

# **SMOKE MANAGEMENT**

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FIRE SAFETY ENGINEERING**

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# Handbook of Smoke Control Engineering

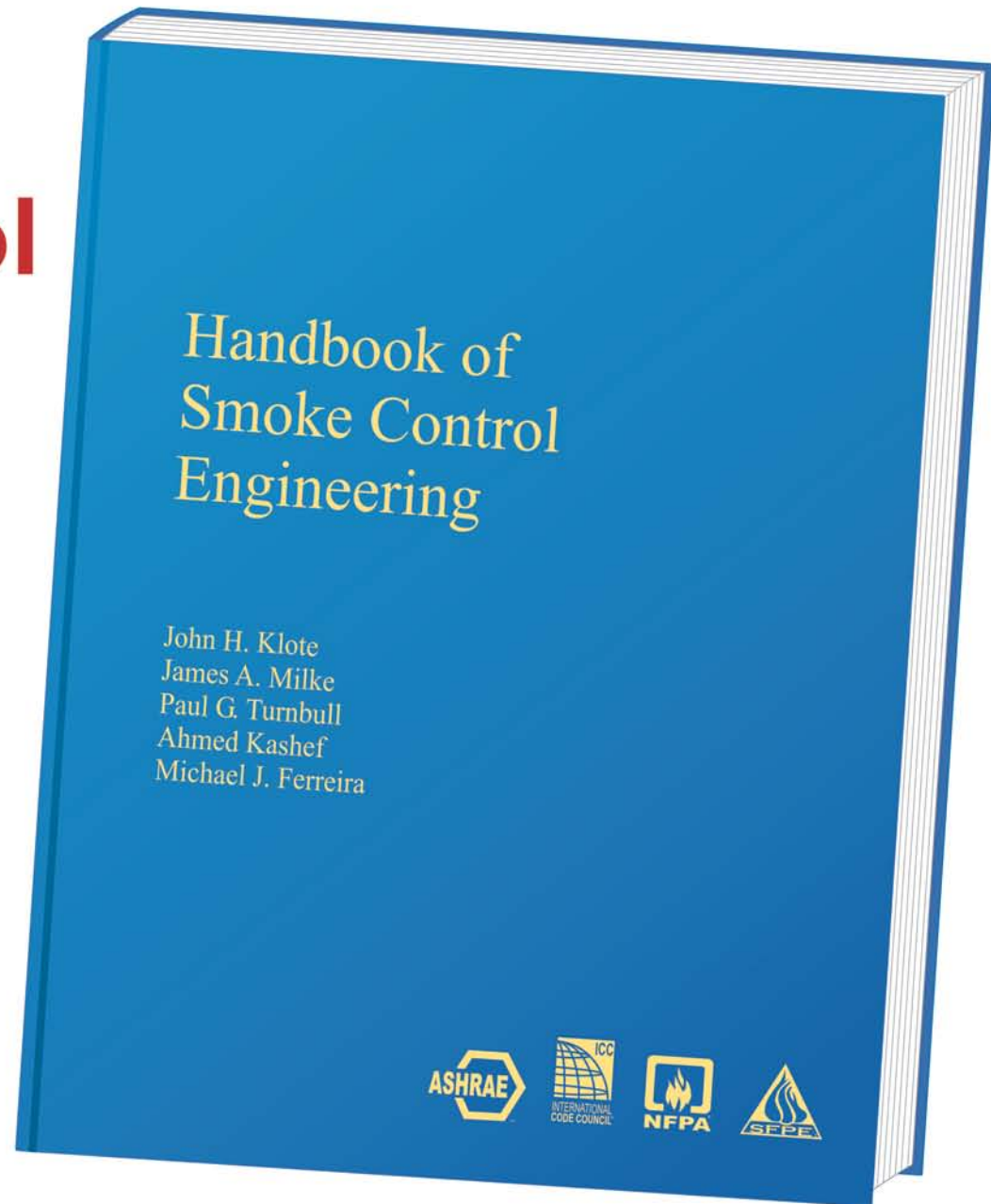
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# Topics in New Smoke Control Book

- Design Weather Data
- Flow of Air and Smoke
- Egress Analysis
- Design Fires
- Human Exposure to Smoke
- Automatic Controls
- Pressurized Stairwells
- Pressurized Elevators
- Zoned Smoke Control
- Atrium Smoke Control

# Topics (Continued)

- Fire and Smoke Control in Transport Tunnels
- Computer Analysis (CONTAM, CFAST & CFD)
- Full Scale Fire Testing
- Commissioning & Periodic Testing
- Appendix: Derivation of Equations

# Smoke Control

- Smoke control includes all methods that can be used singly or in combination to modify smoke movement for:
  - The protection of people.
  - The reduction of property damage.
- These methods are (1) compartmentation, (2) dilution, (3) pressurization, (4) airflow, and (5) buoyancy.

