Frost Protection

Every renovation is an opportunity

Energy Efficient Retrofits

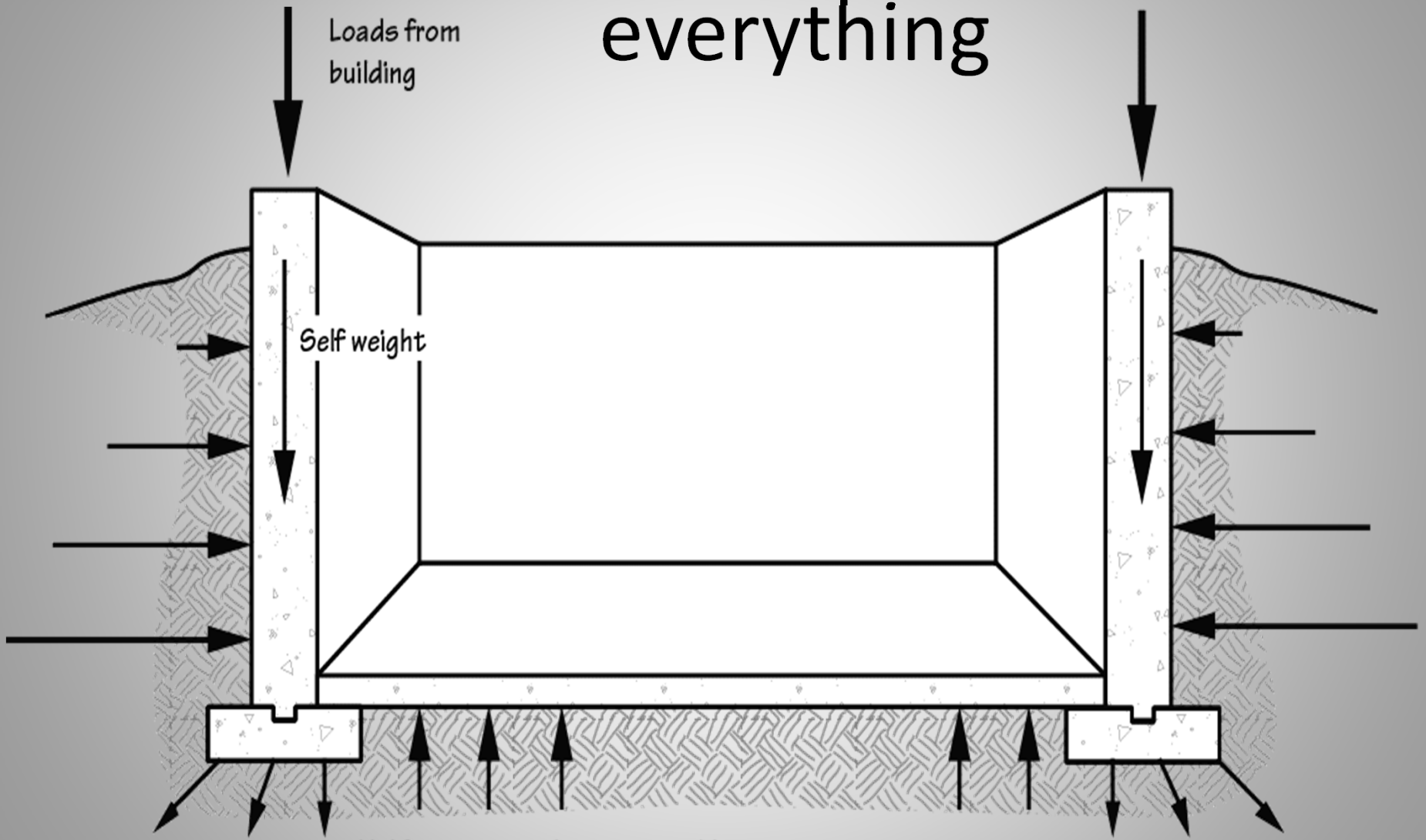
- INVESTING in our homes
- GREEN - 80% of Green is energy, if it isn't energy efficient, it isn't Green
- DURABLE - if it isn't durable, it isn't green……. The NBC is based on delivering 50 year housing, that is a minimum
- LEAN - do more with less…… improving durability, greater energy efficiency, healthier housing

The good news – everything we do to make houses energy efficient, makes houses more durable, healthy and safe

Everything begins with a good foundation

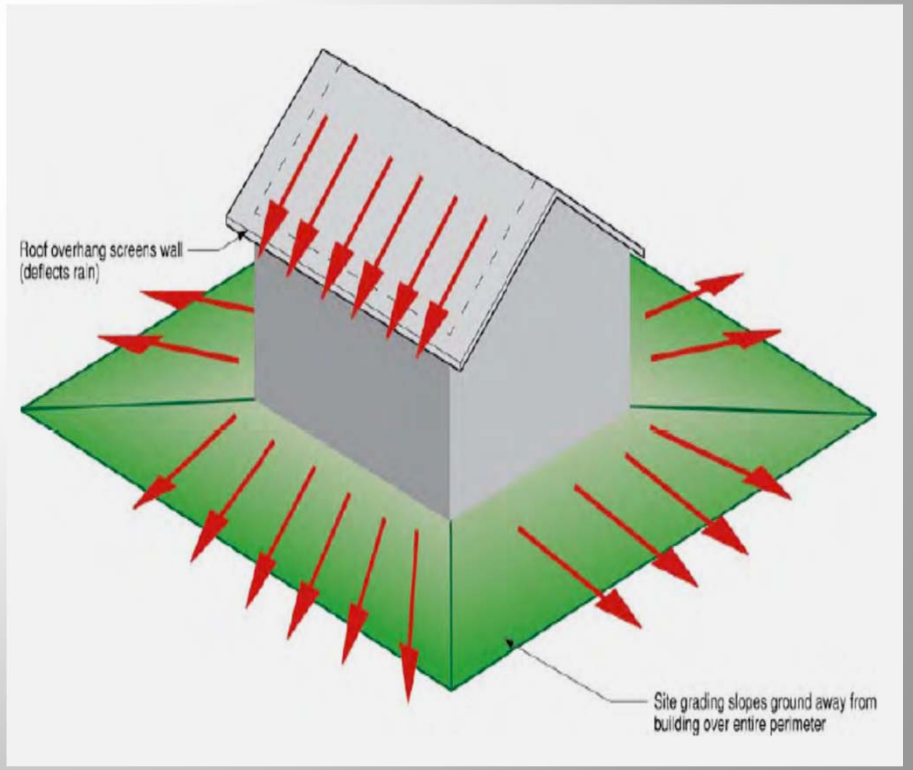
1 – buildings can’t move
2 – protect them from freezing
3 – start from the ground up
4 – turn cold and damp into warm and dry
5 – drainage, drainage, drainage
6 – rethink crawlspaces – conditioned, no vents
7 – turn crawlspaces into living spaces

