RESIDENTIAL WOOD SMOKE WORKSHOP 2020

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TEMPERATURE DIFFERENCE

- The greater the temperature difference between the gases inside the flue and the air outside the chimney, the greater the draft will be, and air will be drawn more forcefully into the system.

NATURAL DRAFT

- Force that moves air into the appliance and combustion by-products out of the venting system
- Pressure difference venting system
  - Temperature difference between gases in the venting system and that of outdoor air
    - Greater the temperature difference the more draft created
  - Movement from zones of high pressure to zones of low pressure

FLOW

Volume of gases that pass through venting system as a result of draft

Enough flow to remove combustion by-products required

Resistance to flow has net effect of reduced draft

- Adverse effect on combustion process
- Lower flue gas temperatures

Flow Capacity

Three factors which influence flow capacity are:

- Draft
- Amount of resistance to flow
- Size of venting passageways

RESISTANCE TO FLOW

- Friction always exists between moving gases and the flue walls.
- Variables affecting friction – or resistance to flow – include:
  - Bends & turns in venting system
  - Changes in size or shape
  - Surface irregularities (mortar protrusions, etc.)
  - Appliance air inlet settings

Draft and Flow

Cross-sectional area of vent

- Flow capacity increases with size of vent
  - EXCEPT: Draft reduced as size increases beyond flue collar area
    - Heat loss due to contact with increased surface area

Resistance to flow

- Turns in direction (elbows, tees, offsets)
- Horizontal runs
- Obstructions in vent
- Wind
- Competing sources of negative pressure

RESISTANCE TO FLOW?

Relationship of Draft and Flow

Fireplaces require large flow capacity but not strong draft.

The dilution air sucked into the fireplace promotes rapid combustion which requires large flow capacity to vent the high volume of flue gases. Due to the large flow capacity draft may be weaker

Closed appliances such as inserts, and free-standing stoves require strong draft but not large flow capacity

Because combustion air is limited the combustion is slower and the reduced volume of flue gases require less flow capacity

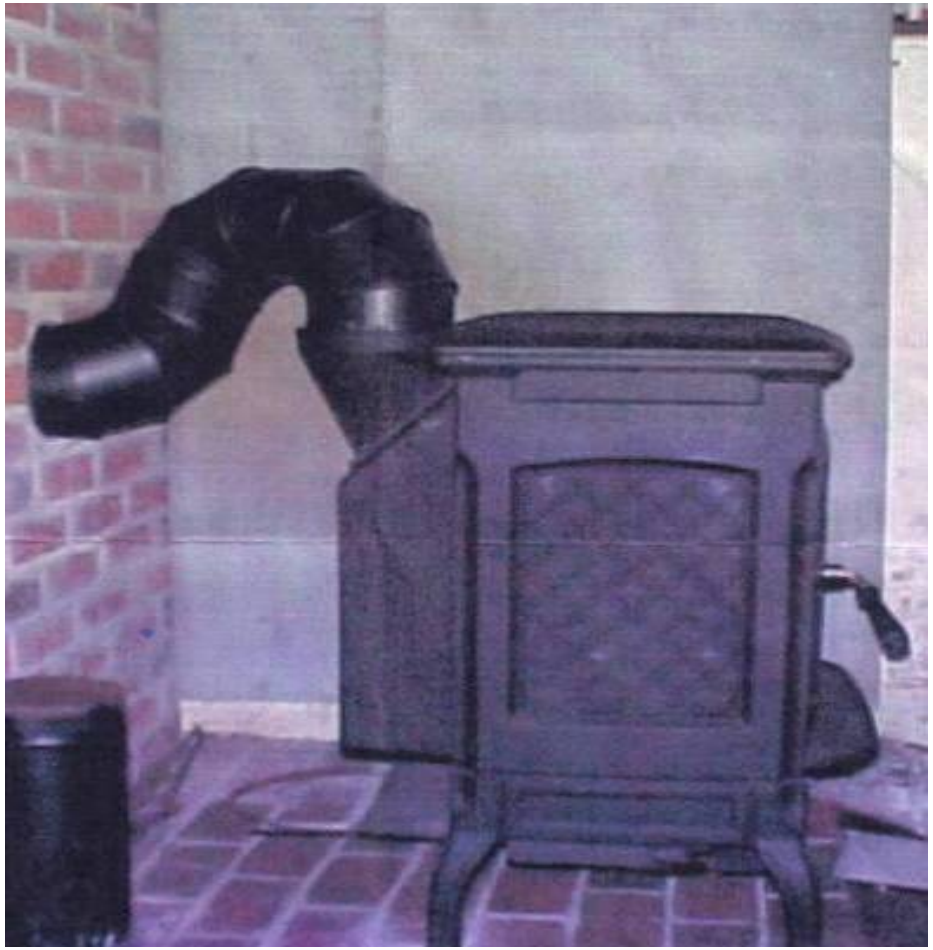
Taller chimneys contain a taller column of warm, rising gas