# Compartmentation

- Barriers w/ Fire Endurance – Long History
- Barriers – Some Smoke Protection
- Compartmentation Alone - Passive Smoke Protection
  - Sometimes Code Mandated without Analysis
  - Sometimes Designed with Tenability Analysis
- Compartmentation w/ Pressurization
  - Discussed Later

# Dilution

- Dilution in a Space Removed From Fire
  - Sometimes called *Smoke Purging*, *Smoke Removal*, and *Smoke Extraction*.
  - These terms are not recommended. They imply a high level of performance that can be misleading.
- Dilution in Fire Space – Not Recommended
- Dilution in Atrium\* – Discussed Later

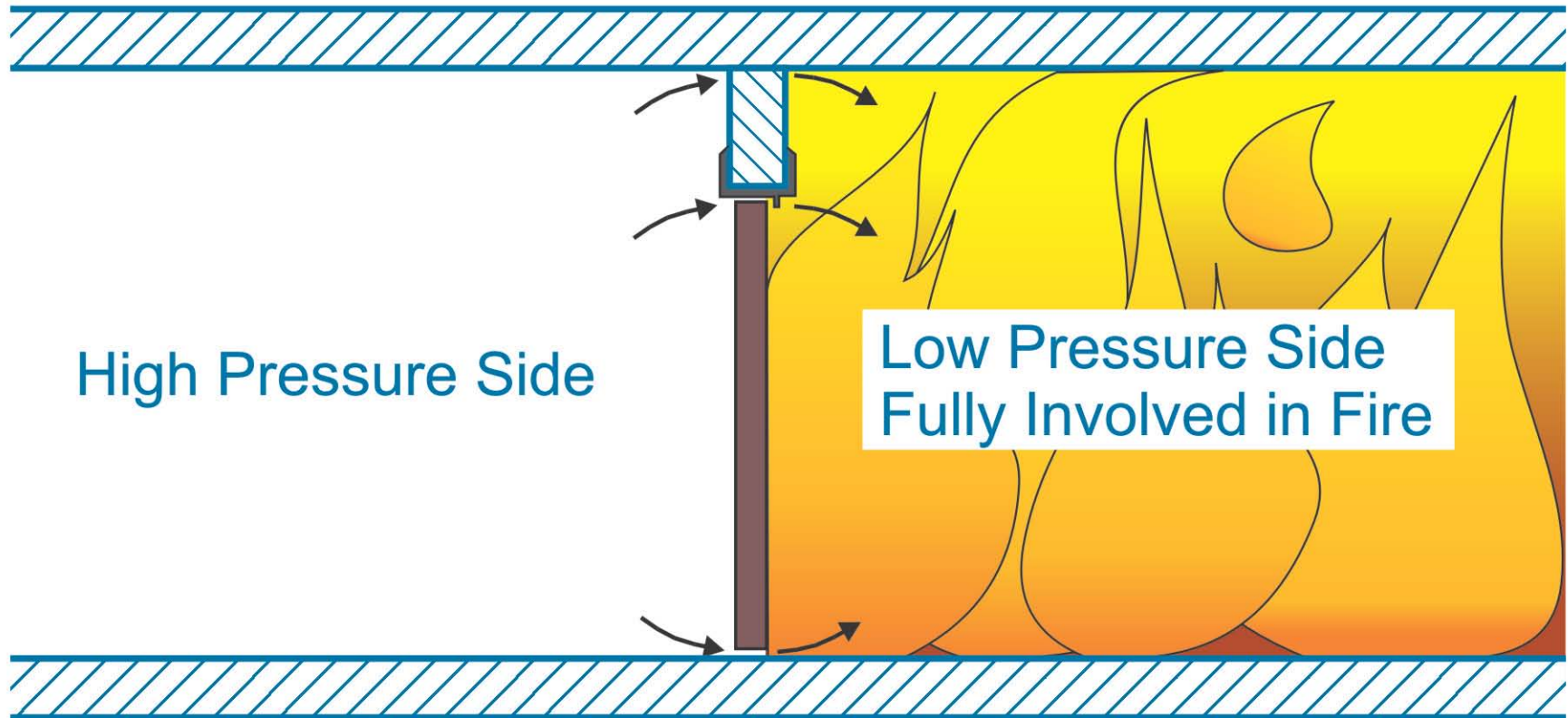
\*The term *atrium* is used here a generic sense to mean any large-volume space (enclosed shopping mall, arcade, sports arena, etc.).

