Washington State Ventilation and Indoor Air Quality Code

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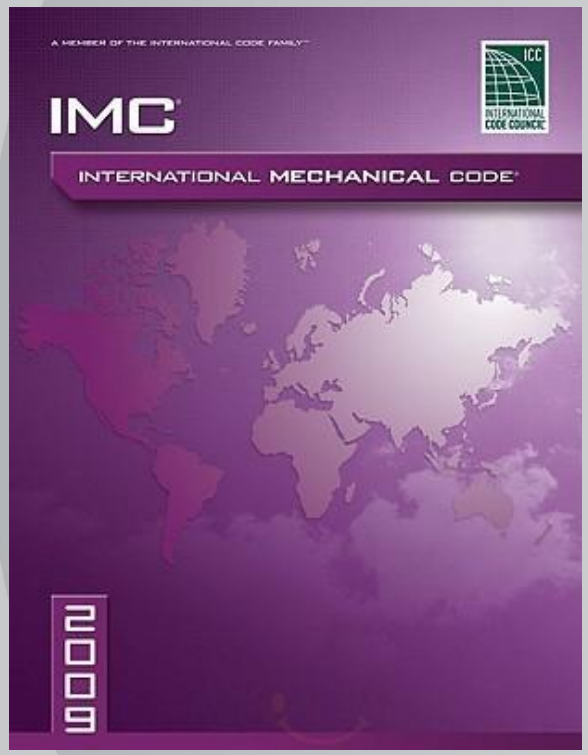
WASHINGTON STATE UNIVERSITY
EXTENSION ENERGY PROGRAM

On July 1, 2010 the Washington State VIAQ Code Went Away (sort of)

- Requirements of the VIAQ Code are incorporated into the International Mechanical Code (IMC) & International Residential Code (IRC) as Washington State Amendments
- The location of the ventilation requirements are in Chapter 4 of the IMC & Chapter 15 of the IRC
- Applies to ALL Group R Occupancies

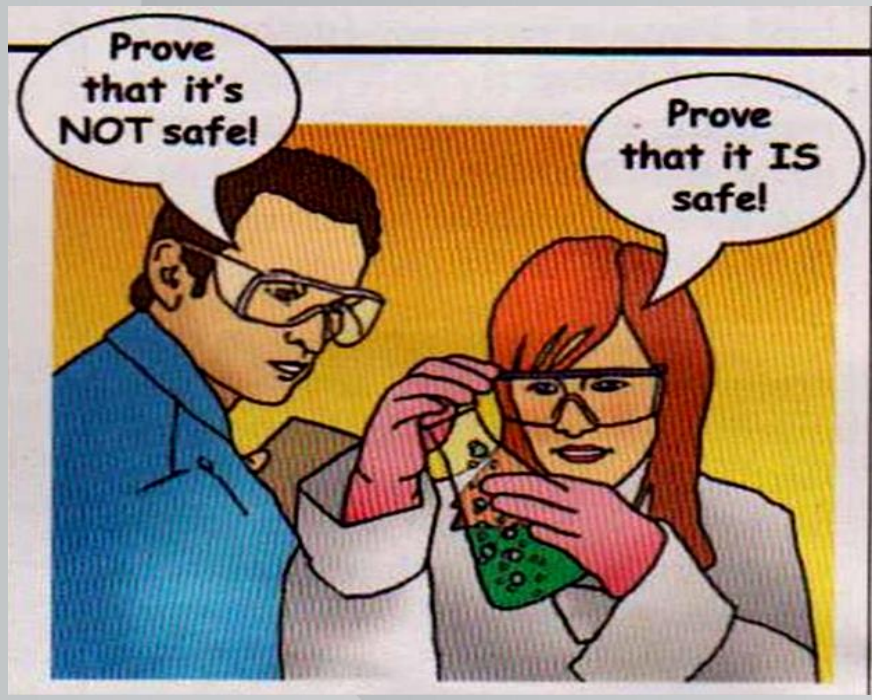


2009 IMC/IRC Residential Requirements

- Residential Occupancies are required to have:
  - Whole House Ventilation System (403.8 & M1508.1)
  - Source Specific Ventilation Systems (403.8 & M1507.1)
    - Kitchens
    - Bathrooms
    - Water Closets
    - Laundry Rooms
    - Indoor pools and spas
    - Other areas where water vapor or cooking odors are produced

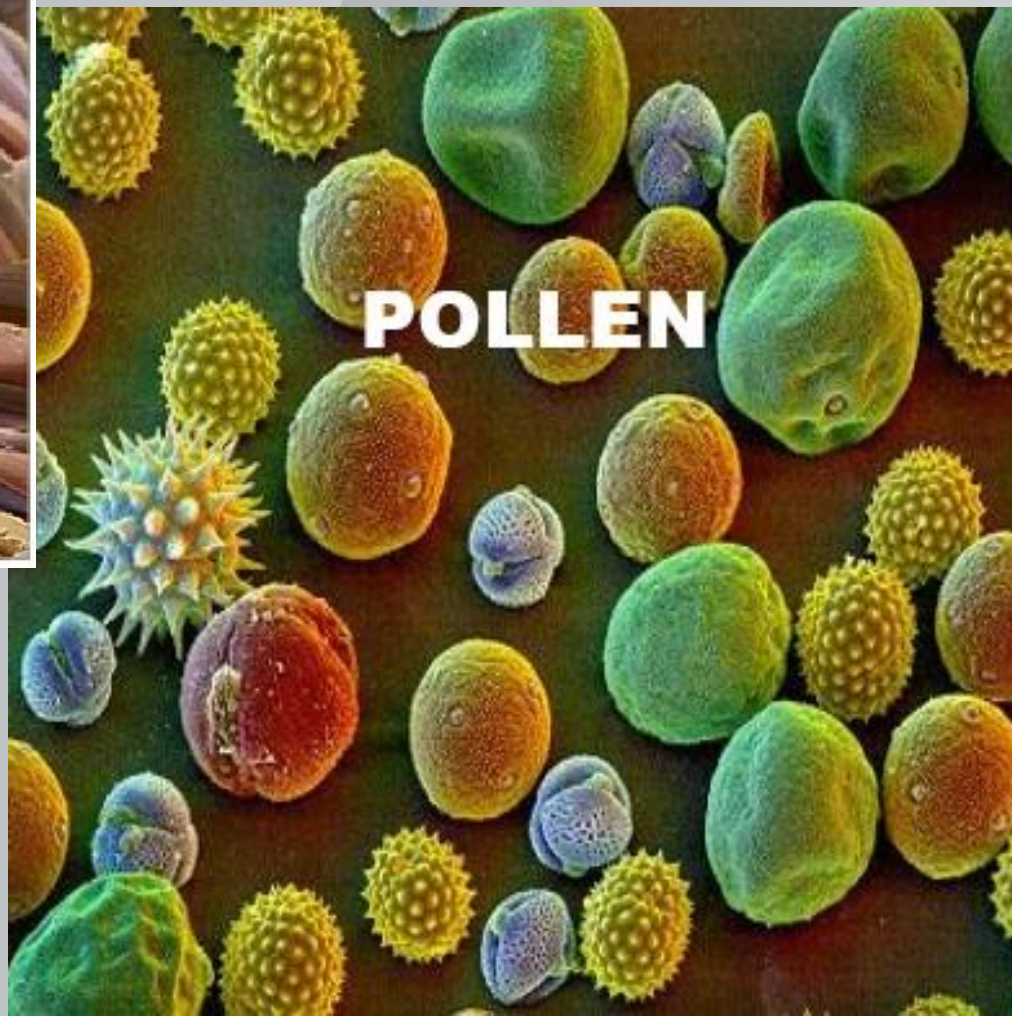
Why Do (should) We Care About Ventilation?

- Health
- Productivity/achievement
- Quality of life
- Durability of structures
- Energy costs
- Costs of renovations/repairs
- Legal fees/lawsuits



What's In the Air?

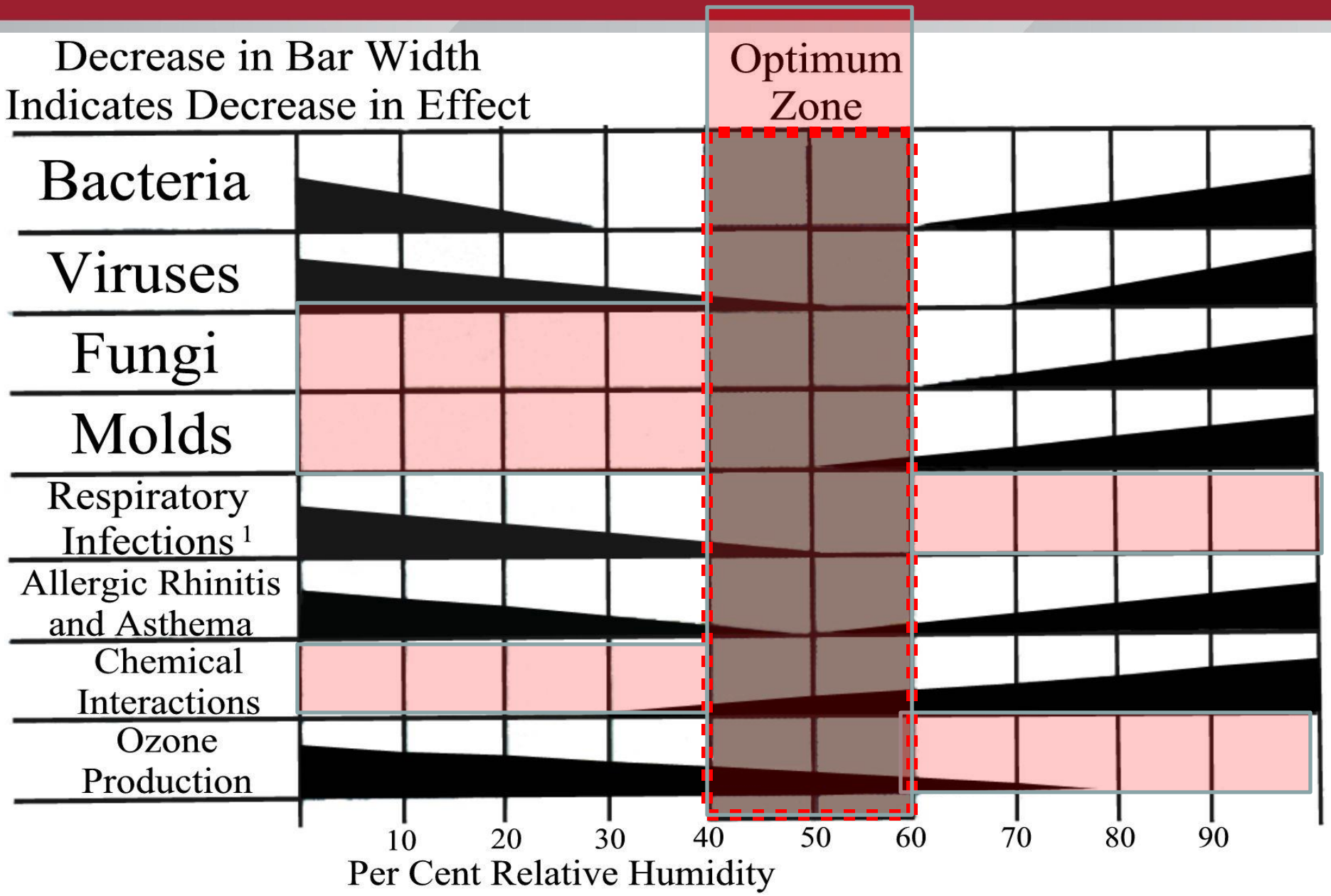
- Lead
- Cadmium
- Gypsum
- Fiberglass
- Carpet fibers
- Soot
- Dust mite feces
- Molds
- Fire retardants
- Asbestos
- Chemicals
- Tire fragments
- Dander
- Charred wood
- Insect parts
- Paint spheres
- Plant particles
- Pollens
- Paper
- Pesticides
- Herbicides
- Fly ash
- ***And other stuff . . . .***


POLLEN

Moisture Mitigation

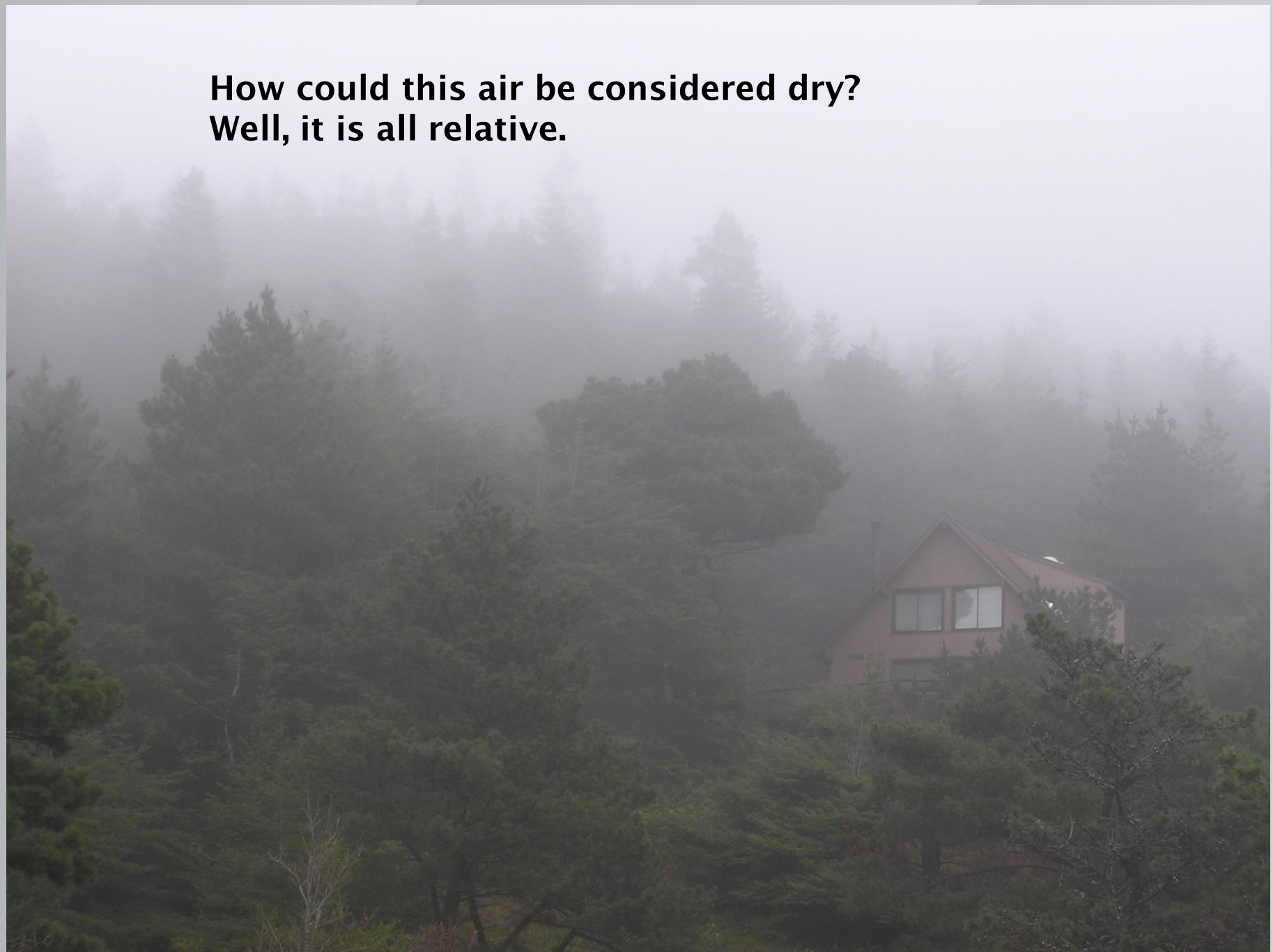
- A family of four can emit over 3 gallons of water into a home each day.

- In Washington State the air inside a new home generally holds more moisture than the outside air, even in the winter.