Structural support is everything

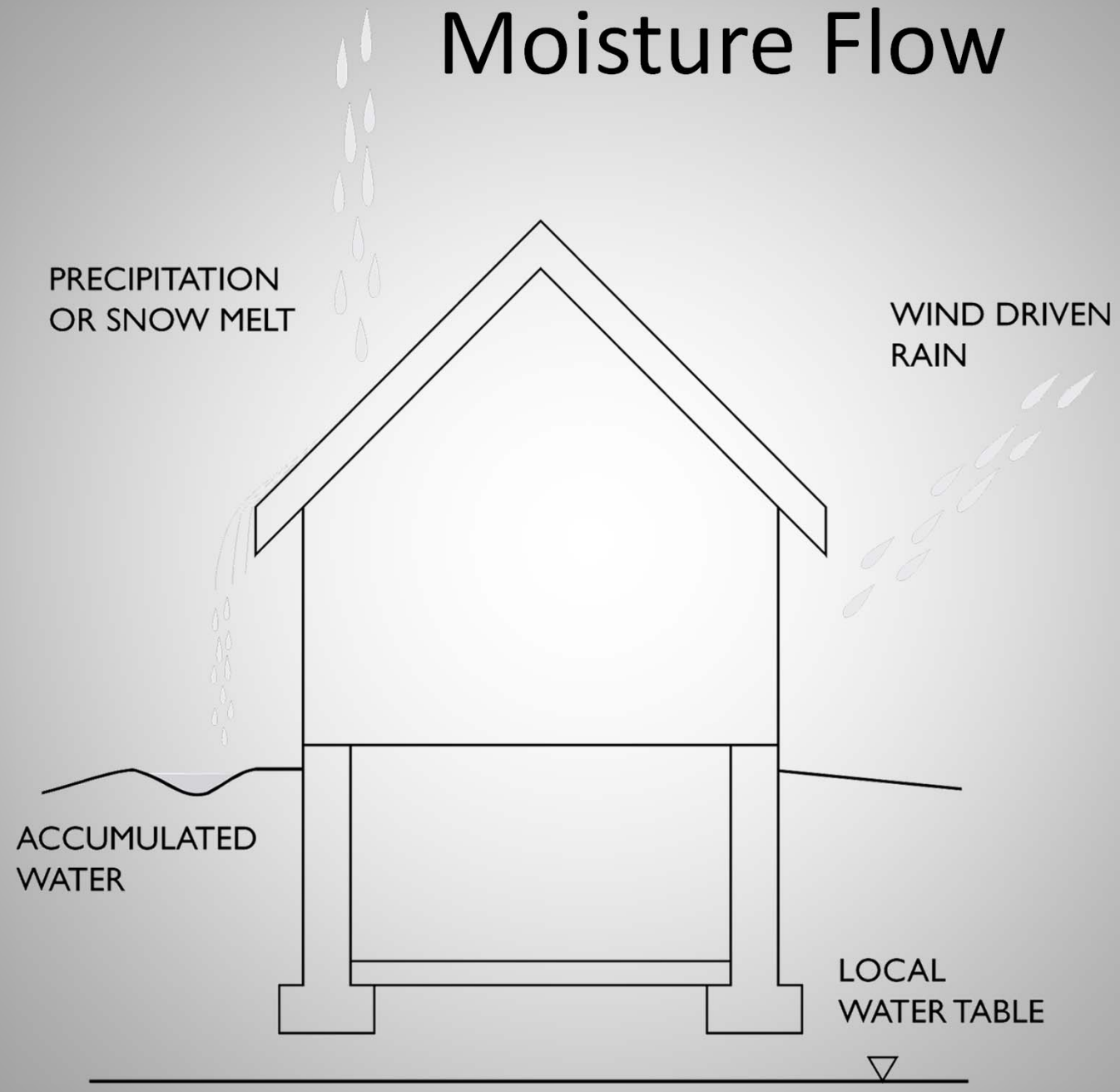


Getting started

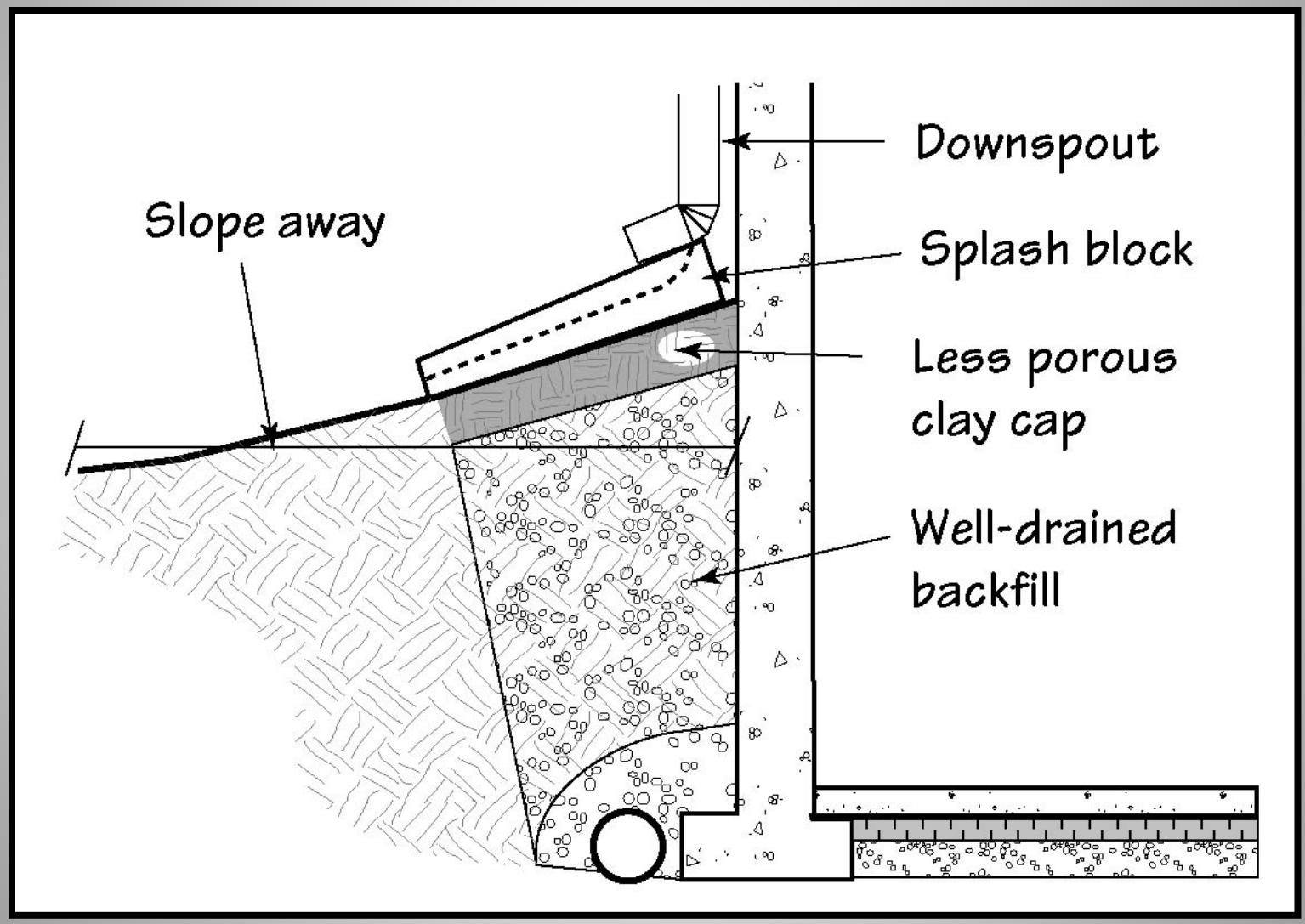
- Site selection
- Height of grade, footings
- Stay out of the water table
- Proper grading of lot
- Drainage
  - natural with sump backup