# Pressurization Systems

- Pressurized Stairwells
- Pressurized Elevators
- Zoned Smoke Control

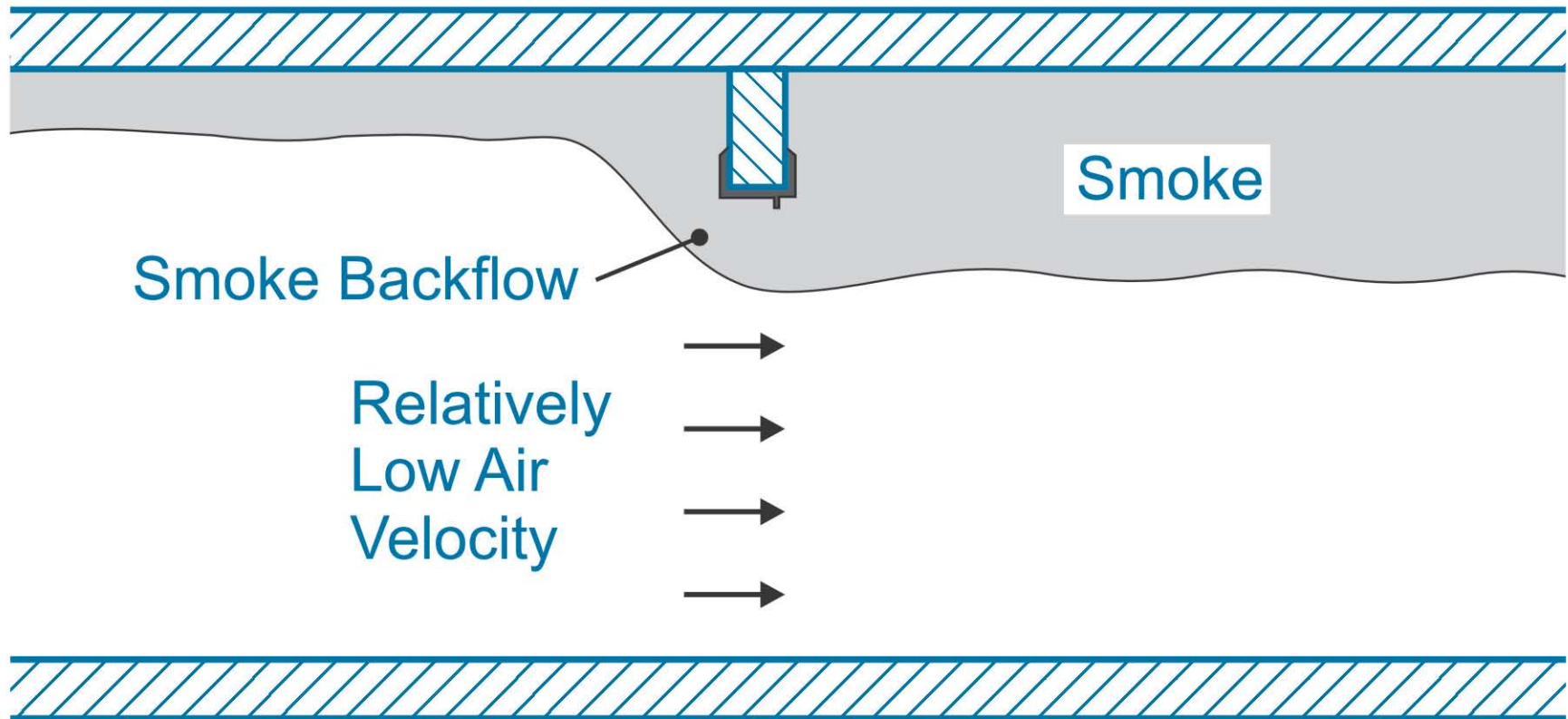


# Pressurization



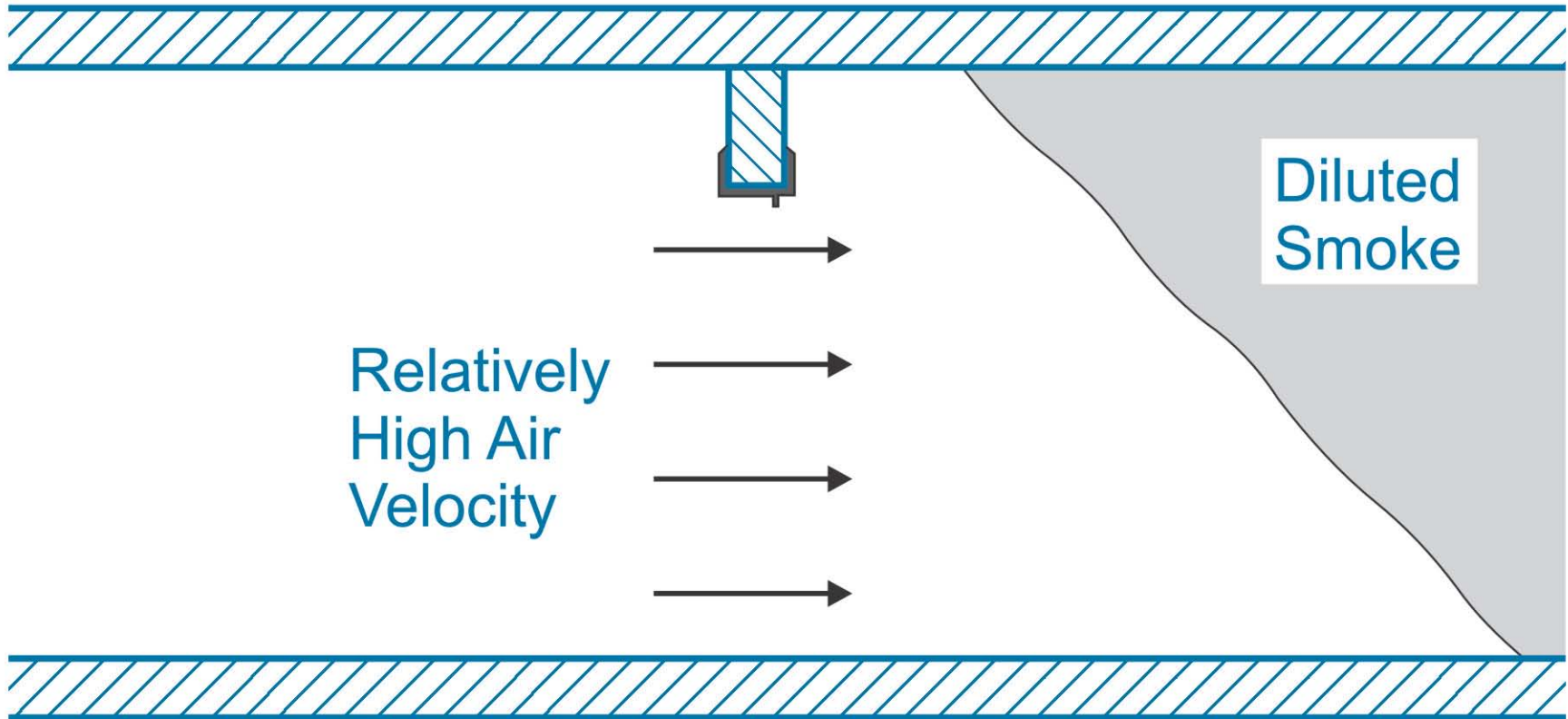
- Closed Door in Barrier
- Airflow in Cracks & Gaps - Prevents Smoke Flow
- Pressurization Works for Fully Involved Fires

# Airflow



- Relatively low air velocity results in smoke backflow.

