


UNIVERSITY OF  
**MARYLAND**  
Department of Fire Protection Engineering



# Smoke Control Systems

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## Stages of Fire Growth

- Life safety: 67% of fire deaths in US in 2010 were due to smoke inhalation (87% in residences occupancies)



Nov. 21, 1980

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## Why provide smoke control?

- Property damage: smoke contamination of contents



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## Smoke Control Objectives



- Maintain tenable environment in key areas
  - ⇒ egress paths during time required for evacuation
  - ⇒ area of refuge during entire incident
  - ⇒ command center during entire incident
- Limit migration of smoke beyond fire area during entire incident
- Provide conditions in and outside of fire zone to assist emergency personnel conducting search & rescue and locating/controlling fire
- Limit quantity of smoke exposing property & contents
- Aid in post-fire smoke removal

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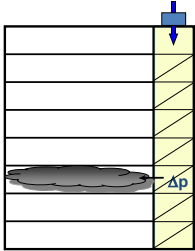
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## Stairwell Pressurization



- Design Basis
  - Minimum pressure difference: pressure from fire effects
  - Maximum pressure difference: force to open door
- Approach: Dedicated fans
- Activation: Any fire alarm initiating device



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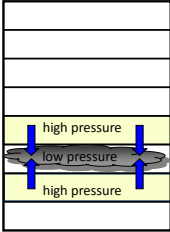
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## Zoned Smoke Control



- Required
  - Areas of refuge
  - Underground spaces
  - High-rise buildings
- Design Objective: Establish  $\Delta p$  to prevent smoke spread into non-fire area
- Approach: HVAC system or dedicated fans
- Activation: Fire alarm initiating device which can reliably identify fire zone



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### Covered Malls





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### Indoor Arena





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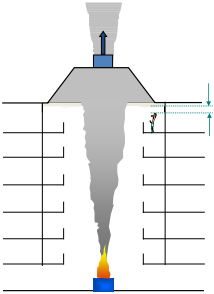
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### Atrium Smoke Control



- Design Basis
  - Provide minimum clear height above highest walking level
  - Limit conditions of smoke layer
  - Prevent smoke spread from large space
- Approaches:
  - Dedicated fans
  - Natural vents
- Activation: Any fire alarm initiating device



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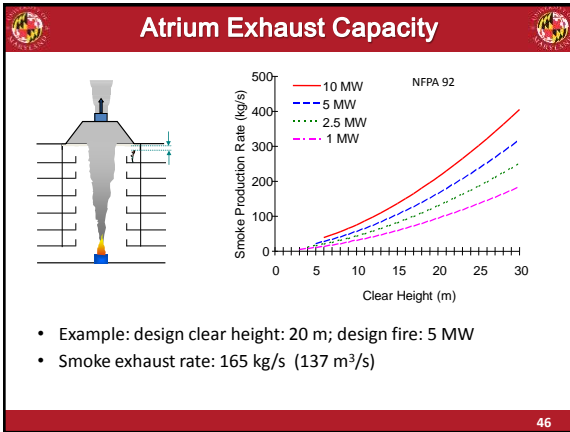
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- ### Summary
- Smoke control systems are designed to achieve identified objectives
  - Smoke control methods are available to limit smoke spread or exhaust smoke
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- ### Discussion Topic
- For atrium smoke management, is the exhaust rate more sensitive to the fire's heat release rate or the clear height? Analyze this by comparing the atrium exhaust capacity needed:
    - if the fire size is 2.5 MW, with a clear height of 20 m
    - If the fire size is 5 MW, with a clear height of 10 m.
  - Select one of the following topics:
    - Suggest a fire detector for an application involving a wood working shop (where wood dust is prevalent) where rapid detection is needed.
    - Selecting any suppression agent, name two applications that this agent is best suited for and name 2 drawbacks keeping this agent from being used in more applications.
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