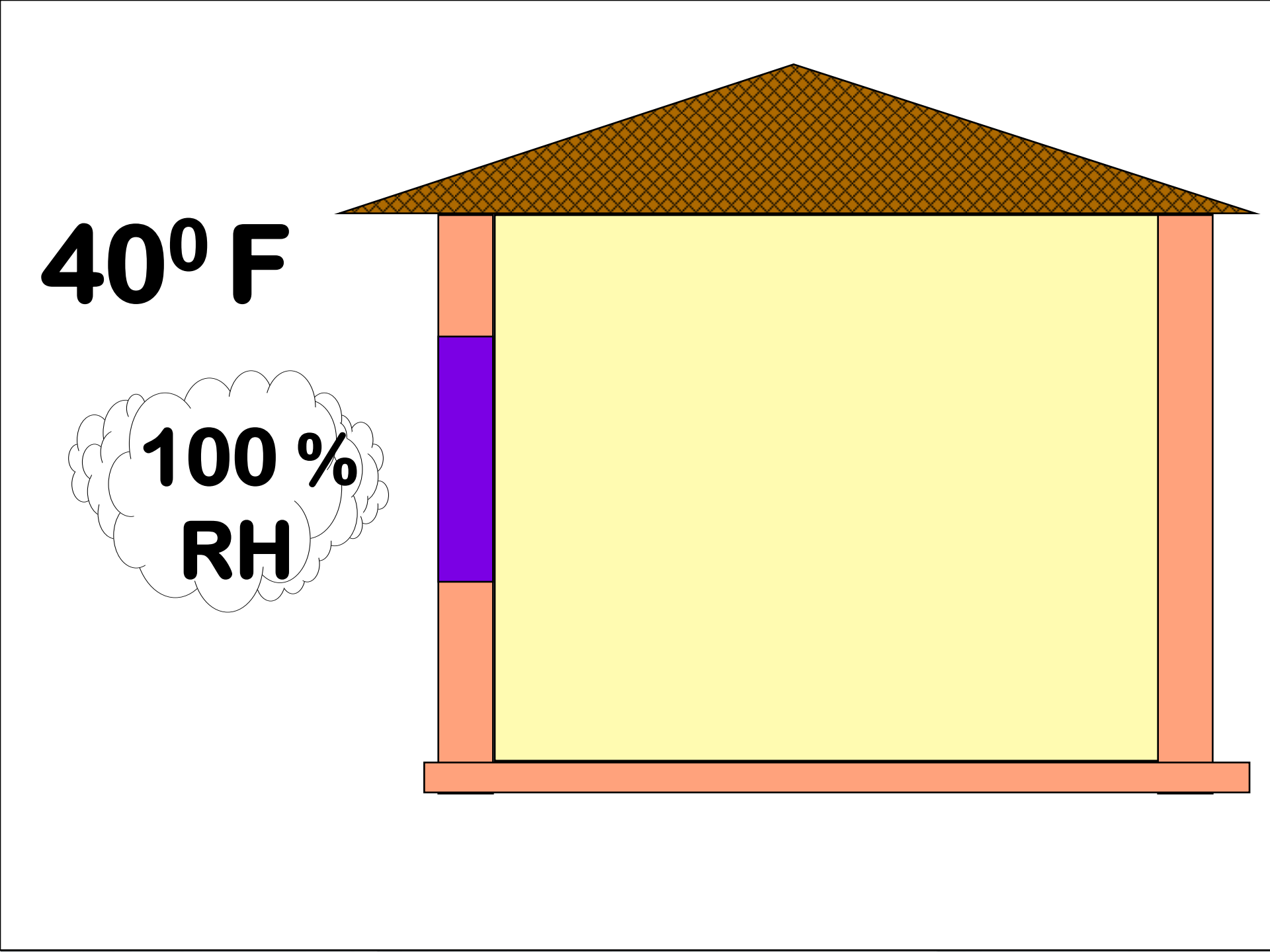


1. Insufficient data above 50% RH

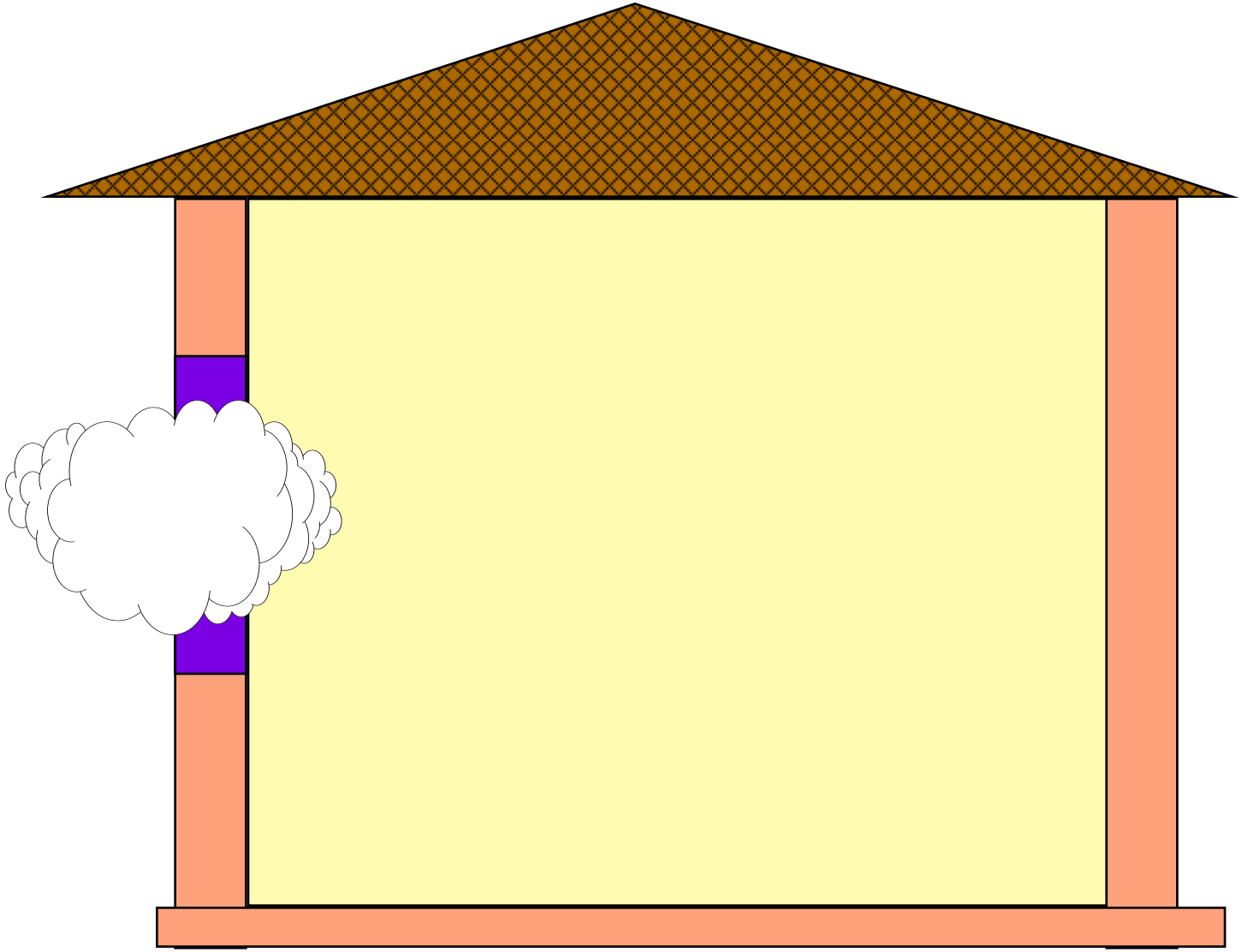
Optimum Relative Humidity Ranges For Health
From "Criteria for Human Exposure to Humidity in Occupied Buildings"
Sterling, Arundel & Sterling ASHRAE Transactions, 1985, Vol 91, Part 1



How could this air be considered dry?
Well, it is all relative.


40⁰ F
100 %
RH

40 ^{0}F



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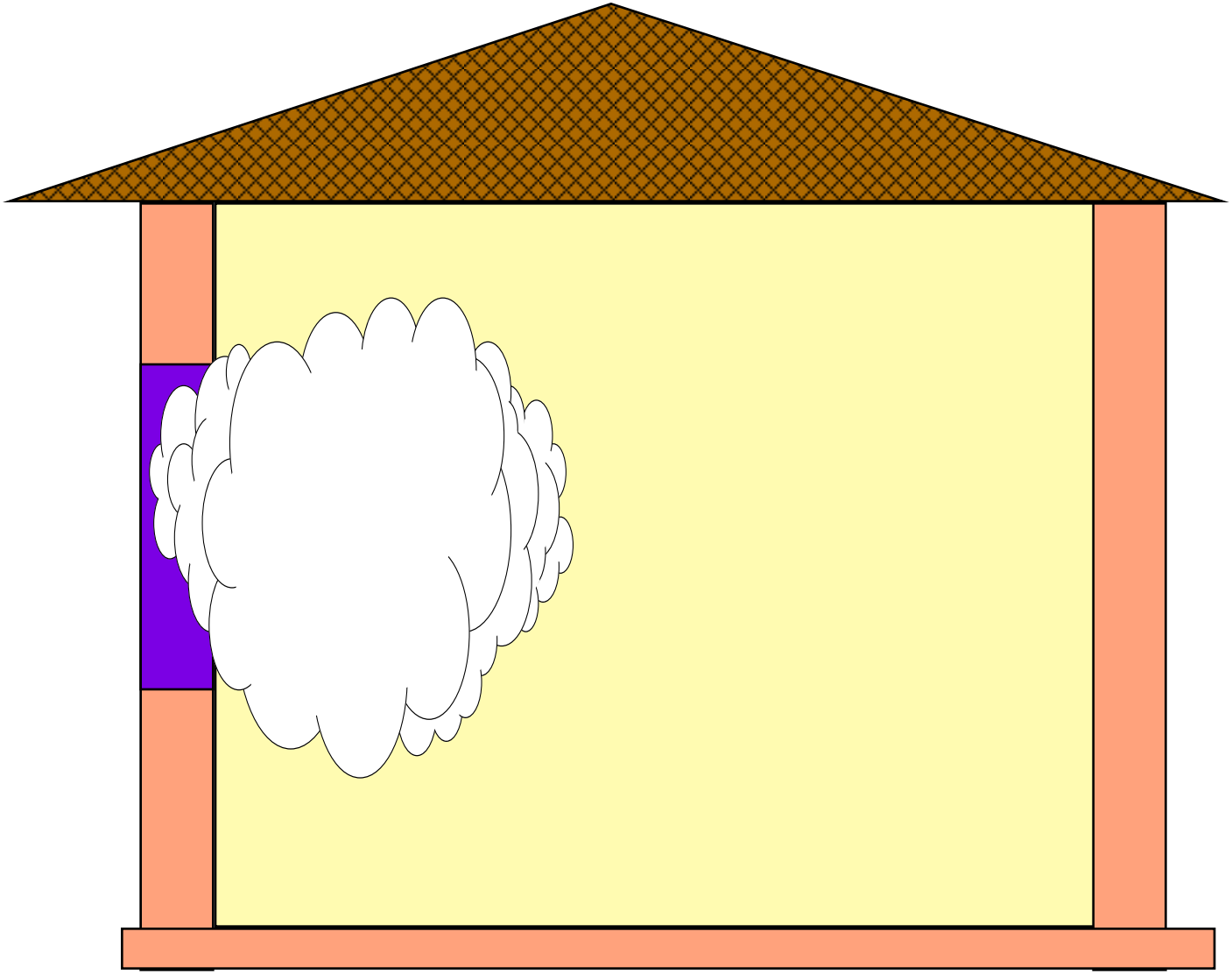
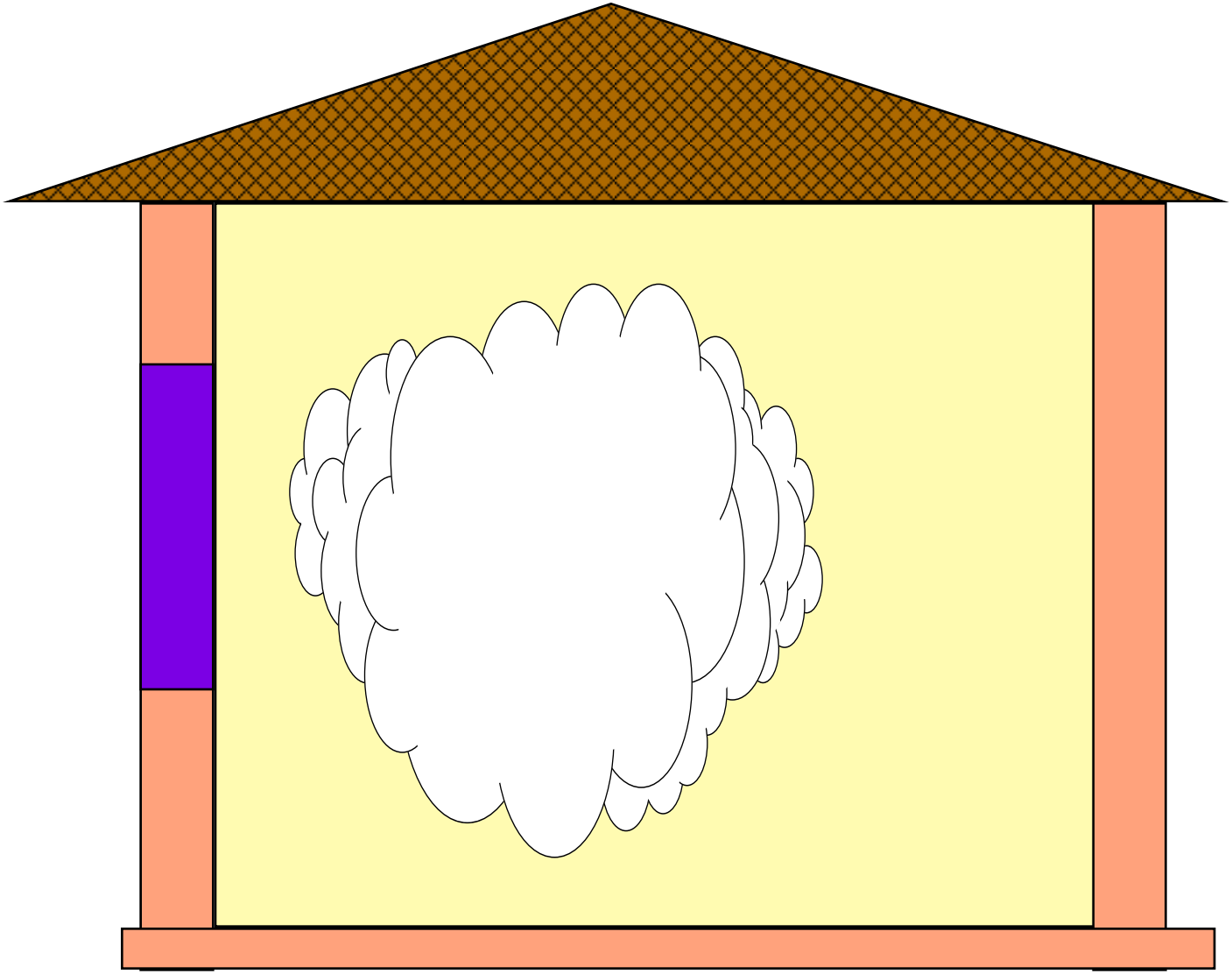
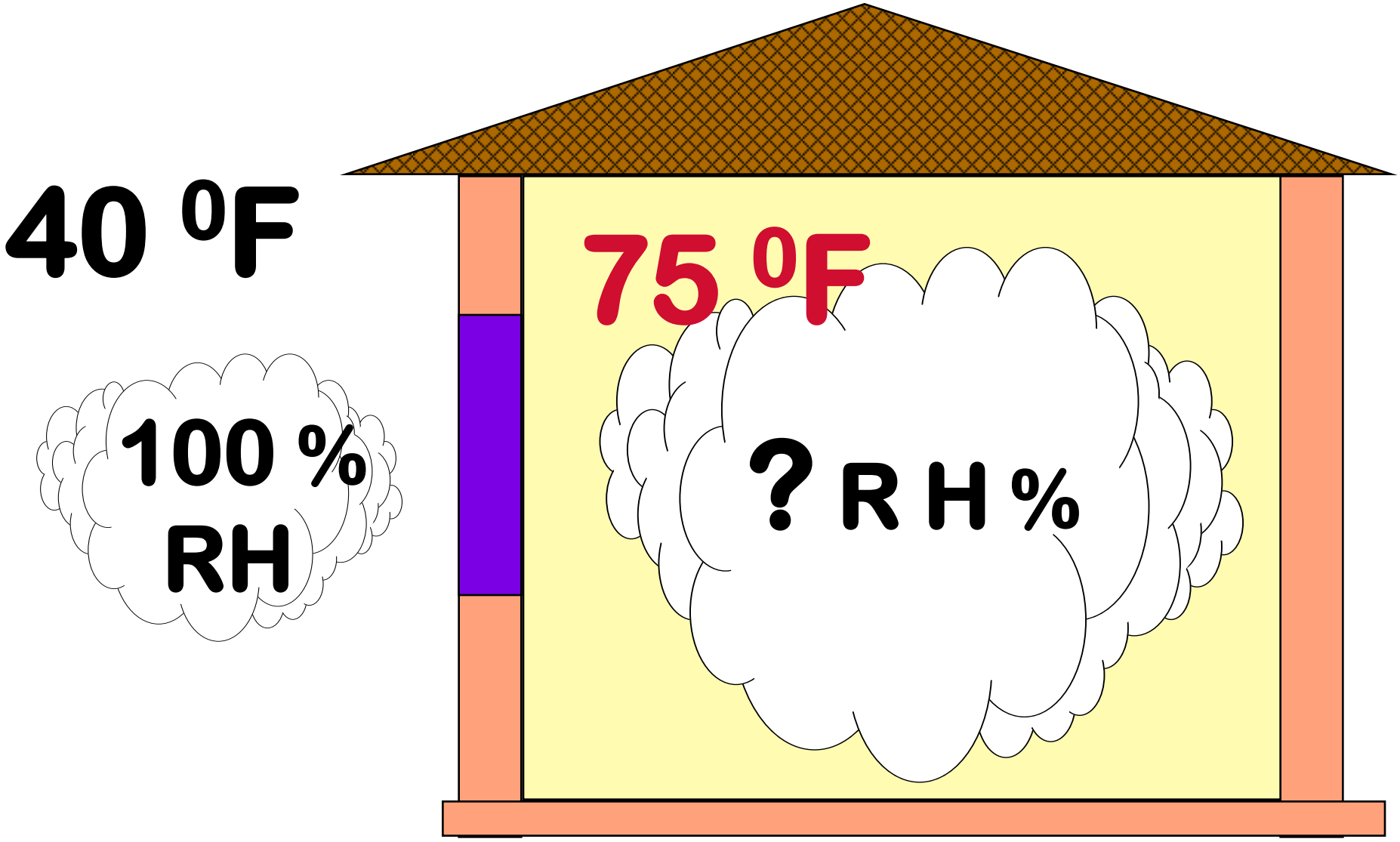
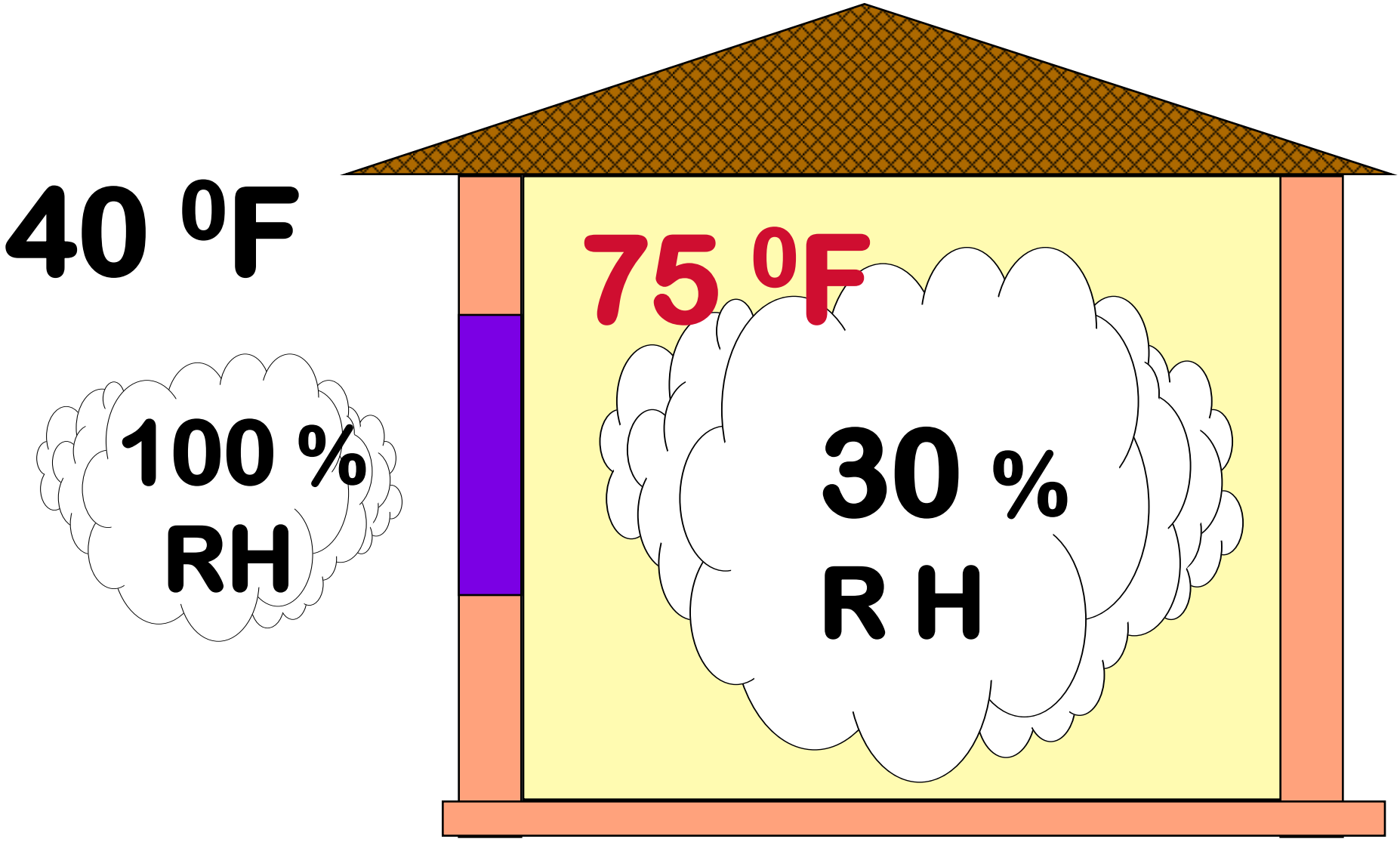