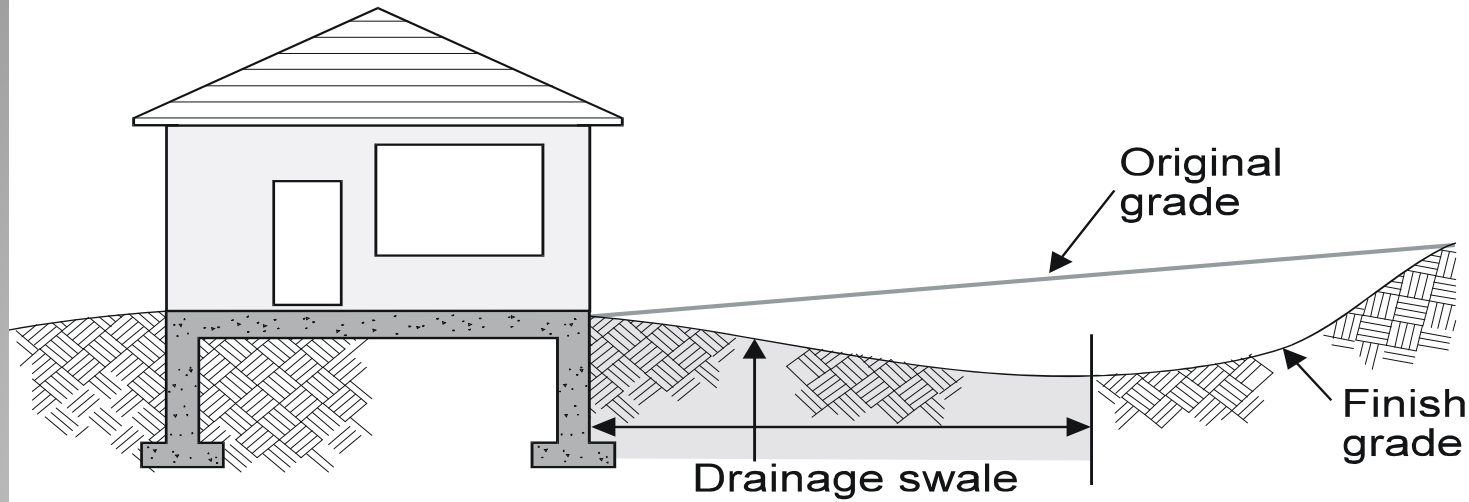


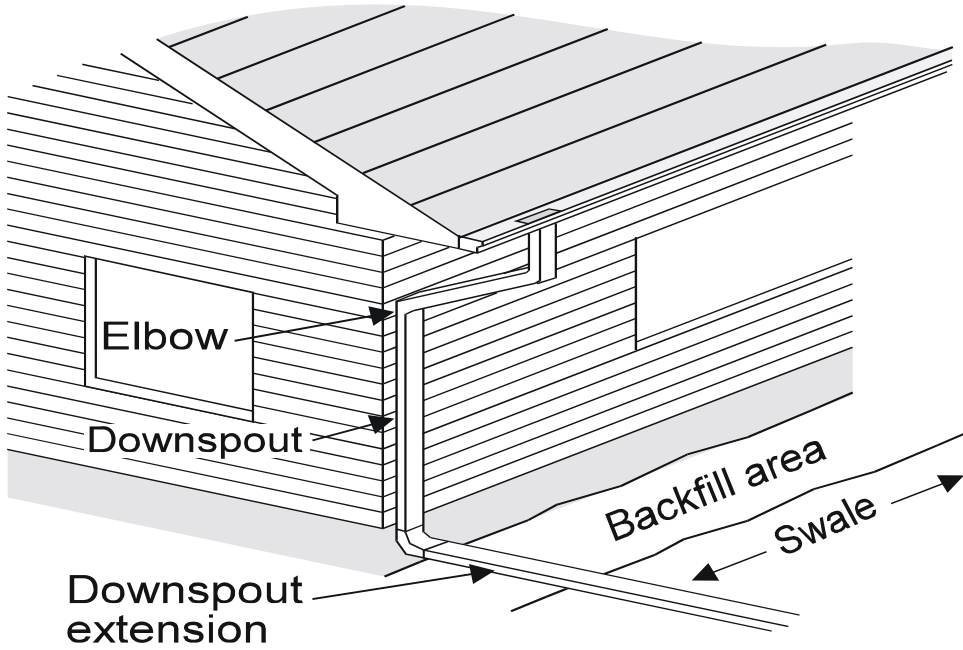
Moisture Flow



Manage surface water

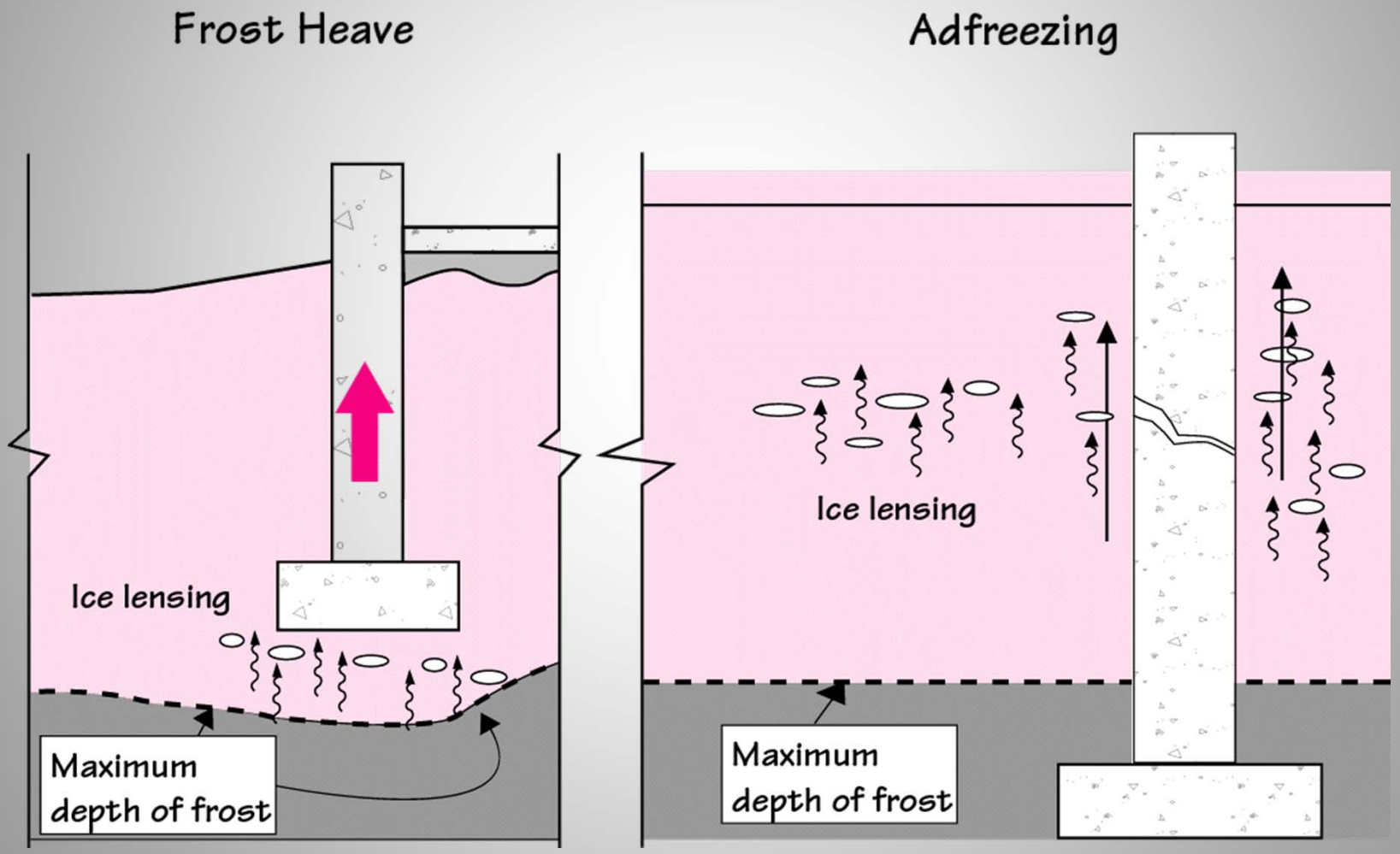






Make sure the building is equipped with a proper roof drainage system - including downspout extensions to divert rainwater away from the foundation