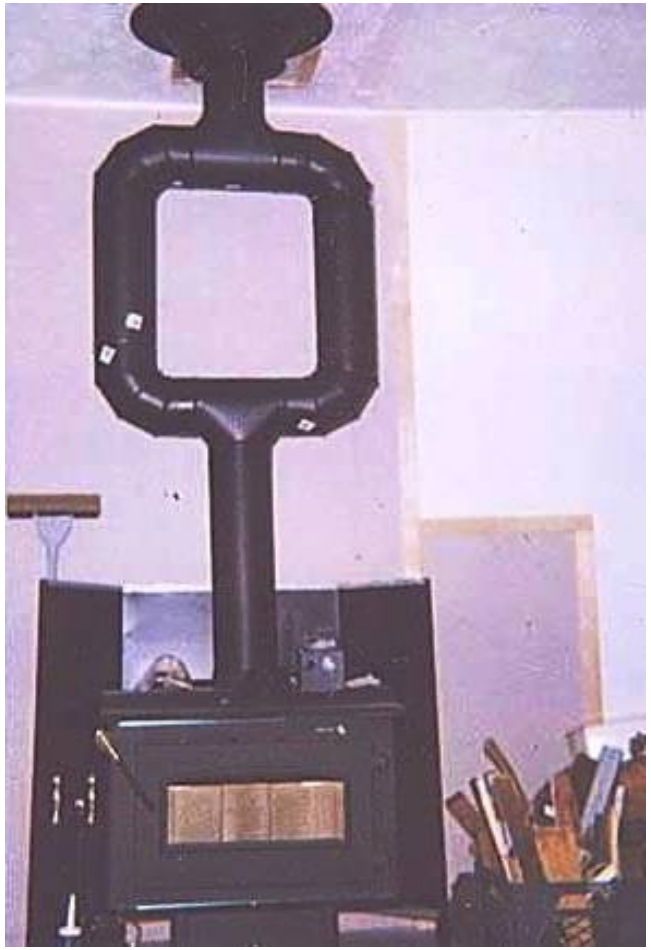
The movement of the gases increase the draft