# Airflow

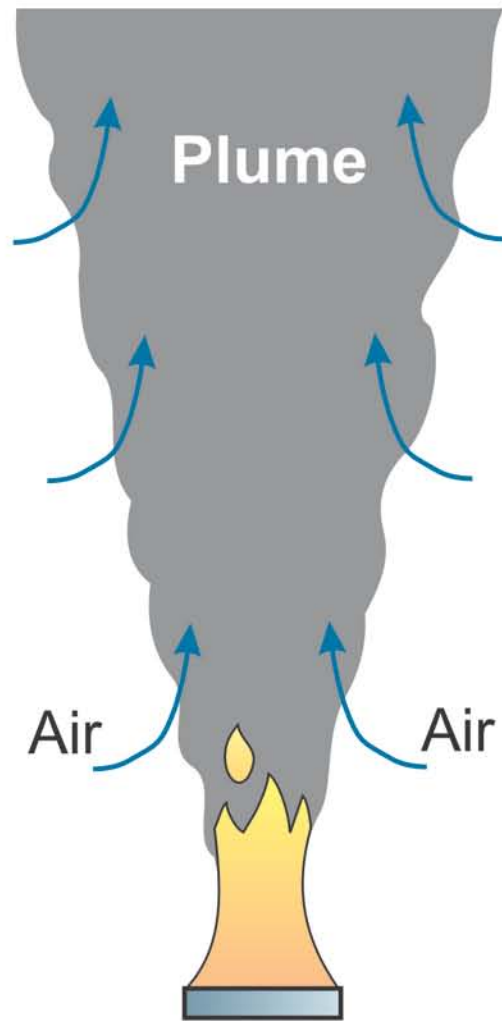


- Relatively high velocity airflow can control smoke.  
Caution: Airflow supplies air to the fire. Use it with great care.