Frost Heaving and Adfreezing



Common Crawl Space Problems

Structural Failure

- **inadequate lateral support**
- **Frost heave, ad-freezing**

Water Leakage:

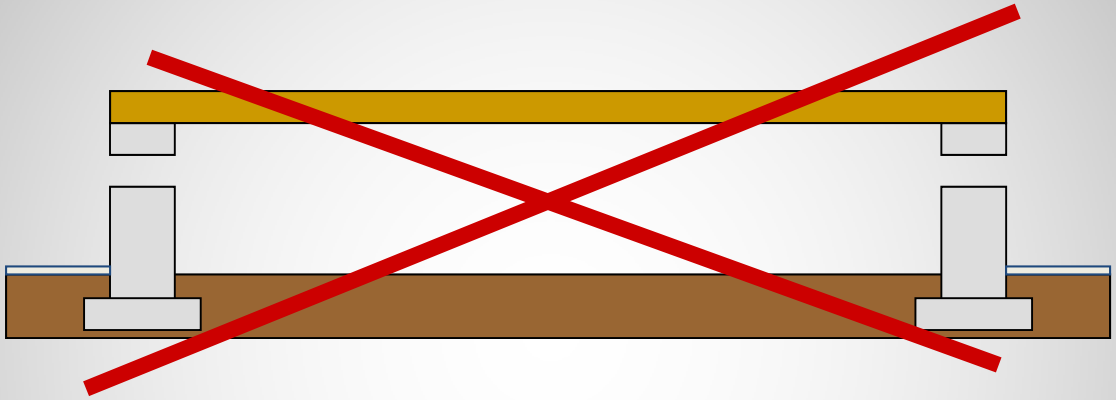
- **Poor grading around the building**
- **through settlement and shrinkage cracks**
- **through form ties**
- **through openings in floor slab**
- **Sump not installed or not connected**

Comfort Related

- cold floors / frozen pipes
- high humidity levels / molds and mildews
- high energy costs to maintain services from freezing
- Too easy to “forget”
- Difficult to service heating, ventilating equipment
- Confusion as to whether this should it be heated or unheated, vented or unvented

Moving forward

Not recommended



Recommended (mini basement)

Turn this…….

CRAWL SPACES

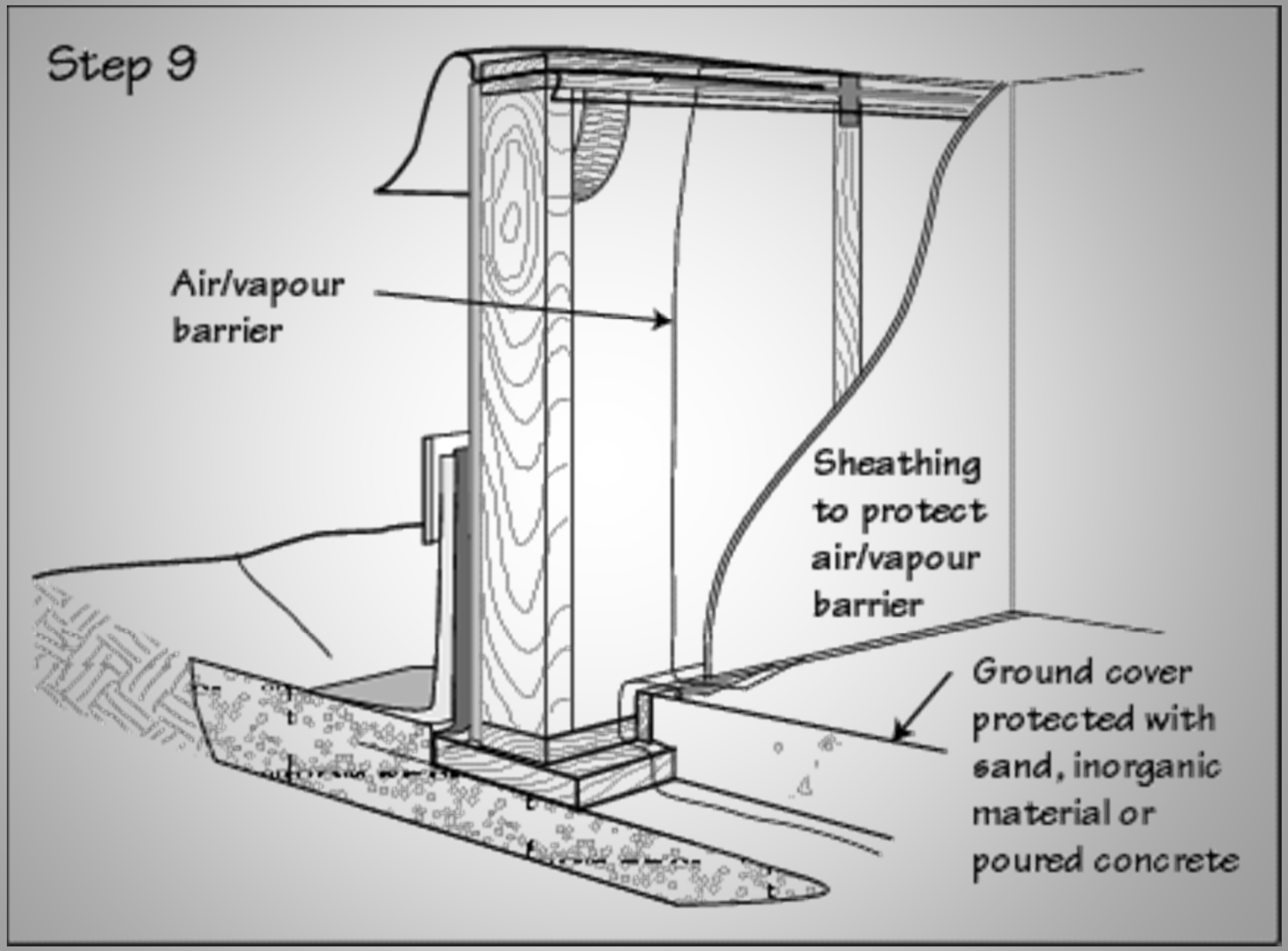
Into this……

What 2 words best describe the average basement / crawlspace?

