TYPES

□ I CODES (Local AHJs)

- I-2 - “medical care on a 24-hour basis for more than five persons who are incapable of self-preservation. This group shall include, but not be limited to, the following:

Foster care facilities

Detoxification facilities

Hospitals

Nursing homes

Psychiatric hospitals

OCCUPANCY TYPES

- NFPA 101 - Business
 - An occupancy used for the transaction of business other than mercantile.

OCCUPANCY TYPES

- NFPA 101 - Ambulatory Healthcare
 - A building or portion thereof used to provide services or treatment simultaneously to four or more patients that provides, on an outpatient basis, one or more of the following: (1) **treatment** for patients that renders the patients **incapable of taking action for self-preservation** under emergency conditions without the assistance of others; (2) **anesthesia** that renders the patients **incapable of taking action for self-preservation** under emergency conditions without the assistance of others; (3) **emergency or urgent care** for patients who, due to the nature of their injury or illness, are **incapable of taking action for self-preservation** under emergency conditions without the assistance of others.

OCCUPANCY TYPES

- NFPA 101 - Healthcare
 - An occupancy used for purposes of medical or other treatment or care of four or more persons where such occupants are mostly incapable of self-preservation due to age, physical or mental disability, or because of security measures not under the occupants' control

MIXED USE AND OCCUPANCY

- NFPA 101 - Healthcare must be separated from non healthcare by a 2 hour Fire Barrier, 1 hour for Ambulatory Healthcare.
 - ▣ 2000 version - openings between Healthcare and other occupancies only in Corridors
- IBC - If non-separated, must use worst of construction and area requirements.
- “Accessory Use” if $< 10\%$ of area
- If separated Fire Barriers at separations

MIXED USE AND OCCUPANCY

- Fire Barriers or Smoke Partitions at specific areas
 - ▣ NFPA 101 – Hazardous Areas
 - ▣ IBC – Incidental Use Areas

ROOM OR AREA	SEPARATION
FUEL FIRED EQUIPMENT OVER 400 MBH; BOILERS OVER 15 PSI AND 10 HP; REFRIGERANT MACHINERY ROOM	SPRINKLERED BUSINESS - SMOKE PARTITION NON-SPRINKLERED BUSINESS/AHC - 1 HOUR HEALTHCARE - 1 HOUR
SOILED LINEN ROOM	<u>NFPA</u> HEALTHCARE - 1 HOUR <u>NFPA</u> SPRINKLERED AHC, BUSINESS – SMOKE PARTITION <u>NFPA</u> NON SPRINKLERED AHC, BUSINESS - 1 HOUR <u>IBC</u> 1-2, AHC, - 1 HOUR <u>IBC</u> B – OVER 100 SF UNSPRINKLERED -1 HOUR <u>IBC</u> B OVER 100 SF SPRINKLERED – SMOKE PARTITION
STORAGE OVER 100 SF	<u>NFPA</u> HEALTHCARE - 1 HOUR <u>NFPA</u> SPRINKLERED AHC, BUSINESS – SMOKE PARTITION <u>NFPA</u> NON SPRINKLERED AHC, BUSINESS - 1 HOUR <u>IBC</u> IF LESS THAN 10% FLOOR AREA - NONE

Fire/ Life Safety Plans

- Shaft Enclosure
 - Fire Walls
 - Fire Barriers
 - Fire Partitions
 - Smoke Barriers
 - Smoke Partitions
 - Construction capable of resisting the passage of smoke
 - Horizontal Assemblies
 - Floor/Ceiling
 - Roof/Ceiling
 - Horizontal Exit
 - Exit Enclosure
 - Exit Passageway
 - Fire Area
-
- Make sure these are identified on FLS plans using the code language.
 - Identify NFPA vs. IBC required FLS features

Smoke Resistance Rated Construction

- SMOKE BARRIERS (Defend-in-place strategy)
 - ▣ NFPA: Healthcare or Ambulatory Healthcare
 - Floor below HC/AHC as well
 - 2012 Revision – not if mechanical only
 - No dampers for ducted penetrations.
 - NFPA 90A Requires Smoke Dampers to isolate AHU
 - ▣ I Codes: I-2 or B with AHC
 - HC/AHC floor only
 - Smoke Dampers at transfer and ducts
 - Exception steel ducts serving only one smoke compartment.
 - ▣ Also a 1-hour Fire Barrier