# Airflow

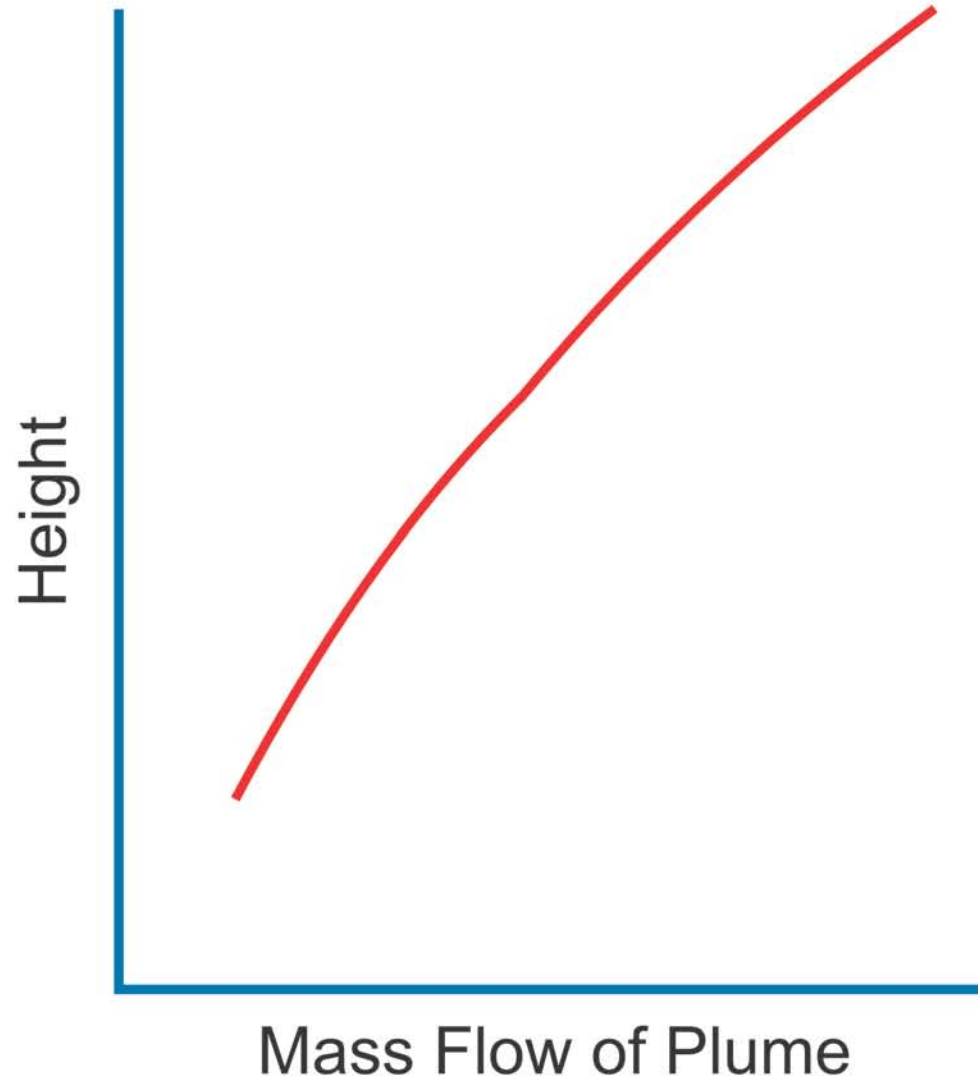
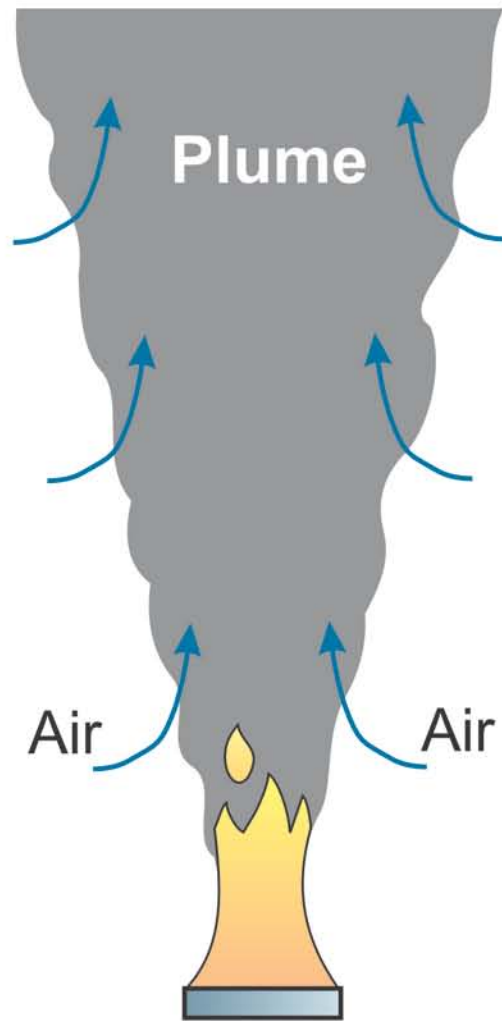
- Airflow can be used to control smoke flow in corridors, tunnels, and doorways.
- Equations for Different Applications (Atria in Chapter 15. Tunnels in Chapter 17.)
- Caution: Oxygen to Fire – Use with Great Care