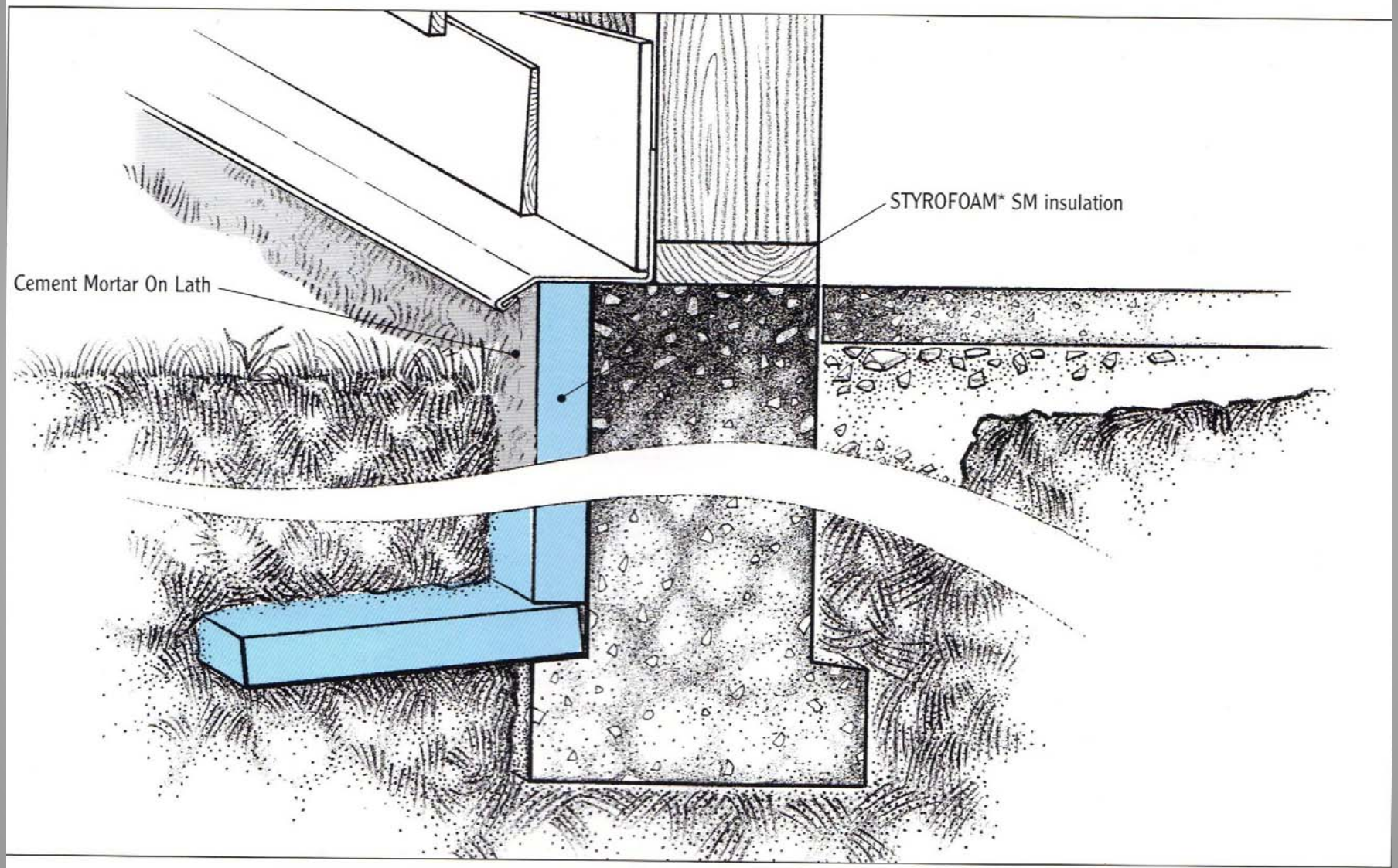
cold and damp

The magic is turning them into

warm and dry


Step 9
Air/vapour barrier
Sheathing to protect air/vapour barrier
Ground cover protected with sand, inorganic material or poured concrete