Smoke Resistance Rated Construction

□ Smoke Partitions

- Healthcare/1-2 and Ambulatory Healthcare corridors, or where Hazardous Areas/Incidental Use Areas utilize the sprinkler exception
- No Fire rating
- IBC – To Deck, Smoke Dampers in transfer openings, not ducted penetrations
- NFPA – To lay-in ceiling, Therefore there is no barrier above ceiling

ASHRAE 170

- ASHRAE 170 is integrated into 2010 FGI Guidelines, and 2012 NFPA 99.
 - ▣ Joint Commission Reference
 - ▣ Not adopted by CMS (yet)
 - ▣ Continuing Maintenance

- Not limited to Hospitals.
 - ▣ Scope based on use of facility
 - ▣ Can include outpatient if similar space use

FGI Guidelines

- Facility Guidelines Institute
- Guidelines for Design and Construction of Healthcare Facilities.
- Consider it Code where it applies
 - State – licensed Facility
 - The Joint Commission
- Code language, new vs. renovation, partial upgrades, interpretations, equivalencies
- ALL types of Healthcare – Hospital, Psych/Rehab, Outpatient, ASC, Endo, Imaging

FGI Guidelines

- Planning Design Construction and Commissioning:
 - Functional Program
 - Infection Control Risk Assessment (ICRA)
 - Acoustics

FGI Guidelines

- Table 1.2-2 Minimum-Maximum Design Criteria for Noise

FGI Guidelines

- Commissioning
 - Basis of Design
 - Pre-functional Checklists
 - Functional Performance Tests
 - TAB
 - O&M

FGI Guidelines

- Common elements
 - Toilet Rooms
 - Handwashing
 - Windows (operable not required)
 - Finishes
 - Ceilings

FGI Guidelines

- Common elements - MEP
 - Plumbing
 - 25 ft max non-recirc hw
 - no dead ends
 - Bedpan washers
 - Handwash sink size, faucets
 - Wrist Blade OK, auto not required.
 - Scrub sinks – knee, foot, or auto
 - No storage under sinks
 - Med Gas – NFPA 99
 - Outlet requirements here
 - Electrical – NEC, NFPA 110, receptacle count, Nurse Call, Paging, IT systems,
 - 24 hours on site generator fuel storage
 - “Where stored fuel is required”

FGI Guidelines

- Common elements - MEP
- HVAC
 - Room pressure monitors – Isolation, Bronchoscopy
 - No Duct Liner in specific critical areas
 - Where allowed, in-room units must have a central, filtered OA system
 - Natural Ventilation limited, Mech vent still required
- ASHRAE Standard 170-2008
Ventilation of Health Care Facilities
 - Continuous Maintenance Standard
 - CDPS - addenda issued up to July 1, 2013.

ASHRAE 170

- Redundancies for Equipment and Essential Accessories serving critical areas.
 - OR, LDR, Recovery, ED, ICU, Nursery, Patient Rooms
 - Subject to breakdown or routine maintenance.
 - Heating: N+1
 - Heating Sources
 - Pumps and return units
 - Fans
 - Not controls
 - Cooling: Level of redundancy required to “meet Facility Plan”
 - Domestic Hot Water

ASHRAE 170

- Air Handling System Components
 - OA Intakes 6' above grade, 3' above roof, 3' above bottom of areawell
 - Min 25 feet from contamination sources
 - Exhaust discharge 10' above roof -
 - Isolation, Branch, ED, Fume Hood, ...
 - ASHRAE 62
 - Radiant/Chilled Beam - dew point control
 - Humidifiers – Steam only.

ASHRAE 170

- Air Handling System Components
 - Filtration:
 - ✦ MERV 7 pre, MERV 14 final most inpatient care, ALL B and C Surgery
 - ✦ Protective Environment – MERV 7/HEPA
 - ✦ MERV 14 – Class A Surgery, lab
 - ✦ MERV 7 most other
 - Ducted return for areas requiring pressure relationships, PACU,
 - Diffuser types:
 - ✦ Non Aspirating (Laminar) - Surgery (all), Trauma, Protective Environment, Wound/Burn.
 - ✦ Mixing or laminar – all others

ASHRAE 170

- **Class A surgery:** provides minor surgical procedures performed under topical, local, or regional anesthesia without preoperative sedation. Excluded are intravenous, spinal, and epidural procedures, which are Class B or C surgeries.
- **Class B surgery:** provides minor or major surgical procedures performed in conjunction with oral, parenteral, or intravenous sedation or performed with the patient under analgesic or dissociative drugs.
- **Class C surgery:** provides major surgical procedures that require general or regional block anesthesia and/or support of vital bodily functions.