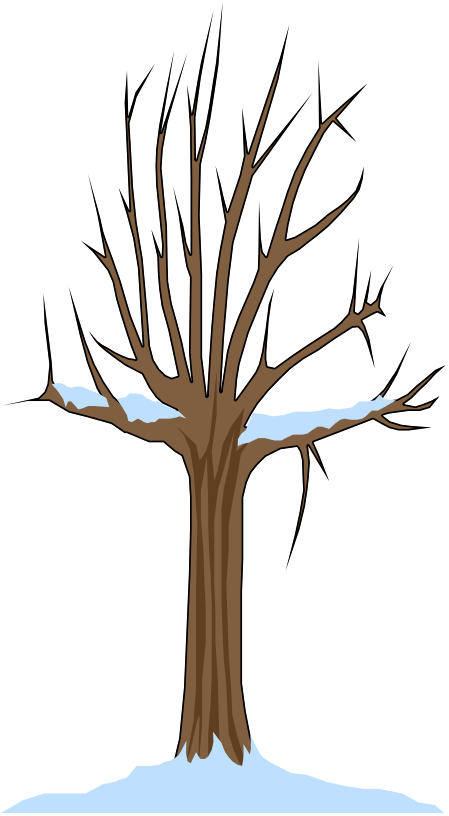
40^{0}F

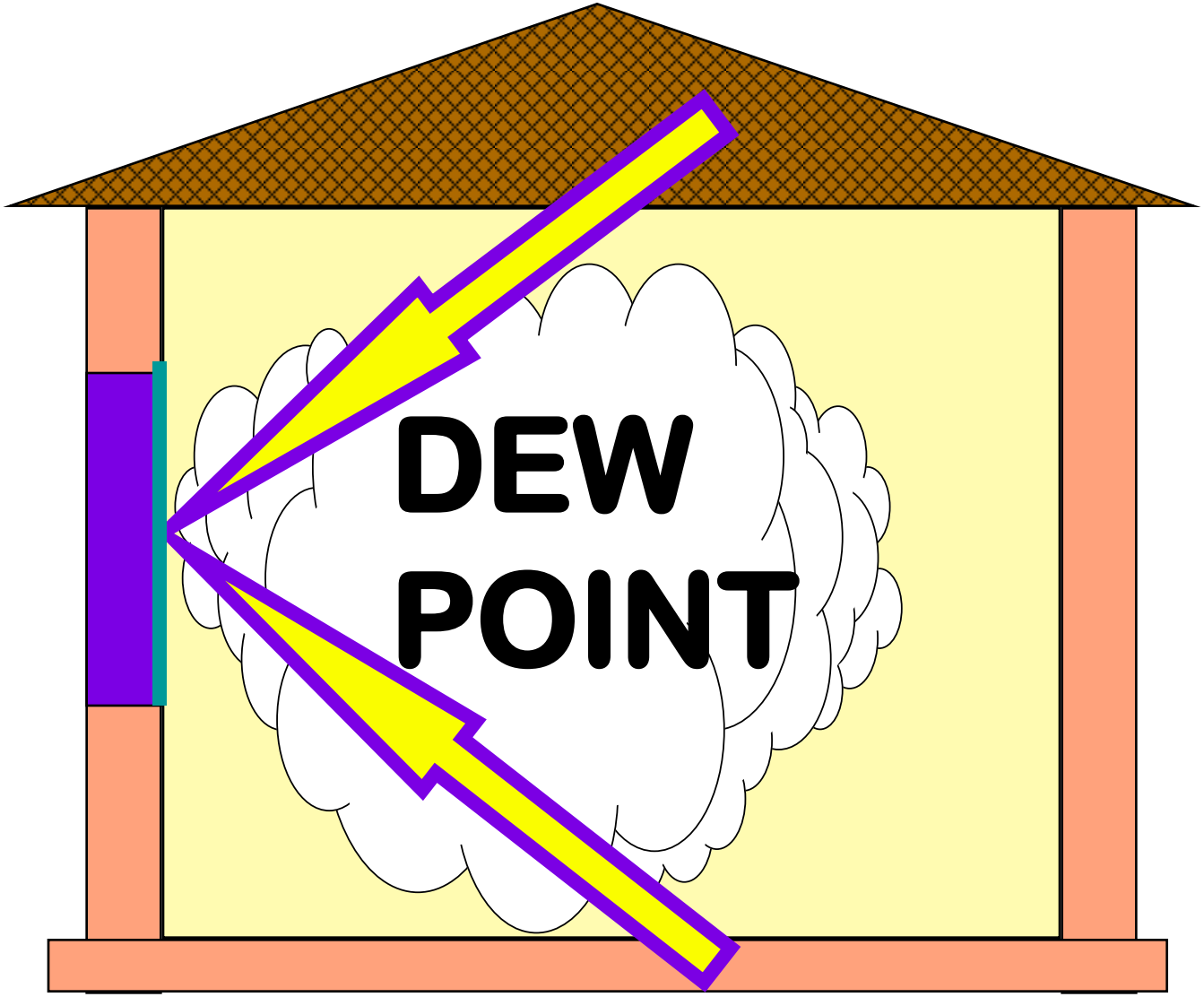



40 ⁰F
100 %
RH
75 ⁰F
? R H %

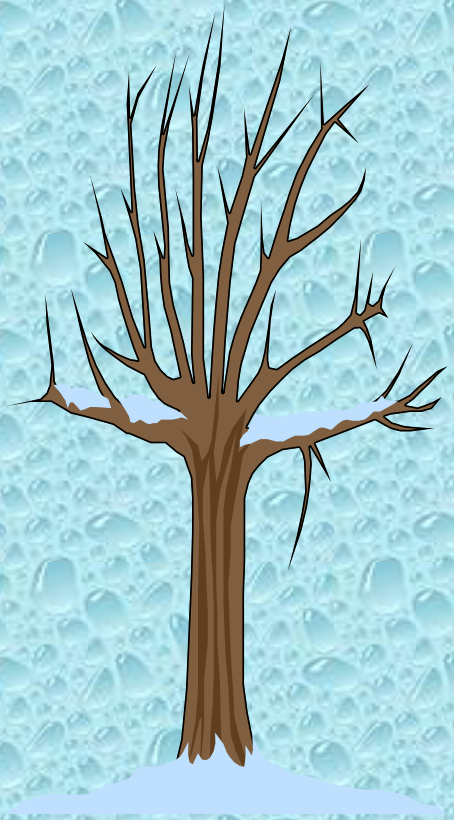

40 ⁰F
100 %
RH
75 ⁰F
30 %
R H

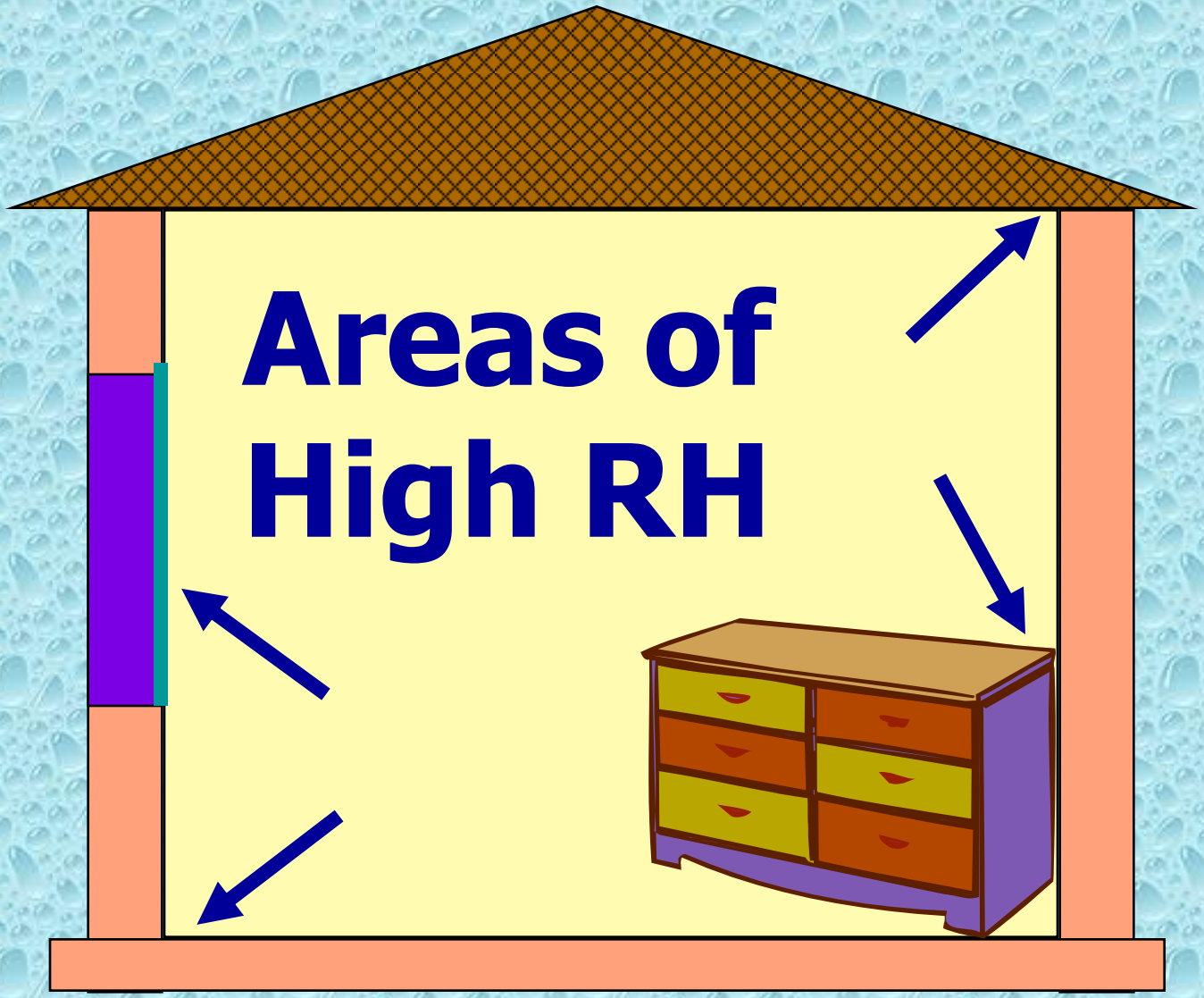
COLD OUTSIDE





COLD OUTSIDE





Buildings have micro-climates

Allow for Air Circulation and Reduce RH

Source Specific Ventilation

Table 403.3/M1507.3.1

Baths & laundry

- 50 cfm intermittent
- 20 cfm continuous

Kitchens

- 100 cfm intermittent
- 25 cfm continuous
- Systems over 400cfm must provide makeup air (M1503.8)