# Buoyancy



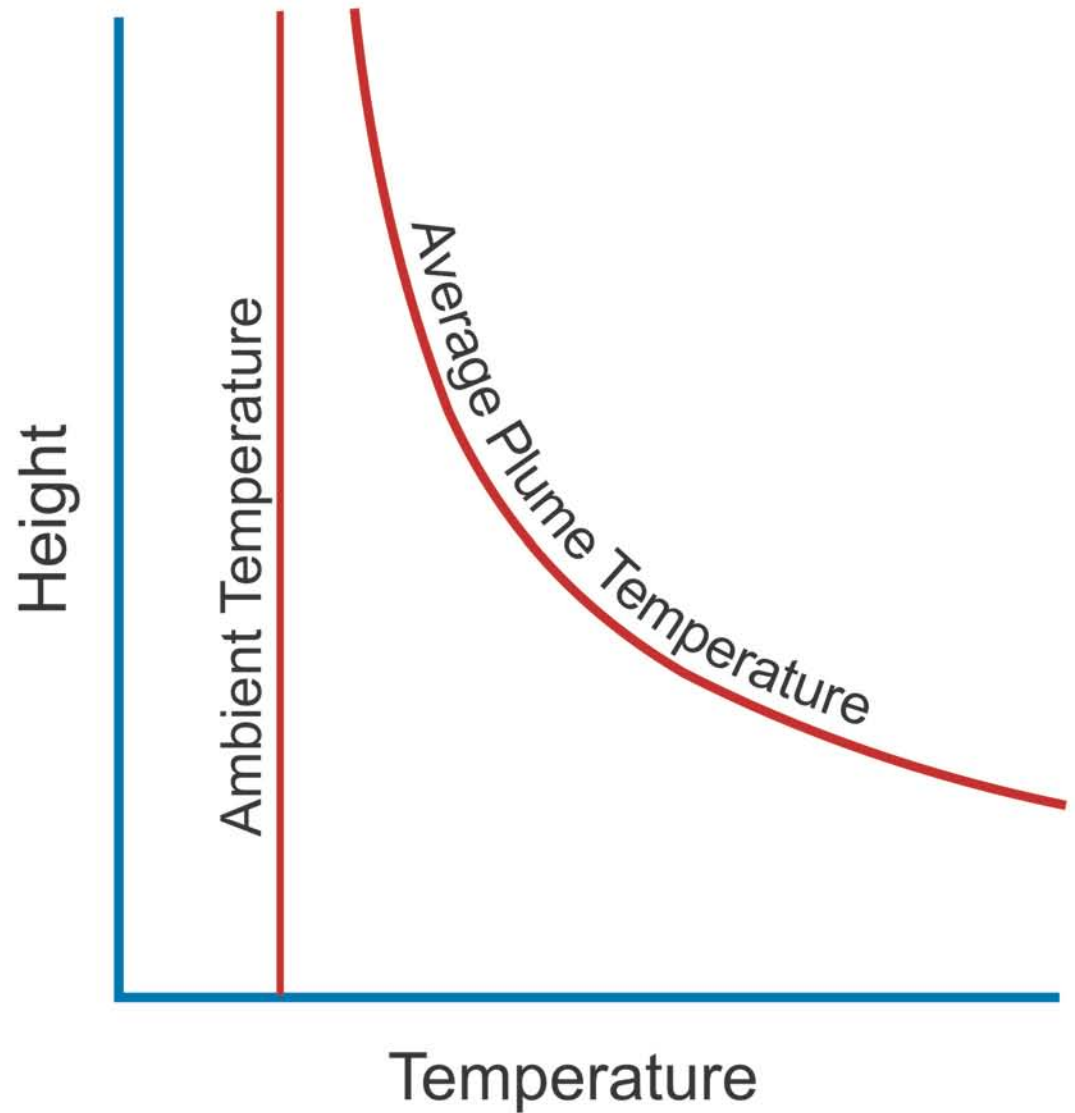
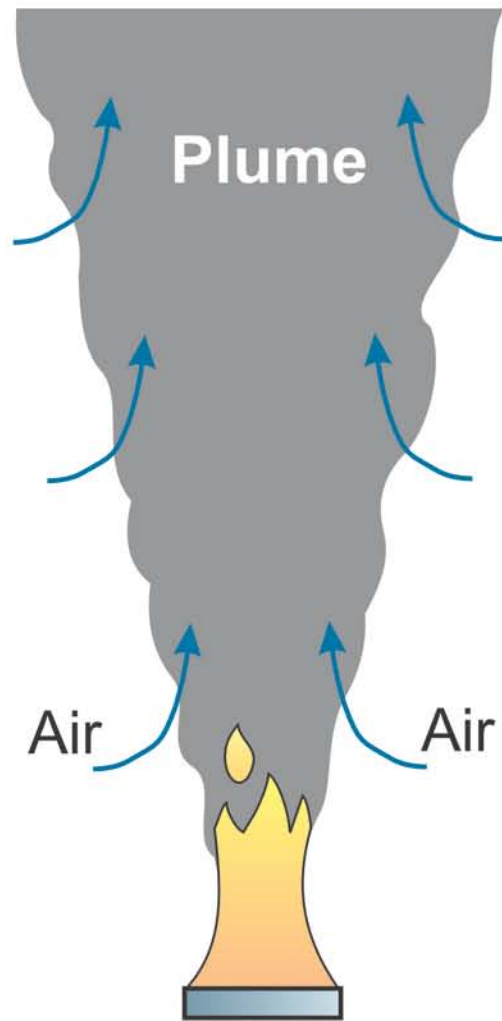
- Buoyancy causes a plume to form above of fire.
- Air is entrained in the plume.
- Mass flow increases with height.
- Temperature decreases with height.