The height is the critical factor, not the volume or movement of the gases

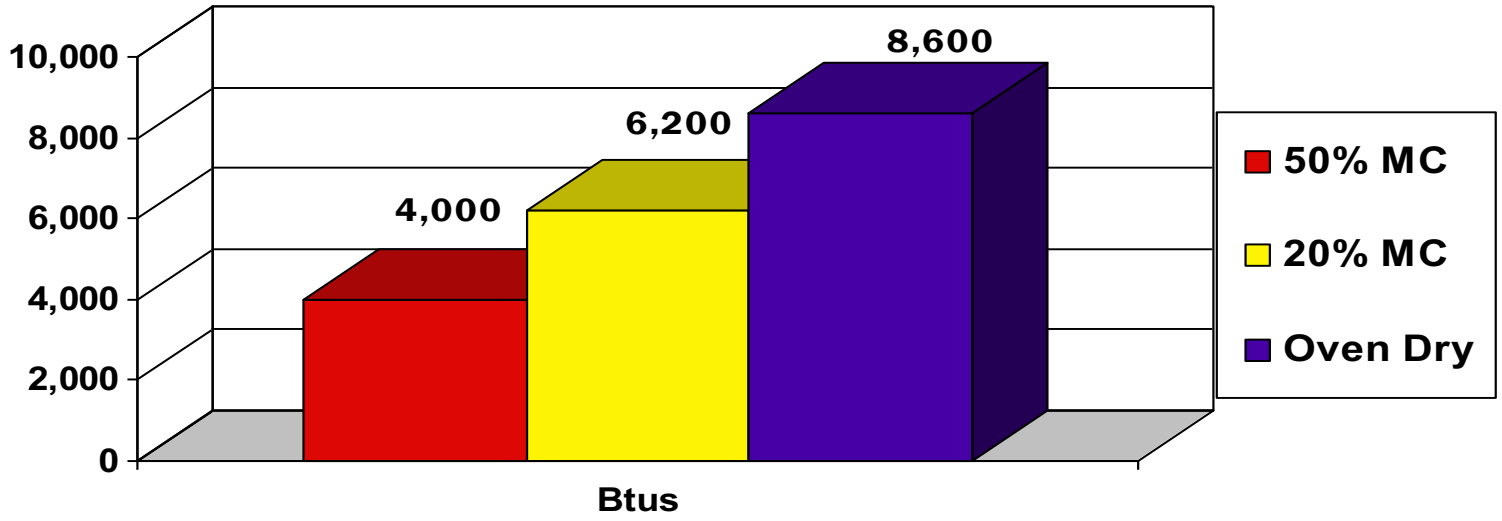
CHIMNEY HEIGHT

Free-Standing Stoves
Connector pipe





MOISTURE CONTENT



MOISTURE CONTENT

INCOMPLETE COMBUSTION CREOSOTE

- Unburned fuel that condenses in chimney
- Combustible: chimney fire
- Carcinogenic
- Amount depends:
  - Density, temperature, speed of smoke
  - Temperature and roughness of flue surface

CHIMNEY FIRE

HOUSE PRESSURE CONDITIONS

- Sources that exhaust air:
- Kitchen range fans
- Clothes dryers
- Central vacuum
- Gas furnace
- Water heaters
- Recessed lighting
- Additional hearth appliances,
  - -especially open fireplace