Some of the greatest ideas originated here

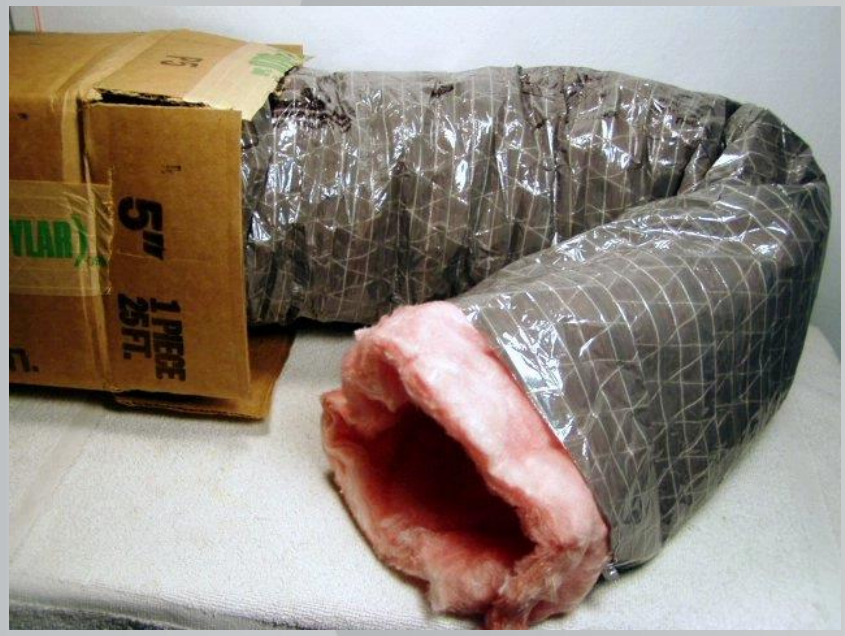
Technician verifying minimum flow rate on a kitchen exhaust fan

Source Specific Ventilation
(403.8.4.1/M1508.4.4)

- Exhaust shall be discharged outdoors
- Backdraft dampers are required

Source Specific Ventilation
(403.8.4.1/M1507.3.3)

- Exhaust ducts in unconditioned spaces insulated to R-4

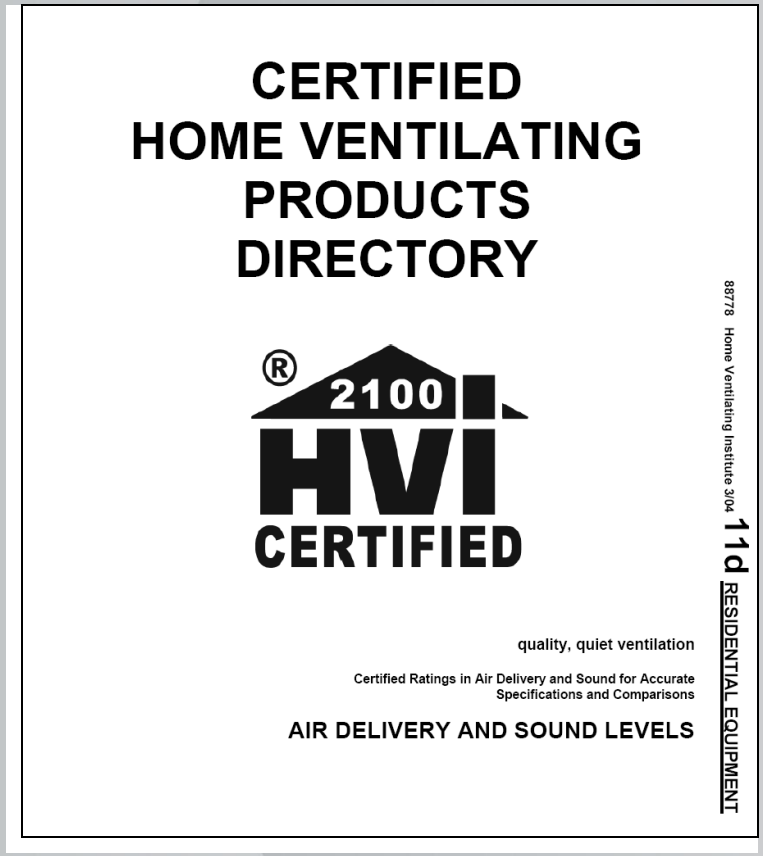


Source Specific Ventilation
(403.8.4.1/M1507.3.3)

- Terminal elements have the same net free area as the duct
- Screened
- Separate dwellings cannot share a common duct
  - Unless engineered for this type of operation

Source Specific Exhaust Fans

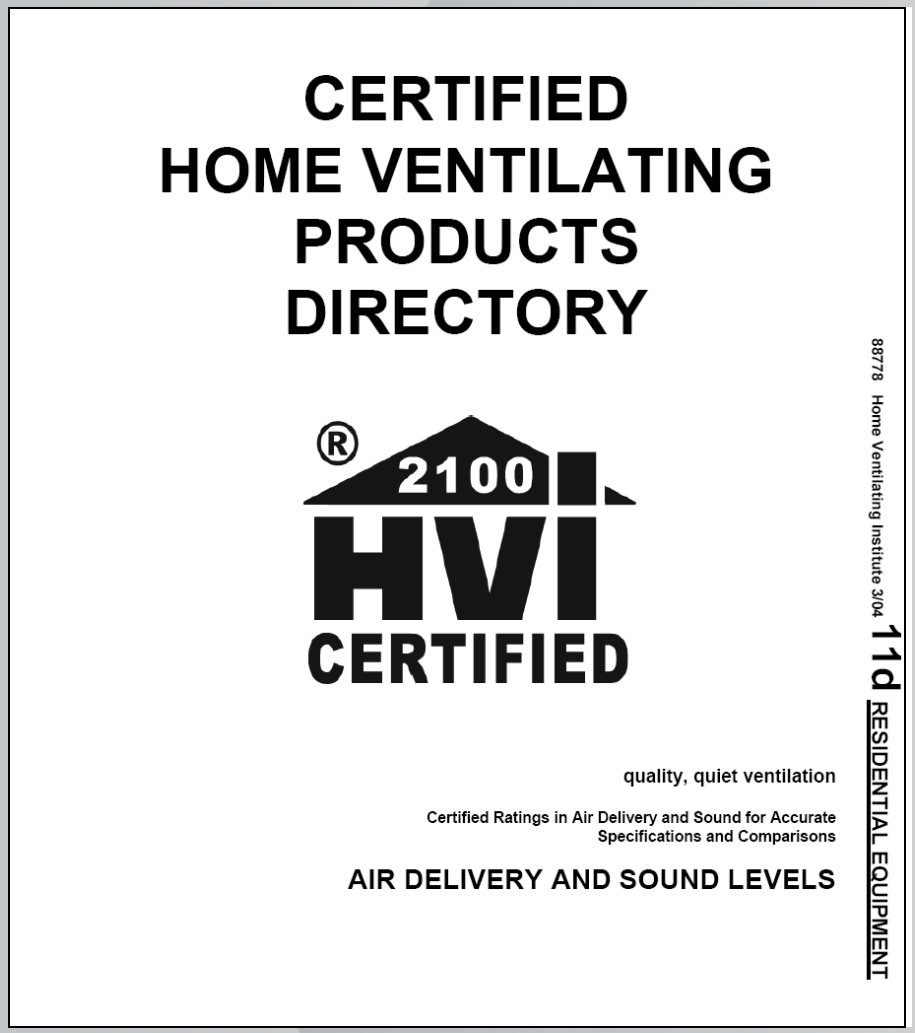
- Tested per HVI Standards
- Installed per mfg.'s instructions
- Designed and installed to deliver the required air flow
- IMC requires prescriptive duct sizing or testing to verify installed flow rate



CFM Ratings

- HVI Directory of Certified Products
- Certified monthly
- Free download

www.hvi.org



Source Specific Exhaust Fan Controls

- Switches
- Timers
- Dehumidistats

Table 403.8.4.2
PRESCRIPTIVE EXHAUST DUCT SIZING

Fan Tested CFM @ 0.25" W.G.	Minimum Flex Diameter	Maximum Length Feet	Minimum Smooth Diameter	Maximum Length Feet	Maximum Elbows[1]
50	4 inch	25	4 inch	70	3
50	5 inch	90	5 inch	100	3
50	6 inch	No Limit	6 inch	No Limit	3
80	4 inch[2]	NA	4 inch	20	3
80	5 inch	15	5 inch	100	3
80	6 inch	90	6 inch	No Limit	3
100	5 inch[2]	NA	5 inch	50	3
100	6 inch	45	6 inch	No Limit	3
125	6 inch	15	6 inch	No Limit	3
125	7 inch	70	7 inch	No Limit	3

1. For each additional elbow subtract 10 feet from length.
2. Flex ducts of this diameter are not permitted with fans of this size

See Handout

PERFORMANCE RATINGS

SOLITAIRE ULTRA-SILENT® BATH FANS - MODELS S50UE, S80UE, S110UE

AMCA LICENSED PERFORMANCE

Model	Sones @ 0.0" Ps	CFM @ Static Pressure (in. wg Ps) 0.0"	0.1"	.125"	.250"	.375"	Volts	Hz	Watts	RPM	Duct Size
S50UE	< 0.3	66	52	48	32	17	120	60	19	720	4" Diameter
S80UE	0.9	90	79	77	62	49	120	60	24	1070	4" Diameter
S110UE	1.9	116	110	107	98	83	120	60	37	1240	4" Diameter

Performance shown is for installation type B - Free inlet, Ducted outlet. Speed (RPM) shown is nominal. Performance is based on actual speed of test. Performance ratings include the effects of supplied inlet grille and backdraft damper in the airstream. The sound ratings shown are loudness values in fan sones at 5' (1.5m) in a hemispherical free field calculated per AMCA Std. 301. Values shown are for installation Type B: free inlet fan sone levels.

SONES

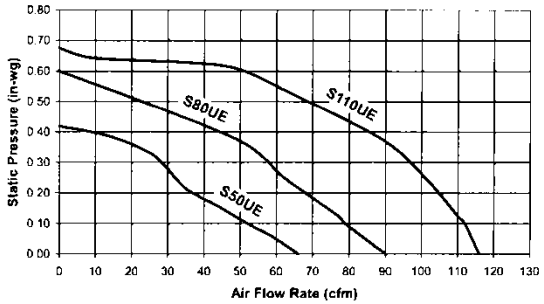
Model	HVI Sones @0.1" Ps*	AMCA Sones @0.0" Ps*
S50UE	< 0.3	< 0.3
S80UE	0.7	0.9
S110UE	1.5	1.9

*There is a difference between sone values certified by HVI for residential use and by AMCA for commercial/industrial use. Exact comparison of these values is not possible. This difference is mainly due to the procedures used to convert measured sound to perceived sound. ANSI S3.4, used by both HVI and AMCA, specifies a procedure for calculating loudness as perceived by a typical listener under specific conditions. HVI establishes values at a distance of 5 feet from the fan in a "spherical free field"; AMCA establishes values at a distance of 5 feet in a "hemispherical free field".

AMPS

Model	Amps
S50UE	0.2
S80UE	0.3
S110UE	0.3

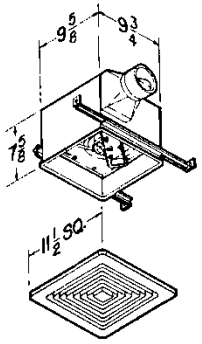
"Broan-NuTone LLC certifies that the models shown herein are licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and AMCA Publication 311 and comply with the requirements of the AMCA Certified Ratings Program."



HVI PERFORMANCE

Model	Sones @ 0.1" Ps	CFM @0.1" Ps	CFM @0.25" Ps
S50UE	< 0.3	50	--
S80UE	0.7	80	--
S110UE	1.5	110	100

HVI-2100 CERTIFIED RATINGS comply with new testing technologies and procedures prescribed by the Home Ventilating Institute, for off-the-shelf products, as they are available to consumers. Product performance is rated at 0.1 in. static pressure, based on tests conducted in AMCA's state-of-the-art test laboratory. Sones are a measure of humanly-perceived loudness, based on laboratory measurements.



WEIGHT

Model	Shipping Weight
S50UE	10 LBS
S80UE	10 LBS
S110UE	10 LBS

Broan-NuTone LLC, 926 West State Street, Hartford, WI 53027 (1-800-637-1453)

See Handout

CERTIFIED VENTILATING FAN PRODUCTS

PANASONIC

Panasonic

MODEL OR SERIES	DETAILS	STATIC PRESSURE*	CFM**	SONES	WATTS
Inline Fans (all models)					
FV-10NLF1		@ 0.20" SP	120		36.2
		@ 0.30" SP	105		35.0
		@ 0.40" SP	82		33.5
FV-20NLF1		@ 0.20" SP	240		57.0
		@ 0.30" SP	225		55.0
		@ 0.40" SP	200		53.2
FV-30NLF1		@ 0.20" SP	340		98.2
		@ 0.30" SP	322		96.4
		@ 0.40" SP	302		94.9
FV-40NLF1		@ 0.20" SP	440		132.0
		@ 0.30" SP	425		128.0
		@ 0.40" SP	408		122.0
Bathroom – Exhaust Fans (all models)					
FV-05VF1	3" Duct		50	0.8	13.5
		@ 0.25" SP	32		13.1
FV-05VF1	4" Duct		50	0.7	13.6
		@ 0.25" SP	31		13.2
FV-07VF1	3" Duct		60	1.2	20.2
		@ 0.25" SP	47		19.8
FV-11VFL1	3" Duct		90	2.0	34.8
		@ 0.25" SP	76		33.7
FV-11VFL1	4" Duct		110	2.0	35.1
		@ 0.25" SP	97		34.8
FV-11VH1			110	1.1	24.5
		@ 0.25" SP	99		24.2
FV-11VHL1			110	1.0	25.0
		@ 0.25" SP	96		24.1
FV-05VQ2			60	<0.3	13.7
		@ 0.25" SP	43		12.9
FV-07VQ2			70	0.3	19.0
		@ 0.25" SP	50		18.1
FV-08VQ2			90	0.7	21.0
		@ 0.25" SP	73		20.1
FV-11VQ2			110	1.5	26.7
		@ 0.25" SP	96		25.7
FV-15VQ3			150	1.5	39.6
		@ 0.25" SP	128		39.0
FV-11VQD2 HS+			110	1.5	26.8
		@ 0.25" SP	92		24.8
FV-11VQD2 LS+			60	<0.3	18.6
		@ 0.25" SP	51		17.6
FV-07VQL3			70	<0.3	18.4


DO NOT REMOVE THIS LABEL.
NOT FOR USE IN KITCHENS.
To protect finish, wash with mild soap or detergent only.
MODEL
VOLTS
HZ
AMPS
CFM
SONES
S110U-A
120
60
0.7
110
1.5
PERMANENTLY LUBRICATED MOTOR.
MAY BE USED OVER TUB OR SHOWER WHEN INSTALLED IN A GFCI BRANCH CIRCUIT
LISTED FANS
E17814
10L
DISCONNECT POWER AT SERVICE ENTRANCE BEFORE CLEANING OR SERVICING.
BROAN
Broan-NuTone
53027
H 990717200B

Whole House Ventilation Systems

- Whole House Ventilation rates are based on ASHRAE 62.2
  - Ventilation rates in Table 403.8.1 & Table M1508.2 are for continuously operating systems
  - Intermittent operation substantially increases fan size

Table 403.8.1/1508.2

MINIMUM VENTILATION RATES (CFM)

(Continuously operating systems)

House Size	Bedrooms				
	0-1	**2-3**	**4-5**	**6-7**	**>7**
<1500	30	45	60	75	90
1501-3000	45	60	75	90	105
3001-4500	60	75	90	105	120
4501-6000	75	90	105	120	135
6001-7500	90	105	120	135	150
>7500	105	120	135	150	165

See Handout

Why the Shift to Continuous Operation?