ASHRAE 170

□ Space Ventilation

- Room Pressure relationships: Clean to Dirty

 - Maintained at all times, including unoccupied

- Air Change per Hour (ACH) Requirements

 - Must be maintained whenever occupied

 - Spaces with pressure relationships may be reduced, but can not be shut off.

 - Minimum means minimum – VAV reheat, packaged units.

ASHRAE 170

TABLE 7-1 Design Parameters

Function of Space	Pressure Relationship to Adjacent Areas (n)	Minimum Outdoor ach	Minimum Total ach	All Room Air Exhausted Directly to Outdoors (j)	Air Recirculated by Means of Room Units (a)	RH (k), %	Design Temperature (l), °F/°C
Examination room	N/R	2	6	N/R	N/R	max 60	70–75/21–24
Medication room	Positive	2	4	N/R	N/R	max 60	70–75/21–24
Endoscopy	Positive	2	15	N/R	No	30–60	68–73/20–23
Endoscope cleaning	Negative	2	10	Yes	No	N/R	N/R
Treatment room	N/R	2	6	N/R	N/R	max 60	70–75/21–24
Hydrotherapy	Negative	2	6	N/R	N/R	N/R	72–80/22–27
Physical therapy	Negative	2	6	N/R	N/R	Max 65	72–80/22–27
STERILIZING							
Sterilizer equipment room	Negative	N/R	10	Yes	No	N/R	N/R
CENTRAL MEDICAL AND SURGICAL SUPPLY							
Soiled or decontamination room	Negative	2	6	Yes	No	N/R	72–78/22–26
Clean workroom	Positive	2	4	N/R	No	max 60	72–78/22–26
Sterile storage	Positive	2	4	N/R	N/R	max 60	72–78/22–26
SERVICE							
Food preparation center (i)	N/R	2	10	N/R	No	N/R	72–78/22–26
Warewashing	Negative	N/R	10	Yes	No	N/R	N/R
Dietary storage	N/R	N/R	2	N/R	No	N/R	72–78/22–26
Laundry, general	Negative	2	10	Yes	No	N/R	N/R
Soiled linen sorting and storage	Negative	N/R	10	Yes	No	N/R	N/R
Clean linen storage	Positive	N/R	2	N/R	N/R	N/R	72–78/22–26
Linen and trash chute room	Negative	N/R	10	Yes	No	N/R	N/R
Bedpan room	Negative	N/R	10	Yes	No	N/R	N/R
Bathroom	Negative	N/R	10	Yes	No	N/R	72–78/22–26
Janitor's closet	Negative	N/R	10	Yes	No	N/R	N/R
SUPPORT SPACE							
Soiled workroom or soiled holding	Negative	2	10	Yes	No	N/R	N/R
Clean workroom or clean holding	Positive	2	4	N/R	N/R	N/R	N/R
Hazardous material storage	Negative	2	10	Yes	No	N/R	N/R

Note: N/R = no requirement

ASHRAE 170

Addendum d

TABLE 7-1 Design Parameters

Function of Space	Pressure Relationship to Adjacent Areas (n)	Minimum Outdoor ach	Minimum Total ach	All Room Air Exhausted Directly to Outdoors (j)	Air Recirculated by Means of Room Units (a)	RH (k), %	Design Temperature (l), °F/°C
SURGERY AND CRITICAL CARE							
Class B and C operating rooms, (m), (n), (o)	Positive	4	20	N/R	No	20 ²⁰ -60	68-75/20-24
Operating/surgical cystoscopic rooms, (m), (n), (o)	Positive	4	20	N/R	No	20 ²⁰ -60	68-75/20-24
Delivery room (Caesarean) (m), (n), (o)	Positive	4	20	N/R	No	20 ²⁰ -60	68-75/20-24
Treatment room (p)	N/R	2	6	N/R	N/R	20 ²⁰ -60	70-75/21-24
Trauma room (crisis or shock) (c)	Positive	3	15	N/R	No	20 ²⁰ -60	70-75/21-24
Laser eye room	Positive	3	15	N/R	No	20 ²⁰ -60	70-75/21-24
Class A Operating/Procedure room (o), (d)	Positive	3	15	N/R	No	20 ²⁰ -60	70-75/21-24
DIAGNOSTIC AND TREATMENT							
Gastrointestinal endoscopy procedure room	Positive	2	6	N/R	No	20 ²⁰ -60	68-73/20-23