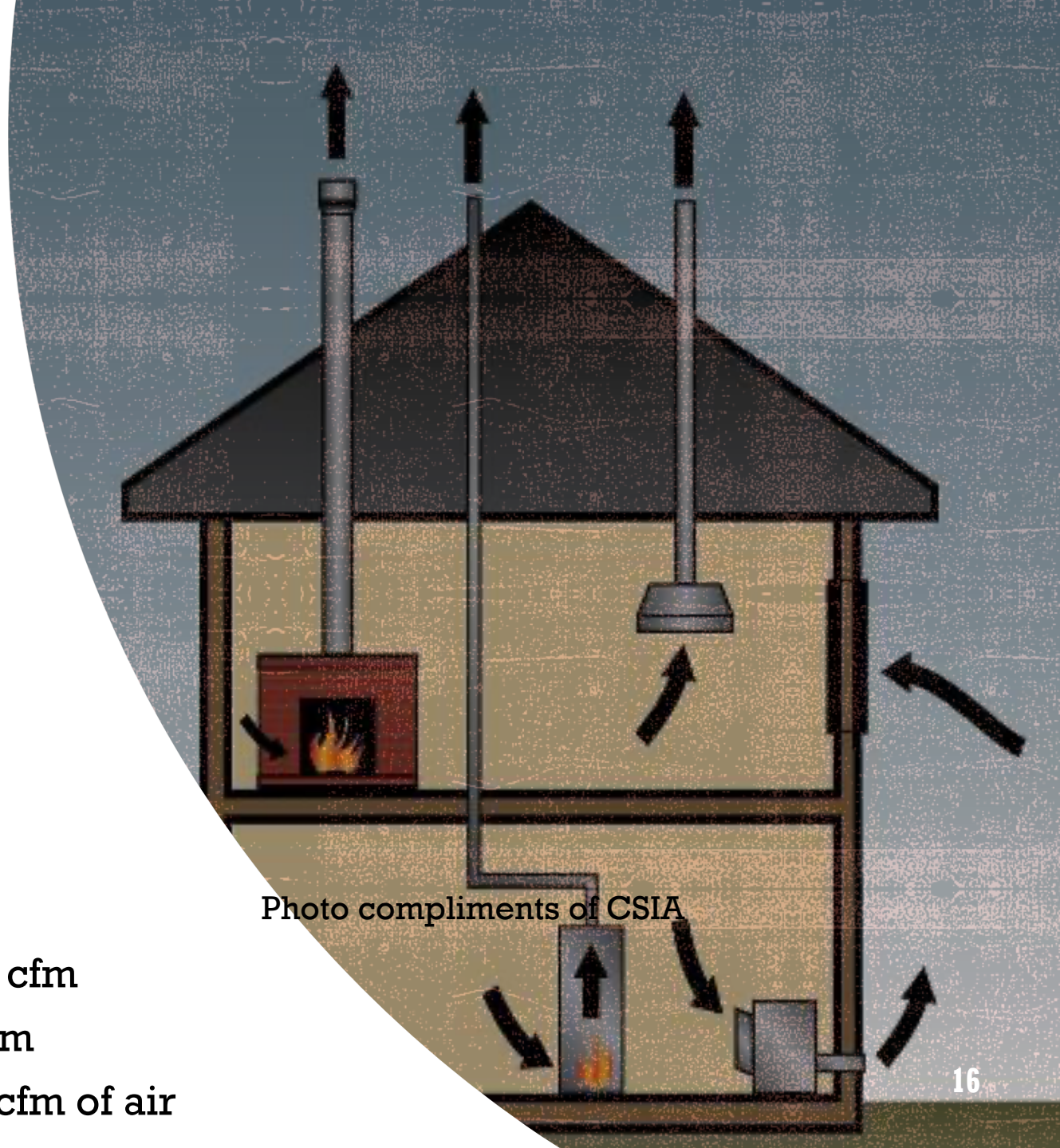


Photo compliments of CSIA

Outside air

- Open fireplaces require 200-300 cfm
- EPA woodstoves require 11-32 cfm
- 4”outside air brings in about 10 cfm of air

HOUSE PRESSURE CONDITIONS

- House Stack Effect
  - Heated portion of house taller than vent termination
  - Leaks (recessed lighting, attic fan), open window in upper portion create greater chimney effect than vent

Heat absorbed from radiant energy raises temperature of combustibles

Heat absorbed by noncombustible transferred to adjacent combustibles with which they are in contact

When ignition temperature reached, combustible material ignites, without direct contact with flame

HEAT TRANSFER

HEAT TRANSFER

Pyrolysis -Ignition temperatures of combustibles lowers with age and heating

Concealed combustibles particularly dangerous

SAFETY STANDARDS

- Product testing by certified testing labs
  - Materials and construction
  - Fire and strength tests
  - Review of installation instructions for required
    warnings and content

PRODUCT SAFETY TESTING

UL, Omni, InterTek, Arnold Greene & Others

CLEARANCES

Space between appliance, chimney connector, chimney and combustible material

Air space with no intervening materials

Or specified noncombustible materials and their position (shields)

Minimum: must meet or exceed

Minimum clearances allow noticeably warm surfaces

COMBUSTIBLES

- Combustible:
  - Walls with wood framing
  - Paper-faced materials
    - Papered sheetrock (dry wall)
      - including fire-rated papered sheetrock
  - Plaster on wood lath or studs

CLEARANCES

THANK YOU!

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