- Low flow, continuously and properly operating systems provide better indoor air quality (IAQ)
- Lower flow rates generally mean a quieter running system and help assure proper operation
- Occupants may worry about energy costs but in many cases costs are less for continuously operated systems
- Can reduce risk of moisture related issues

Cost of Operation

- 2500 sq. ft. house with 3 bedrooms
- 60 CFM fan required
- Operated 24/7
- Fan energy use cost = $.03 per day
- Heat loss cost (from fan exhaust) = $0.22–$0.31 per day
- Total annual cost of < $130

Energy Impacts of Various Systems

1,501 – 3,000sf 2-3 bedroom home located in Olympia Wa

System Type	Flow Rate	Time of Operation	Fan Watts	Fan $[1]	Heating Fuel	Heating System Efficiency	Heating $[1]	Annual Operation $[1]
Exhaust	60	24hr/day	12	$8.94	NG	80 AFUE	$111.97	$120.90
Exhaust	60	24hr/day	12	$8.94	Elec	10.2 HSPF	$67.87	$76.80
Inline Exhaust	180	3hrs. 3X/day	51	$14.24	NG	80 AFUE	$125.96	$140.20
Inline Exhaust	180	3hrs. 3X/day	51	$14.24	Elec	10.2 HSPF	$76.35	$90.59
Integrated	60	24hr/day	500	$372.30	NG	80 AFUE	$111.97	$484.27
Integrated	180	3hrs. 3X/day	500	$139.61	NG	80 AFUE	$125.96	$265.57
HRV/ ERV*	60	24hr/day	59	$43.93	NG	80 AFUE	$55.98	$99.91
HRV/ ERV*	180	3hrs. 3X/day	59	$16.47	NG	80 AFUE	$62.98	$79.46

[1]PSE Utility Rates of $0.085/kWh and 1.10/Therm

*Assuming 50% total recovery efficiency

Intermittent Operation
IMC Table M1507.3.3(2)

TABLE M1507.3.3(2)
INTERMITTENT WHOLE-HOUSE MECHANICAL VENTILATION RATE FACTORS[a, b]

RUN-TIME PERCENTAGE IN EACH 4-HOUR SEGMENT	25%	33%	50%	66%	75%	100%
Factor[a]	4	3	2	1.5	1.3	1.0

a. For ventilation system run time values between those given, the factors are permitted to be determined by interpolation.
b. Extrapolation beyond the table is prohibited.

- Size fan from Table M1507.3.3(1)
- Determine run time
- Determine fan size by using the appropriate factor

Intermittent Operation Example

- The fan will operate 1 hour every 4 hours

TABLE M1507.3.3(2)
INTERMITTENT WHOLE-HOUSE MECHANICAL VENTILATION RATE FACTORS[a, b]

RUN-TIME PERCENTAGE IN EACH 4-HOUR SEGMENT	25%	33%	50%	66%	75%	100%
Factor[a]	4	3	2	1.5	1.3	1.0

a. For ventilation system run time values between those given, the factors are permitted to be determined by interpolation.
b. Extrapolation beyond the table is prohibited.

- Fan size if operated intermittently at 25%:

  60 CFM X 4 = 240 CFM*

*Must meet sone rating – good luck

Intermittent Operation Example 2

- The fan will operate 3 hours every 4 hours

TABLE M1507.3.3(2)
INTERMITTENT WHOLE-HOUSE MECHANICAL VENTILATION RATE FACTORS[a, b]

RUN-TIME PERCENTAGE IN EACH 4-HOUR SEGMENT	25%	33%	50%	66%	75%	100%
Factor[a]	4	3	2	1.5	1.3	1.0

a. For ventilation system run time values between those given, the factors are permitted to be determined by interpolation.
b. Extrapolation beyond the table is prohibited.

- Fan size if operated intermittently at 75%:

  60 CFM X 1.3 = <u>78 CFM</u>

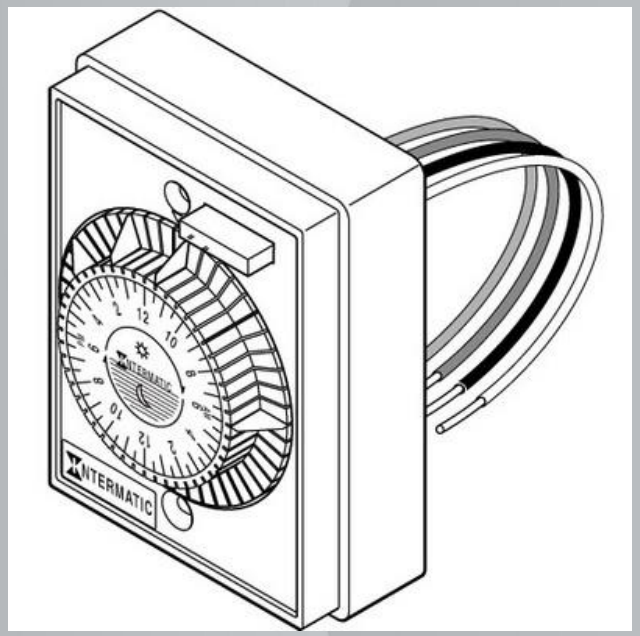
Controls

- Whole house ventilation system controls
  - Must be readily accessible
  - Operating instructions provided to occupant by the installer
  - A label must be attached to the control that says
    - "Whole House Ventilation (see operating instructions)"

Controls

- Whole house ventilation system controls (intermittent)
  - Capable of operating intermittently and continuously
    - Intermittent operation requires much higher flow rate in most cases
  - Capable of Automatic and manual operation
  - Shall be set to operate the fan for a minimum of 8hrs/day at time of final inspection.
  - Integrated systems must be equipped with motorized dampers wired to ventilation controls

Controls



$35

Don't forget the label

$35

$35

Outdoor Air Intakes

- > 10 feet from an appliance vent location
- Not located where they may pick up objectionable odors, fumes or flammable vapors
- Intakes located to not take in air from a room or space with a fuel burning appliance
- No intake air from attics, crawl spaces or garages
- Must provide fresh air directly to each habitable space

ASHRAE 62.2 allows for fresh air to be provided via natural infiltration on exhaust systems only – no vents req'd.

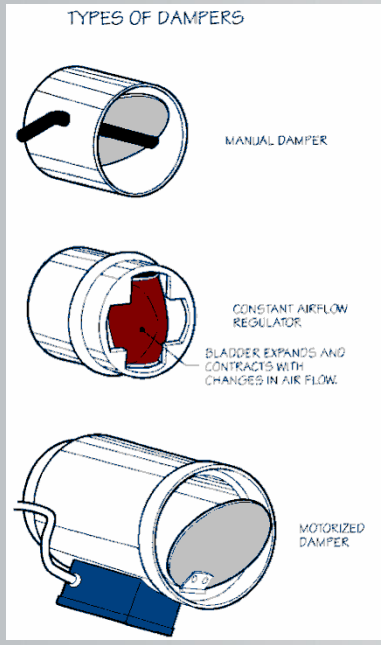
Through wall air inlet

Window vent

Types of Whole House Ventilation Systems

- Exhaust fan system
- Integrated with a forced air system
- Supply fan system
- Heat or energy recovery systems
  - HRV's or ERV's

Integrated Systems

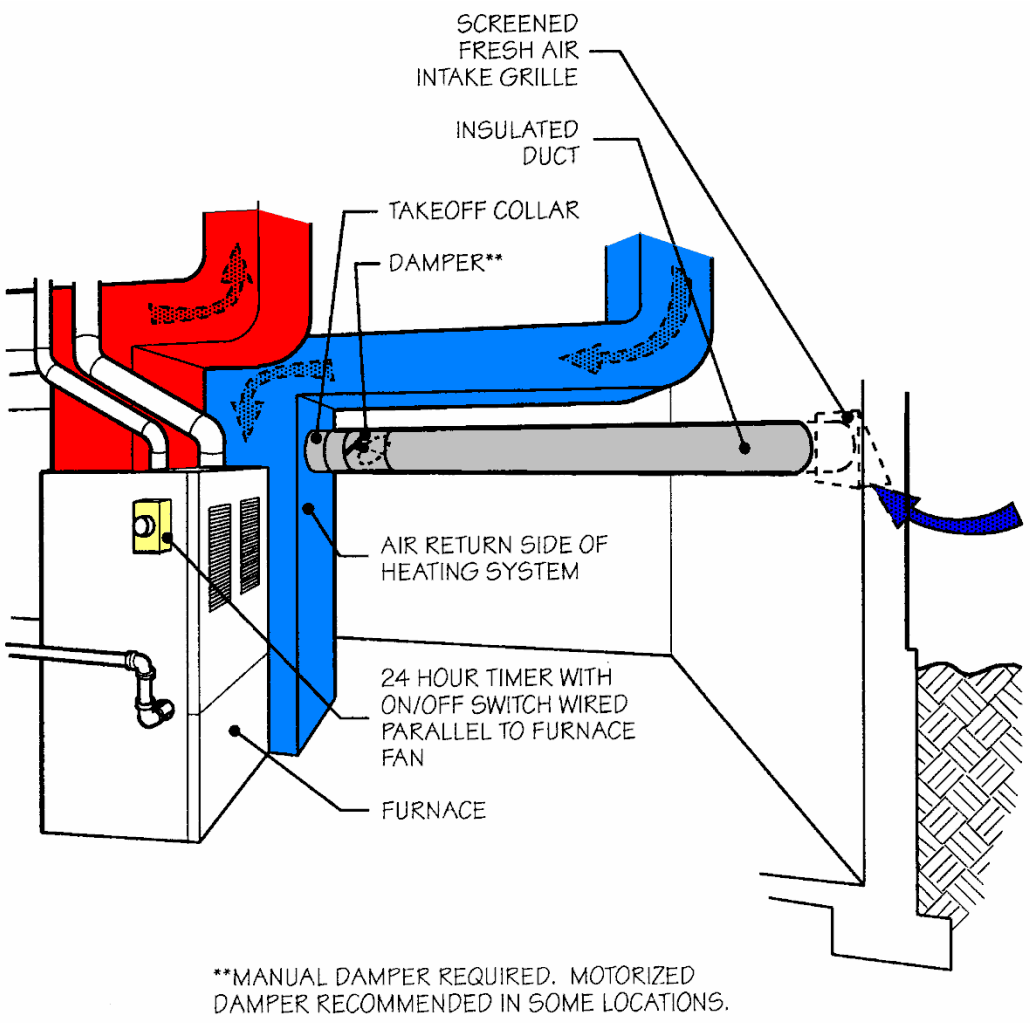


- Fresh air distribution using HVAC system
  - Outdoor grille sized correctly
  - Dampers to balance the system
  - Motorized dampers wired to ventilation controls
  - Air inlet duct must be plumbed into the return plenum within 4’ of the air handler and shall <u>not</u> be connected directly into the furnace cabinet
  - Air inlet duct shall be insulated to R-4 when in conditioned space

Integrated Systems

- Fresh air distribution using HVAC system
  - Flow rates must be tested using a flow hood or similar device
    - Recent field data from SW Washington showed that 68 out of 76 integrated ventilation systems tested were non-functioning

Integrated Forced Air System



Ventilation Using a Supply Fan

- Requires a dedicated fan
- Fresh air duct connected to furnace supply or return plenum or dedicated whole house ventilation duct
- Ducts insulated to min. R-4
- A filter
- Back draft damper
- Field tested calibrated or manual volume damper or an automatic flow regulating device sized to the specified flow rates

Ventilation Using a Supply Fan

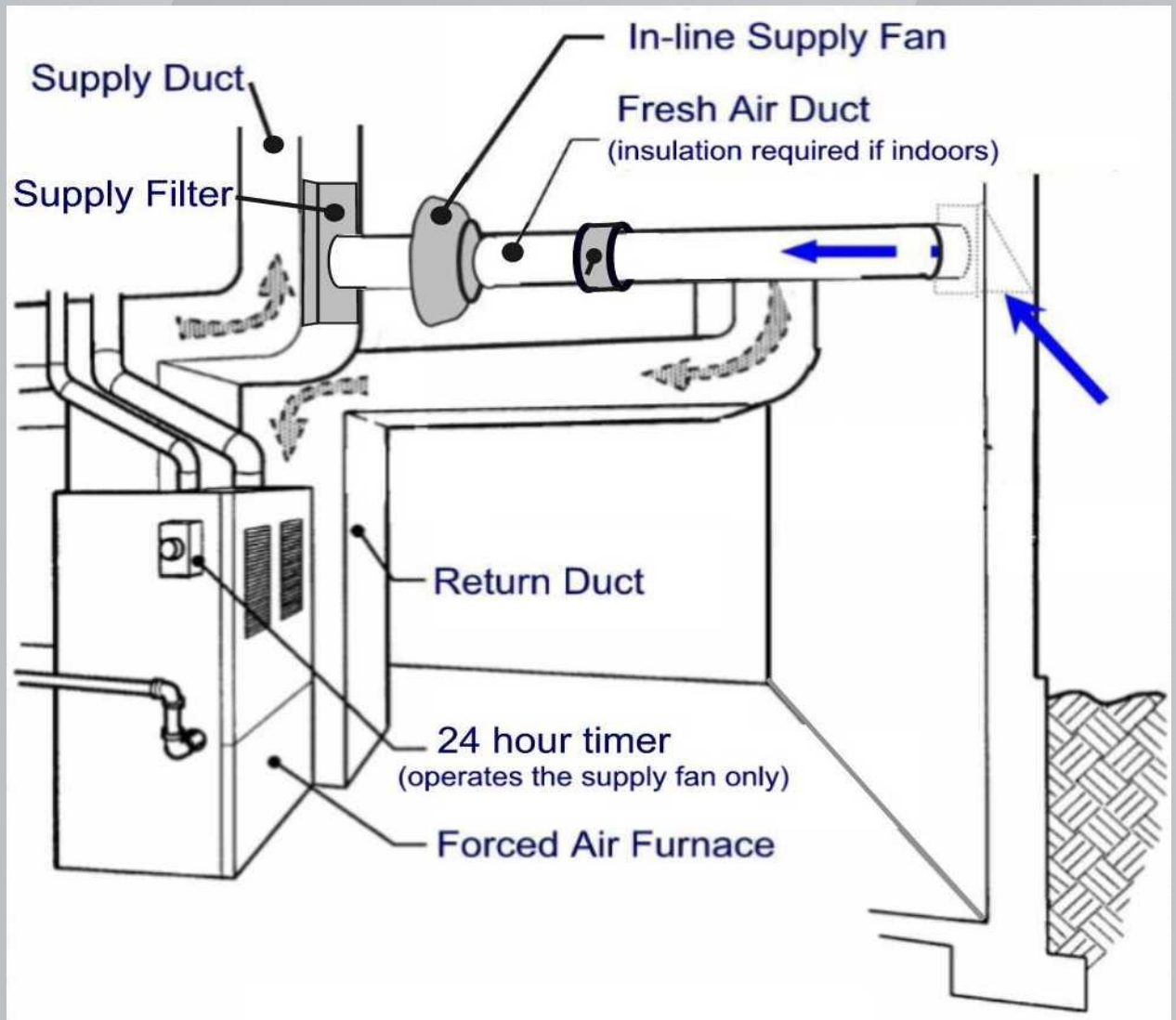
- Fresh air duct must be prescriptively sized in accordance to Table 403.8.5.2/M1508.6.2
- The terminal element on the outside of the building shall be sized 2 inches in diameter larger than the outdoor air inlet duct.