ASHRAE 170

- Patient Room
 - 6 ACH, reduced to 4 ACH for supplemental heat or displacement ventilation
 - Addendum ab revised to 4 ACH as standard
- OR – Class B and C
 - Primary array of laminar diffusers, over table + 12” all around, min 70% coverage, 25-35 fpm face velocity,
 - Low return, min 2 separated as far as possible, additional high ones acceptable.

ASHRAE 170

- Isolation Room
 - Monitor required
 - Neg pressure required at all times, switching to neutral or positive is not allowed.
 - Can go to 6 ACH when not used for Isolation
 - Exhaust in ceiling or wall near head
 - HEPA in lieu of 12 ACH exhaust in renovation only where “impractical”
 - Dedicated exhaust unless HEPA
 - Anteroom optional

NFPA 99

- Healthcare Facility Standard/Code
- Referenced by I-Codes for Medical Gasses
- Referenced by NFPA 101 for Electrical, Med Gas, Anesthetizing Locations
- Fully adopted by State, and proposed by CMS (2012)

1999, 2005, 2012 versions all in play

NFPA 99

- Electrical
 - Required Emergency Power
 - Generator Fuel requirements (also NFPA 110)
- IT/Nurse Call (2012)
- Plumbing (2012) – Plumbing Code, grey water requirements.
- HVAC (2012)- ASHRAE170
- Equipment
- Emergency Planning, other Administrative issues
- Fire Protection
 - Sprinkler zones match smoke compartments
- Medical Gasses
 - ASPE Seminar

NFPA 99

- Anesthetizing Location Smoke Evacuation (1999 version, CMS proposal)
 - “Windowless” rooms wherever use of inhalation anesthetics are intended
 - Disregard “windowless”
 - Automatically vent smoke with no recirculation
 - Can’t remove smoke from a real fire, CMS/State has allowed neg pressure for fire mode room
 - CMS/State has allowed both use of HVAC system and dedicated system
 - Combined with I-Codes = smoke control
 - Infection Control risk

Common Areas of Confusion

- Outpatient
 - FGI, ASHRAE 170, NFPA 99 are applicable where the program has functions covered by those standards

 - Question is when are they enforced?
 - Depends upon Licensure and/or Accreditation

 - I vs. B vs. AHC vs. HC vs. Business
 - MEP indirectly impacted by Occupancy
 - MEP directly impacted by Function – see above

Common Areas of Confusion

- Sequence of Control for Smoke/Fire Dampers
 - ▣ Consider effect of damper closure on HVAC system
 - ▣ Consider effect of damper closure on smoke migration
 - ▣ Code minimum vs. something that works
 - ▣ Engineered smoke control vs. just damper control
 - ▣ Fire Alarm vs. BAS control

Common Areas of Confusion

- Medical Gas Rooms
 - IFC – Triggered at 512 CU Ft. (2 E-cylinders)
 - NFPA 99 – 3000 Cu. Ft. (12 E-cylinders)
 - IFC – over 3000 Cu. Ft, H-3 occupancy, and this reduces with above or below grade floors
 - IFC – Exterior wall louvers or dedicated exhaust and makeup in 2 hour enclosure to the exterior
 - Dampers not allowed
 - 1999, 2005 NFPA 99 – Up to 3000 cu ft 2 exterior wall louvers, each 72 in², or dedicated exhaust at 1 cfm/sf. 3000 cu ft dedicated exhaust required.
 - 2012 NFPA 99 – 2 exterior louvers, each 24 in.²/1000 ft³, or exhaust (not dedicated), or exhaust at 1 cfm per 5 ft³
 - (mis) Interpretation of NFPA 99 – Electric heat can not be inside med gas room.

Common Areas of Confusion

□ Life Safety Plans

- Not all rated construction is treated the same.
- Not all fire resistive construction requires dampers
 - Fire Stop usually is required
- Use IBC/NFPA terminology, not just “1 hour wall” or “Smoke Rated”
- Maintain and update Statement of Condition/
Record Documents.