What is This?

- Fire at MGM Grand Hotel, Las Vegas, 1980
- Fire contained to the Casino level (ground floor)
- 650 Injuries
- 85 Fatalities total – Where?
- 61 Fatalities on the 16th Floor or above
- 16 in the Casino
- Modern smoke control systems (if functioning) would have prevented many of these fatalities.
- Catalyst for improved Building Codes & Fire Codes

Overview

- Smoke Control Systems
- Building Codes & Regulatory Agencies
- Smoke Control Testing

Purpose

- Awareness – Requirements for testing Smoke Control Systems.
- Not giving you step-by-step instructions
- Giving you information
Definition and Purpose

Building Code, Smoke Control, UL 864

What is Smoke Control?

- Smoke Control System Definition:
  - A system which, during an alarm condition, provides selective and overriding control of the mechanical fans, dampers, and the like to produce airflow and pressure differences across smoke barriers to limit or direct smoke movement.

- A system is categorized as either or both of the following system types:
  - Dedicated: A system is used exclusively for the purposes of smoke control
  - Non-dedicated: A system which provides HVAC function normally, and provides a smoke control objective during a fire alarm condition

- Non-dedicated: A system which provides HVAC function normally, and provides a smoke control objective during a fire alarm condition

'Set slide' or choose the 'Reset' button on the 'Home' icon to choose a picture

Click on the 'Reset' button.
What is Smoke Control?

- Per International Building Code, Section 909 – Smoke Control Systems:

  909.1 Scope and purpose.
  "This section applies to mechanical or passive smoke control systems when they are required by other provisions of this code. The purpose of this section is to establish minimum requirements for the design, installation and acceptance testing of smoke control systems that are intended to provide a tenable environment for the evacuation or relocation of occupants. These provisions are not intended for the preservation of contents, the timely restoration of operations or for assistance in the suppression of overhaul activities."

ten-a-bile (tēn′ə-bəl) adj.
1. Capable of being maintained in argument; rationally defensible: a tenable theory.
2. Capable of being held against assault; defensible: a tenable outpost.
3. Capable of enduring or of being tolerated: a tenable situation.


What is Smoke Control?

Systems intended to allow people survive a fire like this...

MG&G Grand Hotel fire, Las Vegas, 1980

… by creating an escape route mostly free of smoke, either by containing and limiting the movement of the smoke …

Diagram: http://www.ventilation-systems.com/
What is Smoke Control?

… or by directing the smoke.

“Smoke Control” is NOT:

• Smoke & Heat Vents (IBC Section 910)
  • For Factories & Warehouses
  • Activated directly from Fire Alarm System
  • Similar result to firefighters breaking out upper windows

“Smoke Control” is NOT:

• Smoke Removal (IBC Section 403.4.7)
  • “To facilitate smoke removal in post-fire salvage and overhaul operations ….”
  • Required for high-rise buildings
  • Does not require a UL 864 listed Building Automation System
What Are Building Codes?

- Building codes are local or state laws that set standards of construction in buildings to protect the public’s health and safety.
  

- A building code is a set of rules that specify the standards for constructed objects such as buildings and non-building structures. The main purpose of building codes is to protect public health, safety and general welfare as they relate to the construction and occupancy of buildings and structures.

- The building code becomes law of a particular jurisdiction when formally enacted by the appropriate governmental or private authority.

(Wikipedia)

State or Municipal Building Codes

- State Building Code = International Building Code + State Amendments
  
  (True for most states in the U.S.)

- State Fire Code = International Fire Code + State Amendments
  
  (True for most states in the U.S.)

Use of Model Codes in the U.S.

- FYI: All states and municipalities in the U.S. have adopted “model codes”, except one major city:

  Chicago
What is UL 864

- “Standard for Control Units and Accessories for Fire Alarm Systems”
- Equipment Standard
- Two Sub-Categories:
  - Fire Alarm Systems (UOJZ)
  - Smoke Control Systems (UUKL)

Purpose of UL 864 Listed Smoke Control Systems

- Ensure compliance with various standards (NFPA)
- Goal system high probability of working when required
  - Ensure electrical/mechanical robustness of system
  - Power redundancy
  - Electrical surge protection
  - Physical protection
- Ensure controllers are capable of meeting requirements for timing, scheduling, retries, program capacity