SHALLOW FOUNDATION



Typical Shallow Foundation Insulation For Heated Buildings


Tyvek

Crawlspaces into living spaces

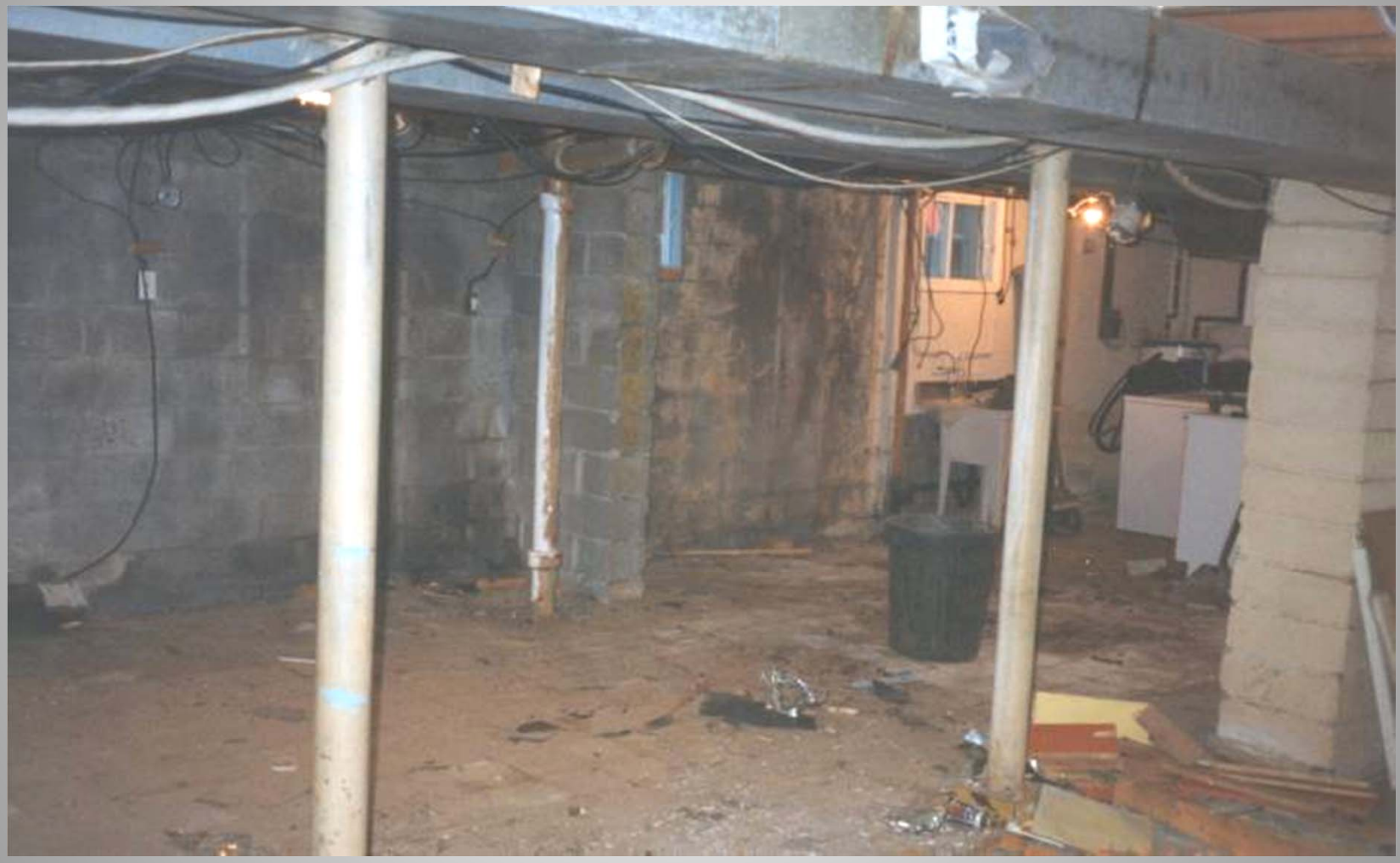
Addresses three persistent problems

1. Shortage of housing
2. Affordability
3. Durability - instability and comfort problems created by faulty crawlspaces

ICF Construction


28/8/2002 09:58

CASE STUDY



CASE STUDY 2- RETROFIT COMPLETE

MANAGING BELOW GRADE MOISTURE

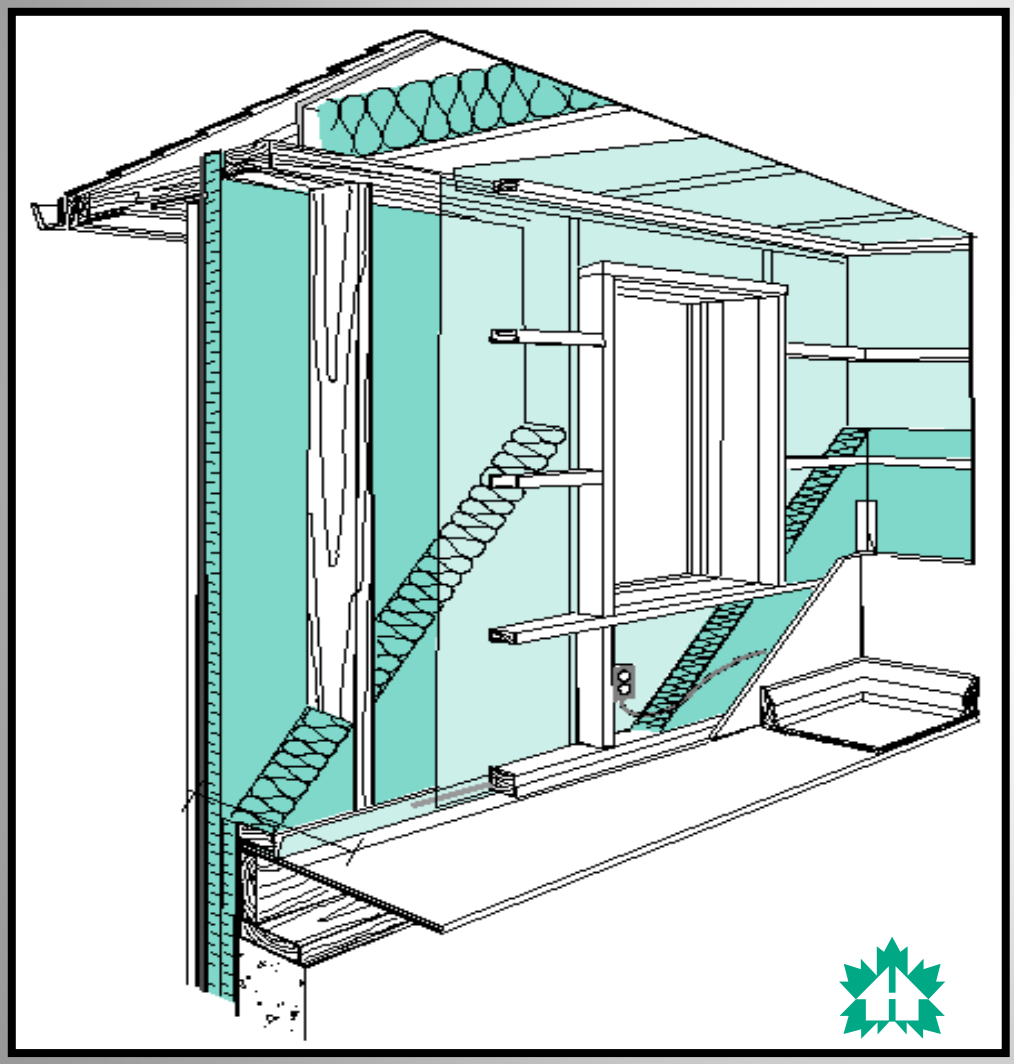
Control moisture from outside

- Drain and damp-proof foundation
- Keep walls warm & dry

-
-
-


SEMBLY
E