Table 403.8.5.2/M1508.6.2
Prescriptive Supply Fan Duct Sizing

Supply Fan Tested cfm at 0.40" w.g.		
Specified Volume From Table 408.1	Minimum Smooth Duct Diameter	Minimum Flexible Duct Diameter
50 – 90 cfm	4 inch	5 inch
90 – 150 cfm	5 inch	6 inch
150 – 250 cfm	6 inch	7 inch
250 – 400 cfm	7 inch	8 inch

See Handout

Ventilation Using a Supply Fan



Ventilation Using Exhaust Fan(s)

- Out with the bad air – in with the good
- Choose fan size from Table 403.8.1/M1508.2
- Ducts outside the conditioned space insulated to R-4
- Requires 1.0 sone rating or less
- Turn it on and leave it on
  - May not be able to find an exhaust fan that meets intermittent flow rates and sone rating

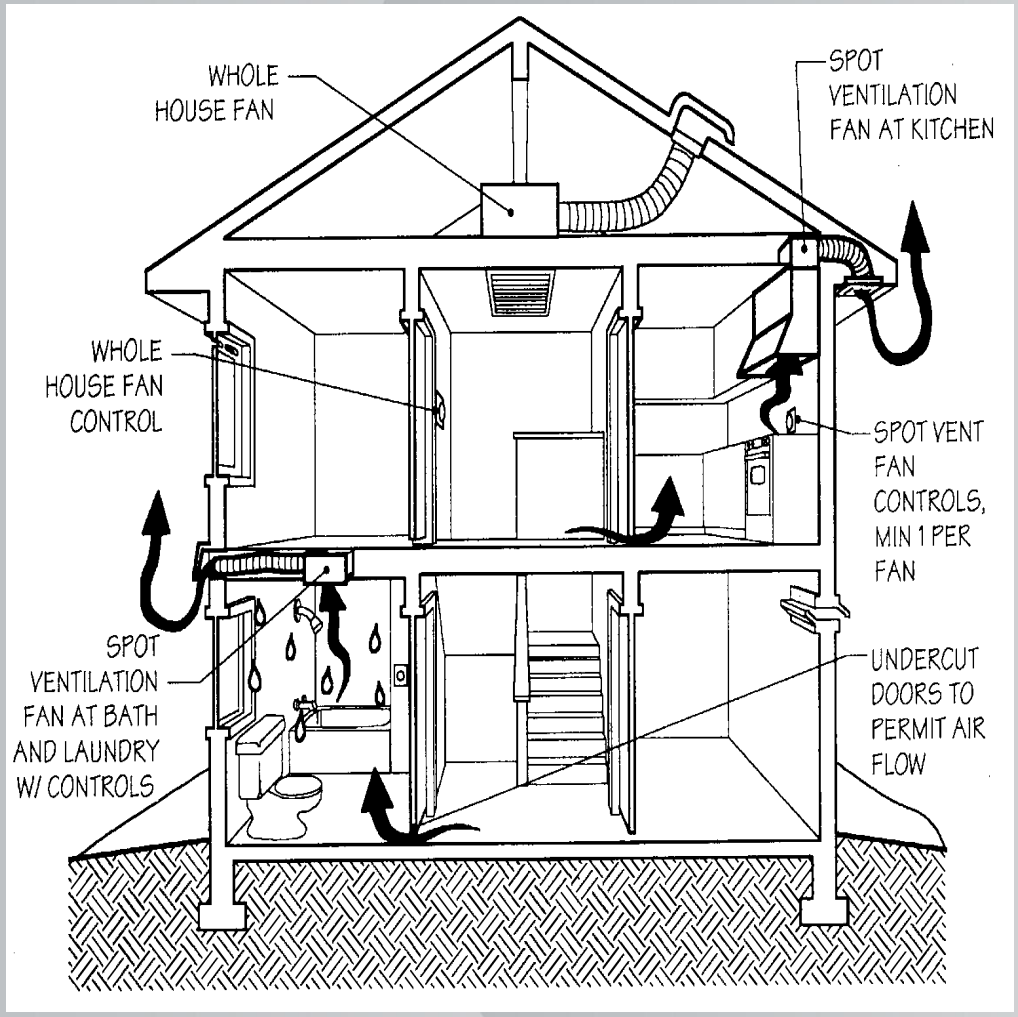
Exhaust Fan Ventilation Systems

Advantages of this system

- Easy to install
- Low cost application
- Can be very quiet

System drawbacks

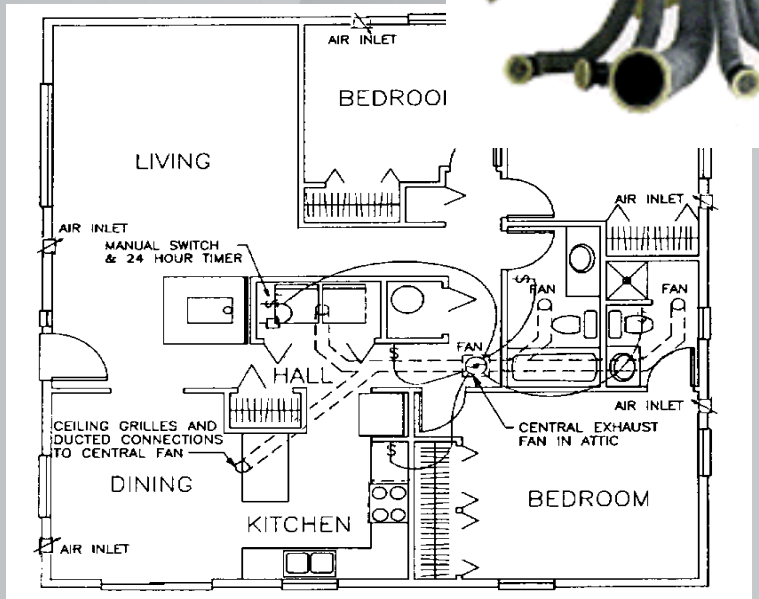
- May not perform well
- Sometimes noisy despite <1.0 sone requirement
- Homeowner sabotage



Central Ducted Exhaust System

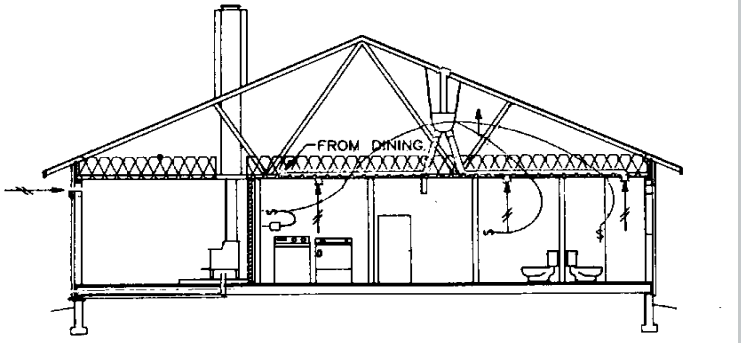
Advantages of this system

- Replaces individual spot fans
- Quiet operation
- Better ventilation



System drawbacks

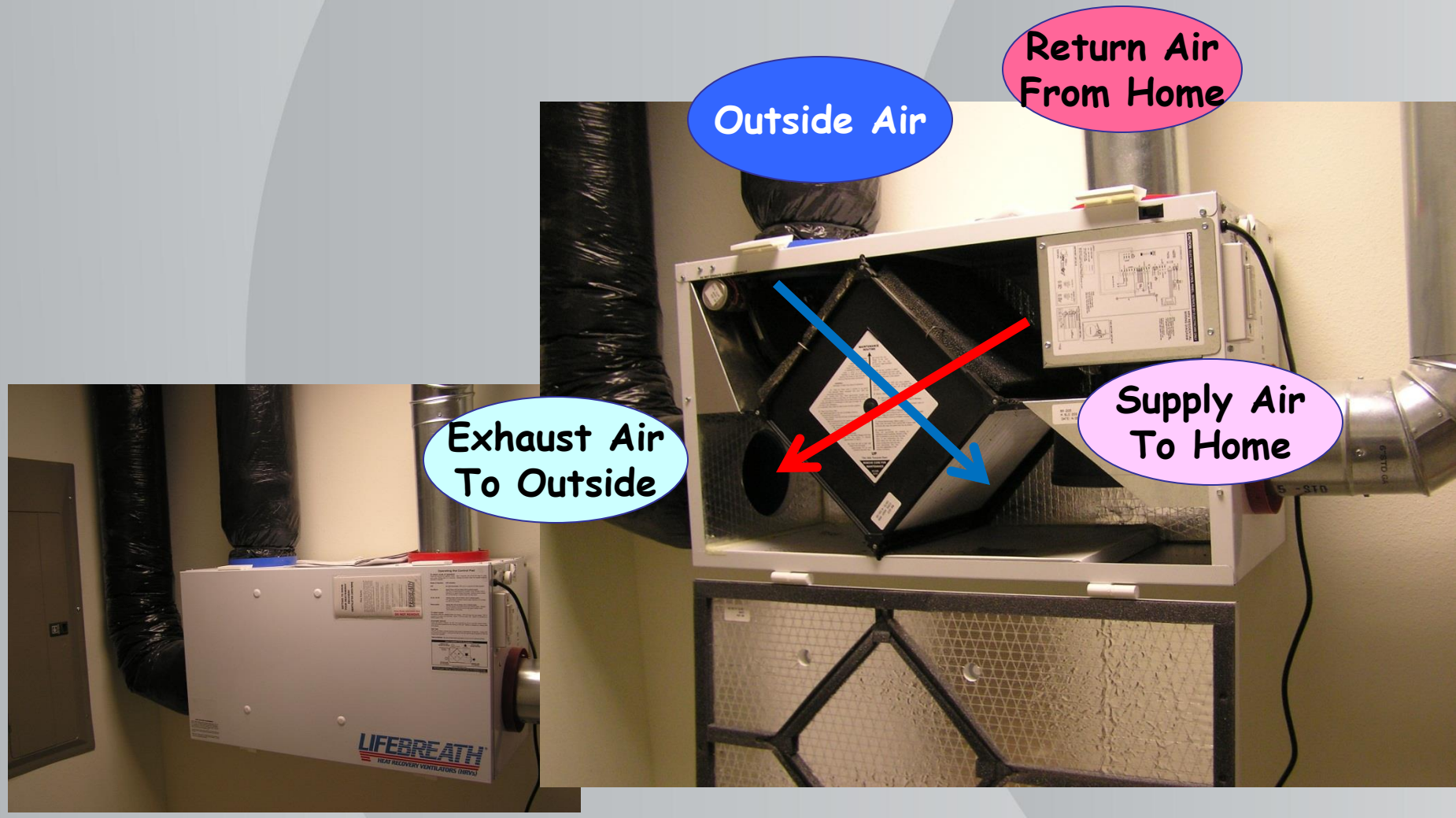
- Higher installation cost (maybe)
- Longer duct runs



Heat Recovery Ventilation

- Installed per mfg's instructions
- MERV 6 filter required on the upstream side of the heat exchanger on both intake and exhaust sides
- All supply ducts inside the conditioned space and upstream of the heat exchanger must be insulated to R-4

Heat Recovery Ventilation



Indoor Air Quality

- Carbon monoxide (315.1)
  - Carbon monoxide detectors must be installed in all new construction and existing construction
  - Owner-occupied (prior to July 1, 2010) are exempt
- Formaldehyde
  - All structural panels must be stamped:
    - Exterior Grade
    - Exposure 1
    - HUD Approved

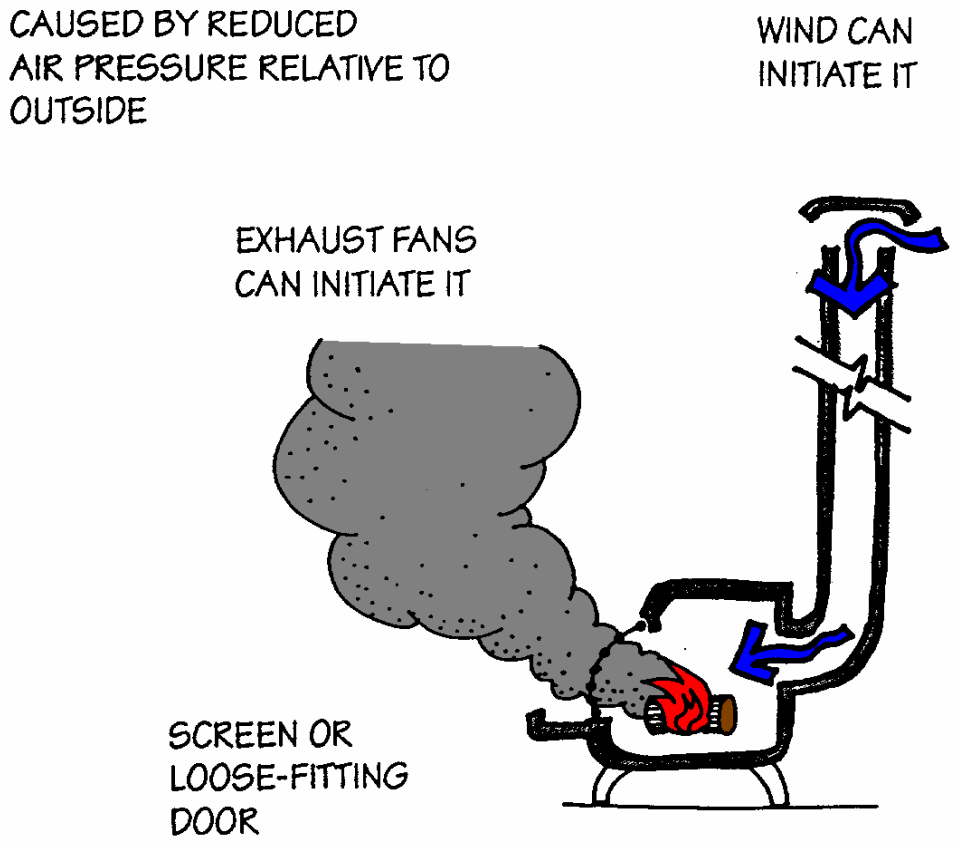
Fireplaces and Wood Stoves
IRC 1006.2

Types of Fireplaces and Stoves

- All woodstoves, including cook stoves
- Pellet stoves
- Fireplaces
- Masonry heaters