Contents of UL 864

1. Control Units and Accessories for Fire Alarm Systems
2. Construction
3. Performance
4. Manufacturing and Production
5. Markings and Instructions
6. Product Design

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Additional Requirements for Health Care

- Anesthetizing Locations
  - Joint Commission
  - CMS
  - NFPA

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Joint Commission & CMS, NFPA Standards

- Joint Commission & CMS have both adopted life safety standards/codes:
  - NFPA Standard 99 – Health Care Facilities Code
    - (To be discussed later)
  - NFPA Standard 92 – Standard for Smoke Control Systems
    - (To be discussed later)
  - (By multiple references from NFPA 101)
  - Not necessarily State Building Codes, BUT ...

- Required for Hospital accreditation and/or collection of payment for Medicare/Medicaid patients

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Agenda

1. Building Code / Fire Code
2. Joint Commission & CMS
3. NFPA
4. Smoke Control Systems
5. Automatic Testing
6. Periodic Testing

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NFPA Standard 99

- “Health Care Facilities Code”
- Adopted by Joint Commission & CMS
  - (Adoption by states not necessary)

NFPA-99 Versions thru 2005 included:

- 6.4.1 Ventilation - Anesthetizing Locations
  - 6.4.1.2 Supply and exhaust systems for anesthetizing locations shall be arranged to automatically vent smoke and products of combustion.
  - 6.4.1.3 Ventilation systems for anesthetizing locations shall be provided that automatically (1) prevent recirculation of smoke originating within the surgical suite and (2) prevent the circulation of smoke entering the system intake, without in either case interfering with the exhaust function of the system.

- NOT a UL-864 listed “Smoke Control System” by Building Code definitions

Recent changes to NFPA-99:

- New: 2012 version of NFPA-99 (adopted by Joint Commission & CMS in 2016) does not include Ventilation for Anesthetizing Locations
- Requirement was based on now-outdated flammable anesthetic chemicals

Automatic Weekly Testing
Automatic Weekly Testing - Overview

- “Dedicated” Smoke Control Systems
- Examples:
  - Stairwell/Elevator Pressurization Fans
  - Some Atrium Smoke Control Supply/Exhaust Fans
- Would never run, unless building catches fire, or unless tested

Automatic Weekly Testing

- Per UL 864 9th Edition:
  - “49.7 Dedicated smoke control systems shall employ an automatic weekly self-test function. The self-test shall automatically command activation of each associated function. An audible and visual trouble signal shall be annunciated at the FSCS identifying any function that fails to operate within the required time period. The self-test function is not required for non-dedicated systems.”

- Per 2012 Building Code and 2012 Fire Code, Section 909.12:
  - “Verification shall include positive confirmation of actuation, leving, manual override, the presence of power downstream of all disconnects and, through a preprogrammed weekly test sequence, report abnormal conditions audibly, visually and by printed report.”

- UL 864 requirement for Dedicated systems only. IBC/IFC requirement does not distinguish
- UL 864 requirement (dedicated only) is typically accepted
Automatic Weekly Testing – Coming Soon?

- Per 2015 Building Code and Fire Code, Section 909.12:
  - "Verification shall include positive confirmation of actuation, testing, manual override, the presence of power downstream of all disconnects and, through a preprogrammed weekly test sequence, report abnormal conditions audibly, visually and by printed report. The preprogrammed weekly test shall operate all devices, equipment, and components used for smoke control."

Exception: Where verification of individual components tested through the preprogrammed weekly testing sequence will interfere with, and produce unwanted effects to, normal building operation, such individual components are permitted to be bypassed from the preprogrammed weekly testing sequence approved by the fire code official, and in accordance with both of the following:
1. Where the operation of components is bypassed from the preprogrammed weekly test, presence of power downstream of all disconnects shall be verified weekly by a listed control unit."  

- 2015 Building Code not yet adopted by most states

Automatic Weekly Testing – How does it work?