# Buoyancy

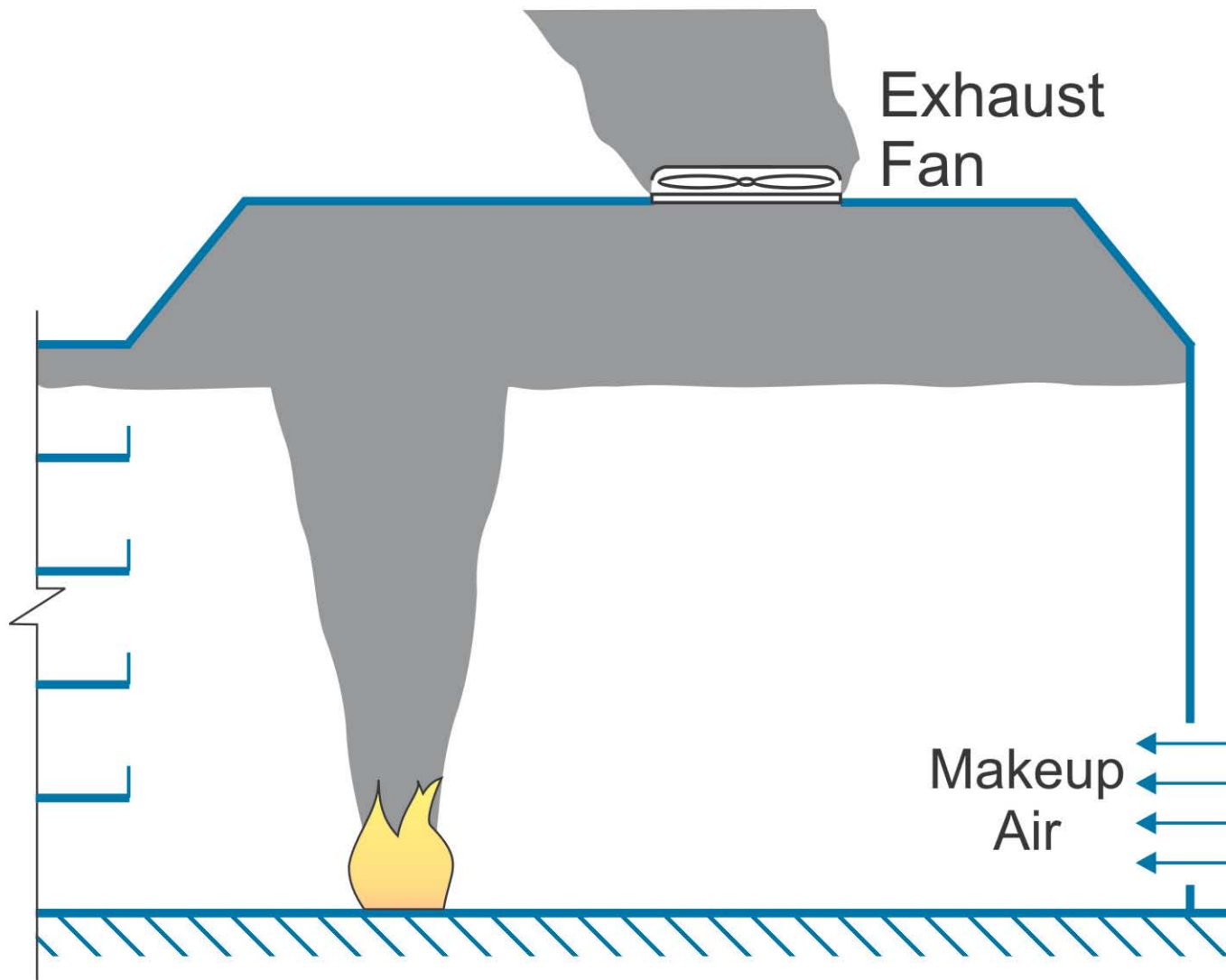




# Buoyancy



# Mechanical Smoke Exhaust





# Atrium Systems

- Mechanical Smoke Exhaust
  - Common in US & Elsewhere
- Natural Smoke Venting
  - Vents in Ceiling Release Smoke
  - Vents in Walls for Makeup Air
  - Eliminates Exhaust Fan
- Smoke Filling
  - Eliminates All Smoke Control Equipment

# Questions?

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