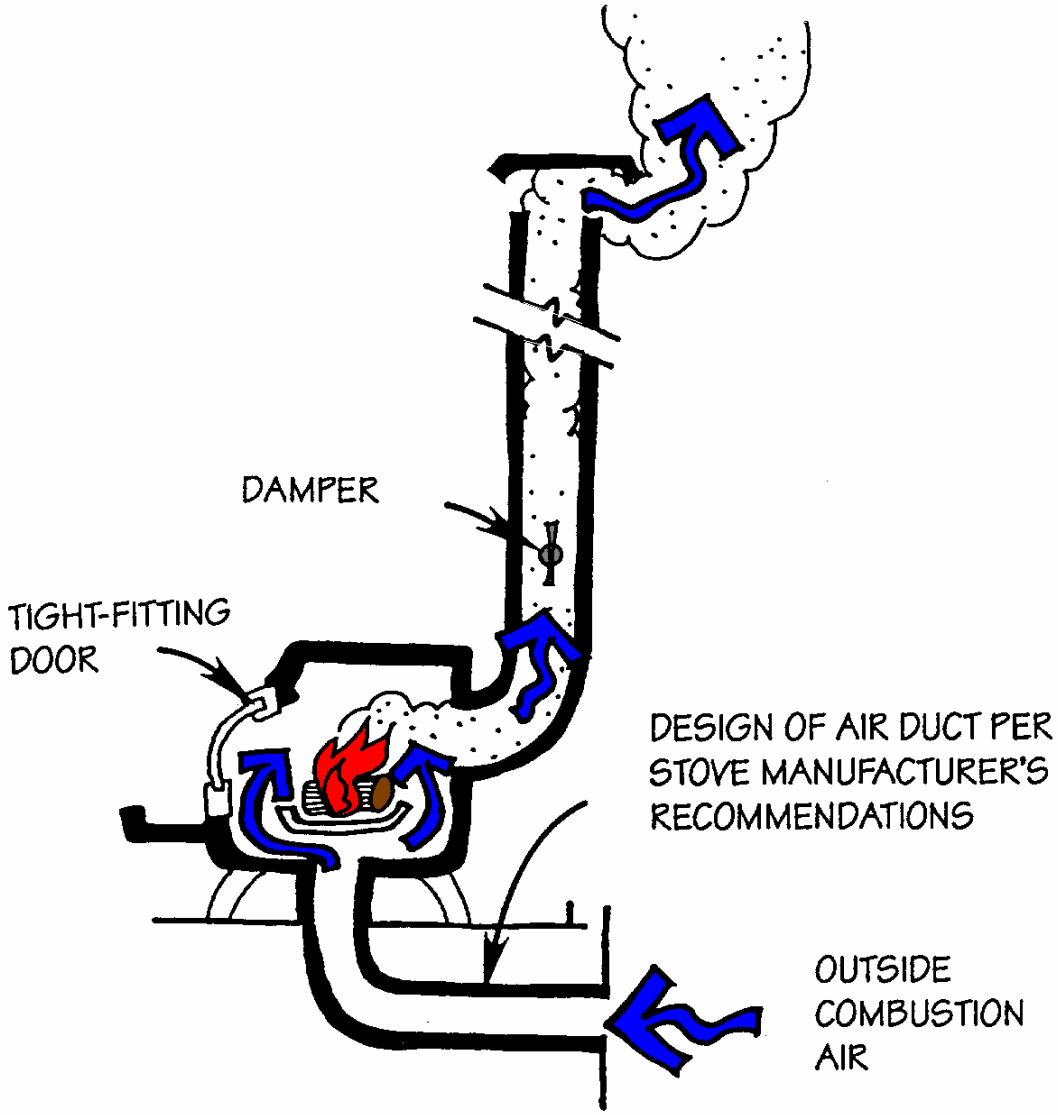
Backdrafting

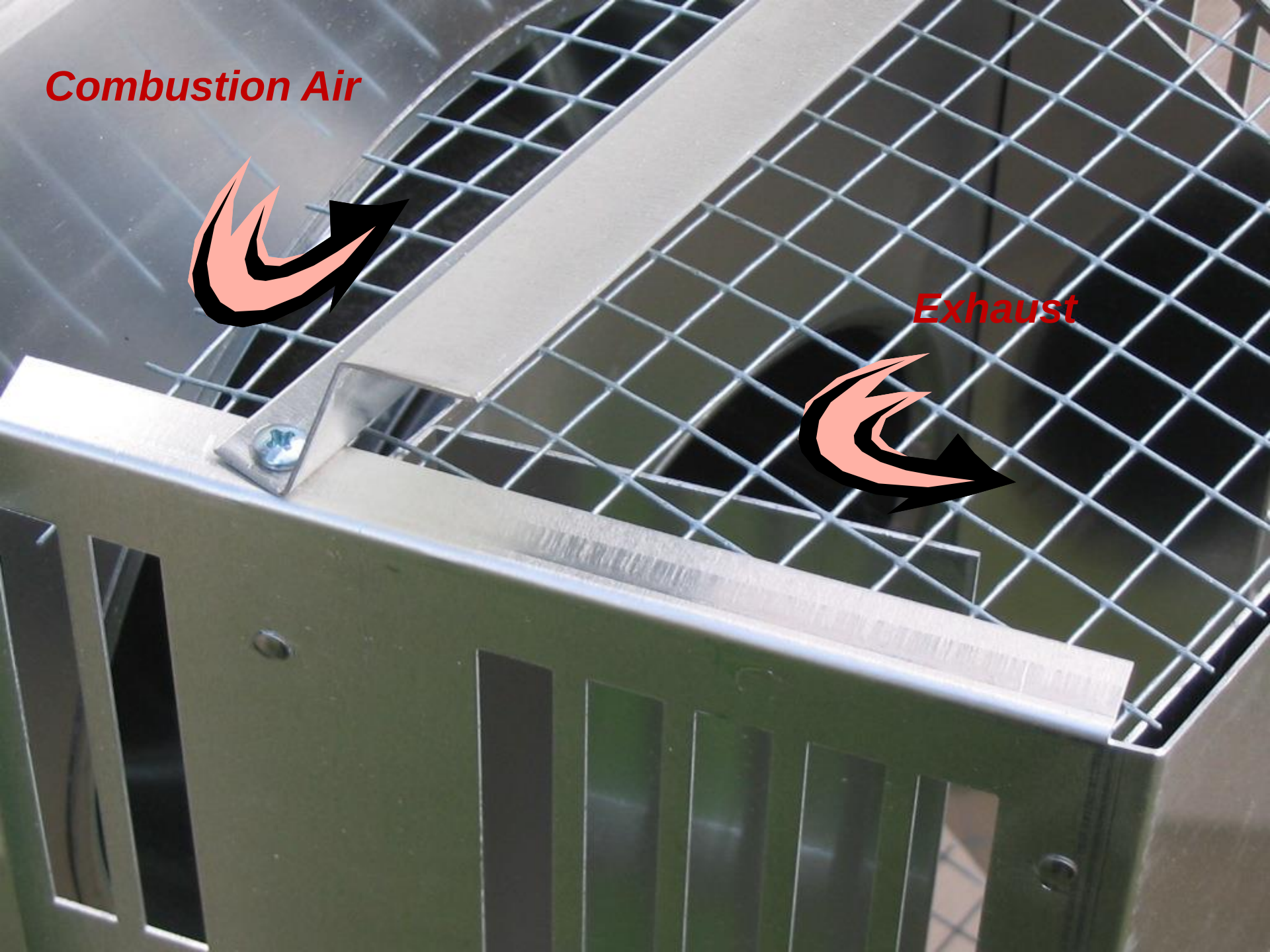
Combustion air reduces the "backdrafting" potential



Combustion Air Requirements IRC Chapter 10

- Must come from outside the building structure
- Must originate from a point below the firebox
- Enter through a duct
  - 4” diameter for stoves
  - 6 in^2 for fireplaces
  - Maximum duct length is 20’
  - Must be directly connected to the appliance


DAMPER
TIGHT-FITTING DOOR
DESIGN OF AIR DUCT PER STOVE MANUFACTURER'S RECOMMENDATIONS
OUTSIDE COMBUSTION AIR


Combustion Air
Exhaust

Exceptions to Combustion Air Requirements

- The appliance is part of a central heating system installed in accordance with IMC requirements
- Installed in existing construction directly on a concrete floor or surrounded by masonry
  - Supply combustion air to the room in which the appliance is located

Fireplace and Wood Stove Requirements IRC Chapter 10

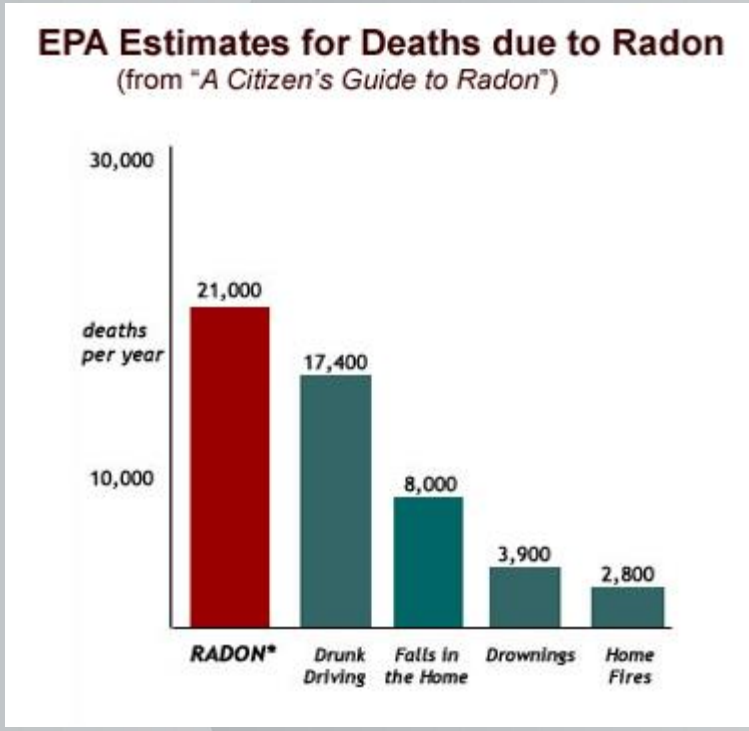
- Tight fitting ceramic glass or metal doors
  - *Exception:* Site built fireplaces may have a flue draft induction fan instead of doors
- Tight fitting flue damper
  - *Exception:* Fireplaces with gas log sets must be installed in accordance with IMC requirements

Return air plenum

Gas Fireplace

Radon Resistive Construction IRC Appendix F

- Radioactive soil gas
- Colorless
- Odorless
- Naturally occurring



EPA estimates 22,000 lung cancer deaths each year. Second only to smoking.


World Famous HEALTH MINE
World Famous
FREE ENTERPRISE
HEALTH MINE
STOP HERE
FREE
BROCHURES
DOCTOR'S REPORT
America's Own
FREE ENTERPRISE
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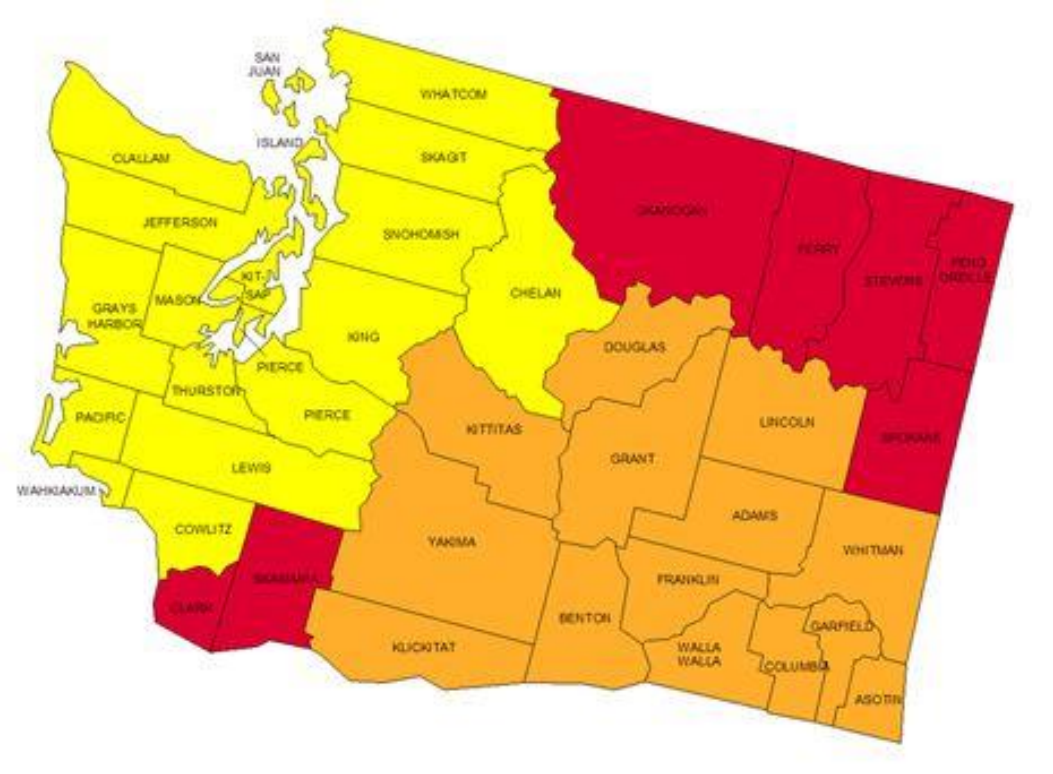
RADON
Tunnel
LONGEST RADIOACTIVE
TUNNEL
ON HIGHWAY 91 5 MILES WEST
RUNNING WATER

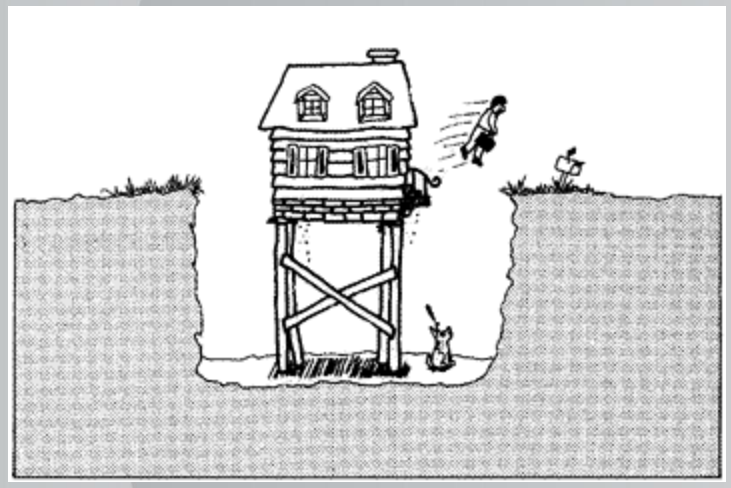

Help
FREE
On-Site
High
Speed
Wireless
internet.
Even
Under-
ground!