- Johnson Controls Metasy® uses:
  - Schedule Object to initiate
  - Control Logic to execute tests (Start, Prove Status, Stop)
  - Alarm Extensions to report success or failure

- Example reports:

Bottom Line:
Periodic Testing
Fire Code

- Remember - IFC adopted as State Fire Code
- Legal requirement for all buildings

**2012 IFC Section 909 – Smoke Control Systems**

- 909.20 Maintenance. Smoke control systems shall be maintained to ensure to a reasonable degree that the system is capable of controlling smoke for the duration required. The system shall be maintained in accordance with the manufacturer's instructions and Sections 909.20.1 through 909.20.5.
  - 909.20.1 Schedule: A routine maintenance and operational testing program shall be adopted annually. A written schedule for routine maintenance and operational testing shall be established.
  - 909.20.2 Written record: A written record of smoke control system testing and maintenance shall be maintained on the premises. The written record shall include the date of the maintenance, identification of the servicing personnel and notification of any unsatisfactory condition and the corrective actions taken, including parts replaced.

Fire Code

- 2012 IFC Section 909 – Smoke Control Systems (continued)
  - 909.20.3 Testing - Operational testing of the smoke control system shall include all equipment such as initiating devices, fans, dampers, controls, doors and shutters.
  - 909.20.4 Dedicated smoke control systems: Dedicated smoke control systems shall be operated for each control sequence annually. The system shall also be tested under standby power conditions.
  - 909.20.5 Non-dedicated smoke control systems: Non-dedicated smoke control systems shall be operated for each control sequence annually. The system shall also be tested under standby power conditions.

Joint Commission, CMS, NFPA Standards

- Both have adopted life safety standards:
  - NFPA Standard 99 – Health Care Facilities Code
  - NFPA Standard 92 – Standard for Smoke Control Systems
  - (By multiple references from NFPA 101)

- 2012 version of NFPA-101 (and therefore NFPA-92) was adopted by Joint Commission & CMS in 2016
- Prior adoption was 2005 version
NFPA Standard 92 – Periodic Testing

- NFPA Standard 92 - Standard for Smoke Control Systems
- 8.6 Periodic Testing
  - 8.6.1 Periodic testing of smoke control equipment shall be performed in accordance with this section.
  - 8.6.1.1 Dedicated Systems shall be tested at least semiannually.
  - 8.6.1.2 Non-dedicated Systems shall be tested at least annually.
  - 8.6.2 The equipment shall be maintained in accordance with the manufacturer’s recommendations.
  - 8.6.3 The periodic tests shall determine the airflow quantities and the pressure differences at the following locations:
    - (1) Across smoke barrier openings
    - (2) At the air makeup supplies
    - (3) At smoke exhaust equipment
  - 8.6.4 All data points shall coincide with the acceptance test location to facilitate comparison measurements.

(Node 8.6.3 & 8.6.4 are new in NFPA 92 2012 versus I2AAB 2005)

NFPA Standard 92 – Periodic Testing

- NFPA Standard 92 - Standard for Smoke Control Systems
- 8.6 Periodic Testing
  - 8.6.5 The system shall be tested by persons who are thoroughly knowledgeable in the operation, testing, and maintenance of the system.
    - 8.6.5.1 The results of the test shall be documented in the operations and maintenance log and made available for inspection.
    - 8.6.5.2 The smoke control system shall be operated for each sequence in the current design criteria.
    - 8.6.5.3 The operation of the correct outputs for each given input shall be observed.
  - 8.6.6 Special arrangements shall be considered for the introduction of large quantities of outside air into occupied areas or sensitive equipment spaces when outside temperature and humidity conditions are extreme and when such unconditioned air could damage contents.

(Spring or Fall would be best times)

NFPA Standard 92 – Periodic Testing

- NFPA Standard 92 - Standard for Smoke Control Systems
- 8.7 Modifications (Building)
  - 8.7.1 All operational and acceptance testing shall be performed on the applicable part of the system whenever the system is changed or modified.
  - 8.7.2 If the smoke control system or the zone boundaries have been modified since the last test, acceptance testing shall be conducted on the portion modified.
  - 8.7.3 Documentation shall be updated to reflect these changes or modifications.

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Summary

- For certain occupancy types, Smoke Control and a UL864 listed control system are required by law (by building code).
- Smoke Control Systems are intended to provide a survivable environment in the first minutes of a fire.
- Fire Code and various NFPA Standards require periodic testing of smoke control systems.
- Building owner is responsible for execution of tests and for maintaining documentation of results.
- Johnson Controls can perform this periodic testing as part of a Planned Service Agreement (PSA).