High Risk Radon Counties



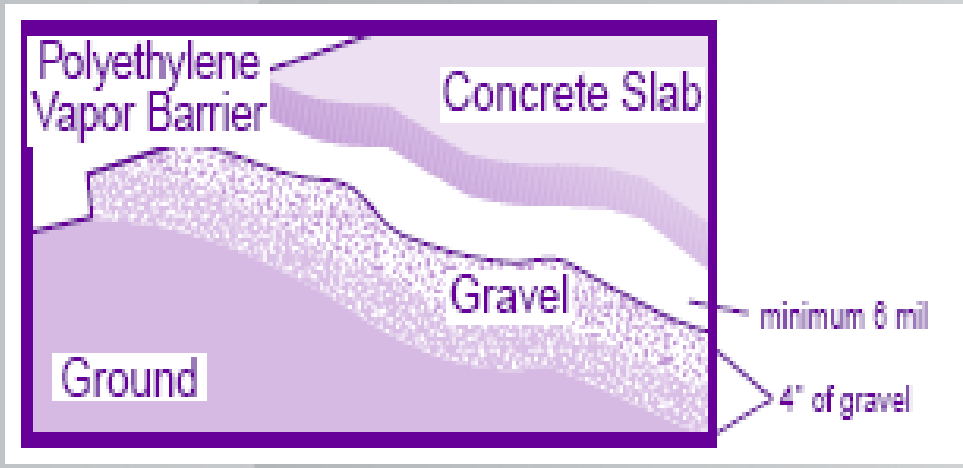
Mitigation System Definitions AF 102.1

- Passive sub-slab depressurization system
- Active sub-slab depressurization system
- Sub-membrane depressurization system
  - Can be active or passive



Subfloor Preparation (slabs and floor in direct contact with the ground) AF 103.2

- Install a layer of:
  - 4” layer of clean aggregate
    - Size: >1/4 “ to <2” (or)
  - 4” of sand covered by a layer of geotextile drainage matting (or)
  - Other materials, systems, or floor designs with demonstrated capabilities to work



Soil-gas-retarder
AF 103.3

- Minimum 6 mil polyethylene
  - May be 3 mil if cross laminated poly is used
- Placed on top of gas permeable layer
- Cover entire floor and have 12”
- Fit tightly around penetrations
- Tears and rips sealed

Potential Radon Entry Points AF 103.4.1

- Floor openings
  - Bathtubs
  - Showers
  - Water closets
  - Pipes
  - Wires
  - Other penetrations
- Must be sealed with polyurethane caulk for both slabs and other floor assemblies

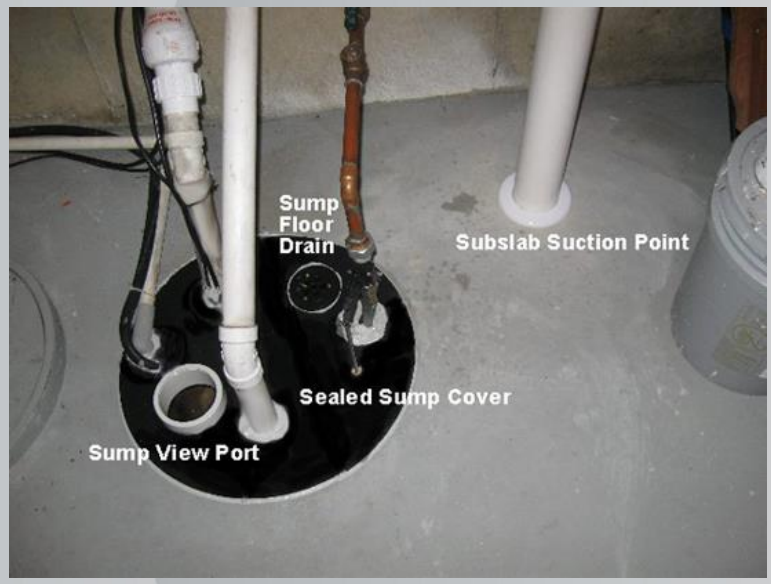
Potential Radon Entry Points

- Concrete joints (AF 103.4.2)
  - Control joints
  - Isolation joints
  - Between slabs and foundation walls

- Condensate lines (AF 103.4.3)
  - must be trapped or in non-perforated pipe routed to daylight

Potential Radon Entry Points

- Sumps (AF 103.4.4)
  - Must have gasketed/sealed lid
  - If the sump is used as a drain it must have a trapped inlet



- Masonry foundation walls (AF 103.4.5)
  - Continuous course of *solid* masonry (or)
  - One course of solid grout (or)
  - A solid beam at or above ground level
  - Joints, cracks or other below grade penetrations must be sealed on interior and exterior sides

Dampproofing
AF 103.4.6

- Exterior below grade surfaces of concrete or masonry walls must be damp proofed per R406
  - Applies to below-grade walls that enclose habitable or useable space.

Air Handling Units
AF 103.4.7

- AHUs installed in a crawl space must be sealed
  - Exception: Units with manufacturer installed gaskets or seals

Ducts
AF 103.4.8

- Ducts passing through or under a slab must be made of seamless material
- Ducts in a crawl space shall be sealed in accordance with M1601.3

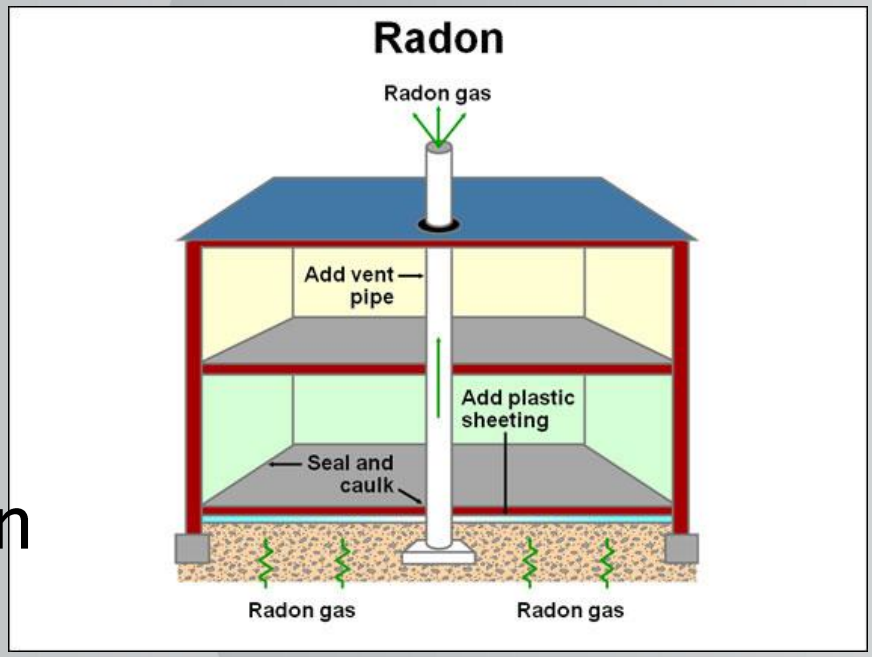
Crawl Spaces

- Crawl space floors (AF 103.4.9)
  - Openings around all penetrations through floor assembly must be caulked of sealed

- Crawl space access (AF 103.4.10)
  - Must be closed, gasketed, or filled to prevent air leakage

Passive Sub-membrane Depressurization System AF 103.5

- Required in buildings with crawl space foundation systems
  - Exception: Buildings with an approved mechanical ventilation system



Crawlspace Ventilation
AF 103.5.1

- Must meet minimum rates of R 408.1
- R408.1 Ventilation. The under-floor space between the bottom of the floor joists and the earth under any building (except space occupied by a basement) shall have ventilation openings through foundation walls or exterior walls.

The minimum net area of ventilation openings shall not be less than 1 square foot for each 150 square feet of under-floor

space area.

One such ventilating opening shall be within 3 feet of each corner of the building.

Unvented Crawl Spaces

- Unvented crawl spaces or foundations with vents with operable louvers require a radon mitigation system (R408.3 State amendments to the IRC)

- Unvented crawl spaces are not permitted in any high radon potential county. (AF101.1 State amendments to the IRC)

Soil-gas-retarder
AF 103.5.2

- Continuous layer of 6 mil poly
- Splices must be lapped at least 12”
- Shall extend to all foundation walls

Vent Pipe

- 3” or 4” pipe
- Connected to a “T”
- “T” placed under the soil-gas-retar membrane
- Pipe extended through floors
- Pipe terminates 12” above roof
  - 10’ away from any opening less than 2’ below terminus
  - 10’ away from any openings in adjacent buildings

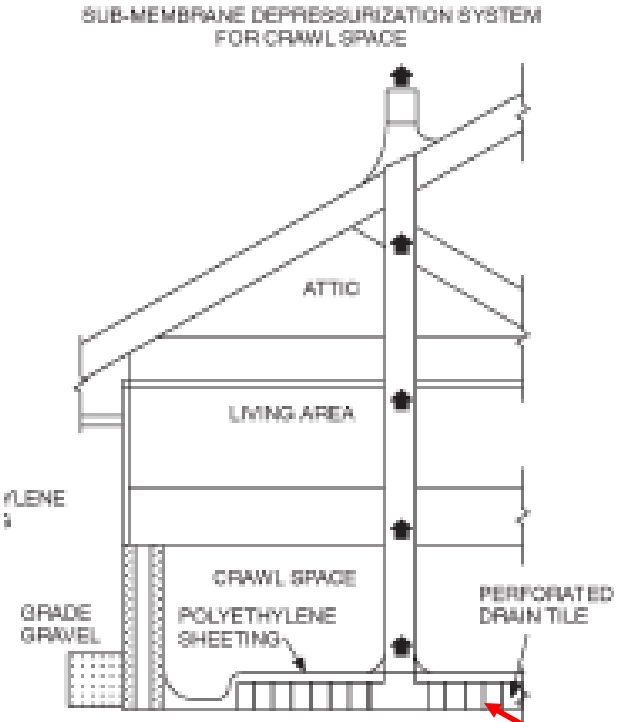
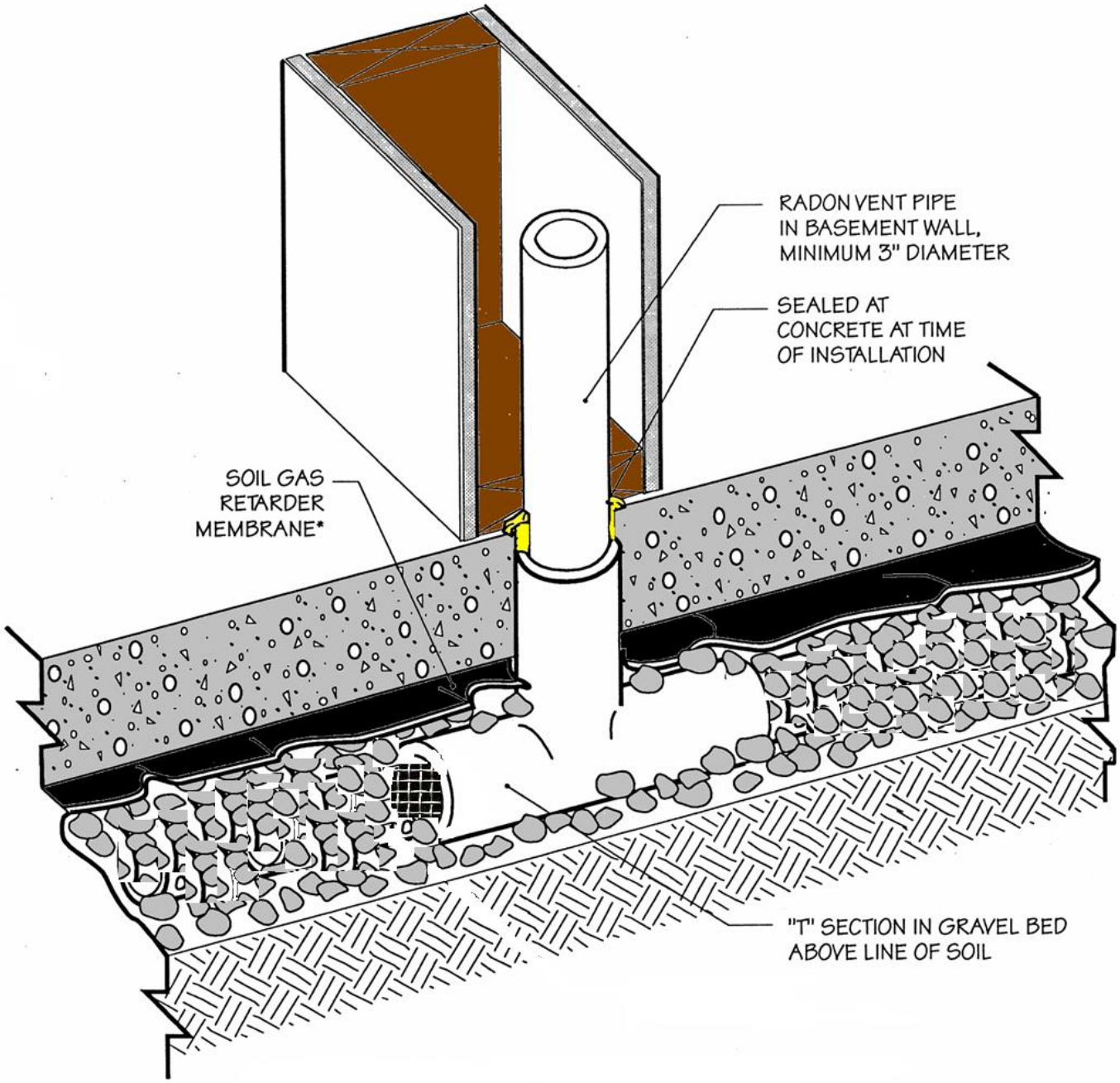


Figure AF 102

Shows “perforated drain tile” Text does not require drain tile – just a “T”

Passive Sub-slab Depressurization System (Houses with basements or slab-on-grade) AF 103.6

- Vent pipe (AF 103.6.1)
  - Minimum 3” diameter ABS, PVC or equal with “T”
  - Embedded into sub slab aggregate
  - Can be connected to an interior perimeter drain


RADON VENT PIPE
IN BASEMENT WALL,
MINIMUM 3" DIAMETER
SEALED AT
CONCRETE AT TIME
OF INSTALLATION
SOIL GAS
RETARDER
MEMBRANE*
"T" SECTION IN GRAVEL BED
ABOVE LINE OF SOIL

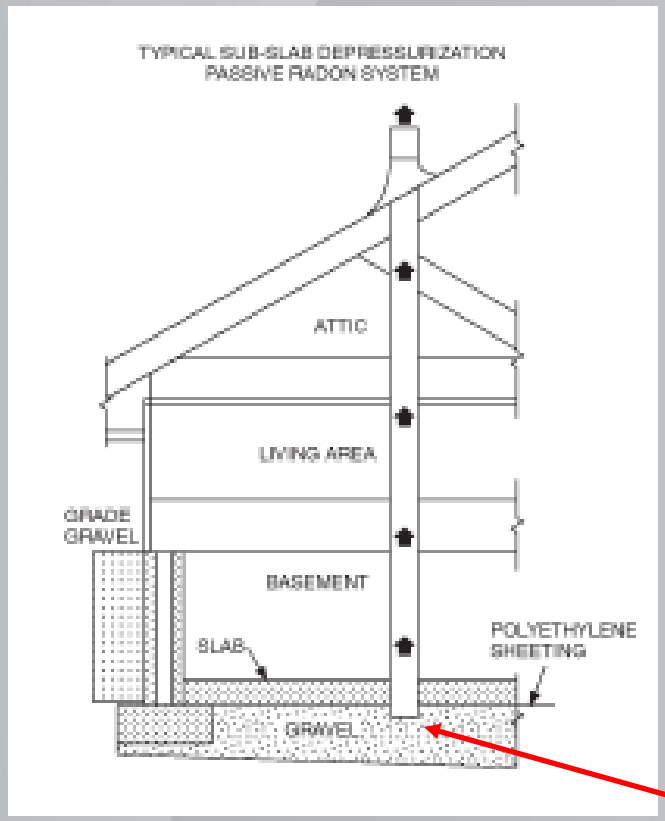


Figure AF 102

Does not show a “T” but text requires one.

Multiple Vent Pipes
AF 103

- Individual vents needed when:
  - House has interior footings
  - Other barriers
  - Individual vents connect to a single vent
  - Single vent terminates through roof

- Also required for combination footings (AF 103.10)

- Vent pipe drainage (AF 103.7)
  - Provide positive drainage to ground beneath slab or poly

- Vent pipe accessibility (AF 103.8)
  - Pipes shall be accessible for future fan installation
    - In attic
    - Other area outside habitable space

- Identification (AF 103.9)
  - One label on each floor and attic of visible radon vents
  - "Radon Reduction System"

- Electrical supply required (AF 103.12)
  - For future fan power if needed


Washington State University
Extension Energy Program
A national leader & catalyst for creating powerful energy solutions
Vision
EXPERIENCE & EXPERTISE
MEETING TODAY'S ENERGY NEEDS
UNMATCHED ENERGY SERVICES
PROMOTING SUSTAINABLE PRACTICES
Time
Temp
Ahead
Warmer
Back
Cooler