CED
M
E SLAB


SK



Insulate
Airtighten
Ventilate

House as a System

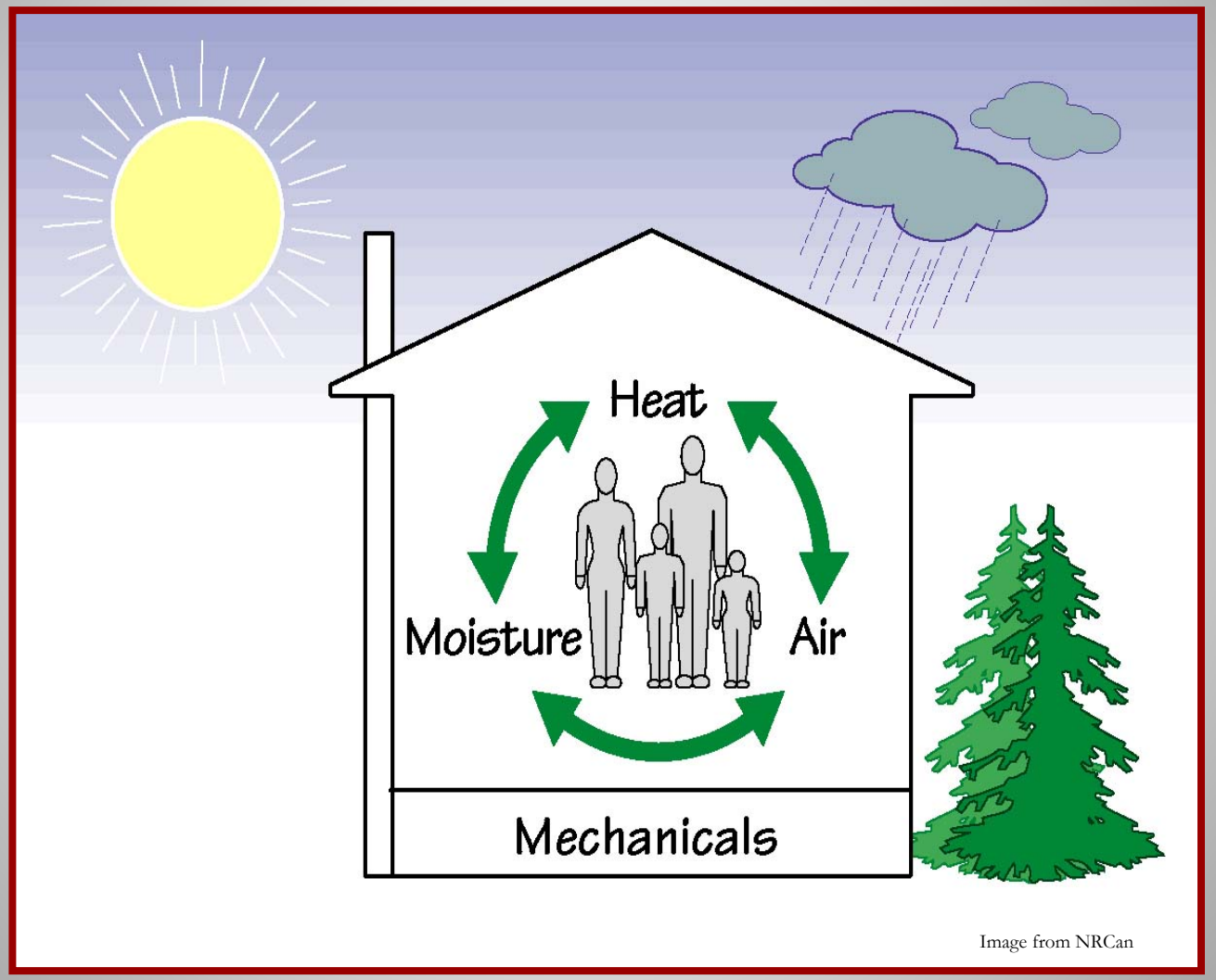


Image from NRCan

How to Control Heat Flow

- Heat flows from Hot to Cold
- Heat flows by convection, conduction and radiation
- Heat flow can never be stopped, you can only slow it down
- Insulation resists heat flow and is rated for it’s R value (RSI)

Not Managing Heat Means…

- High heating bills
- Comfort problems
- Uneven heat - cold rooms / cold floors
- Frozen pipes
- Condensation – Mold, Mildew

Air Flows

High pressure → Low pressure

Temperature / stack

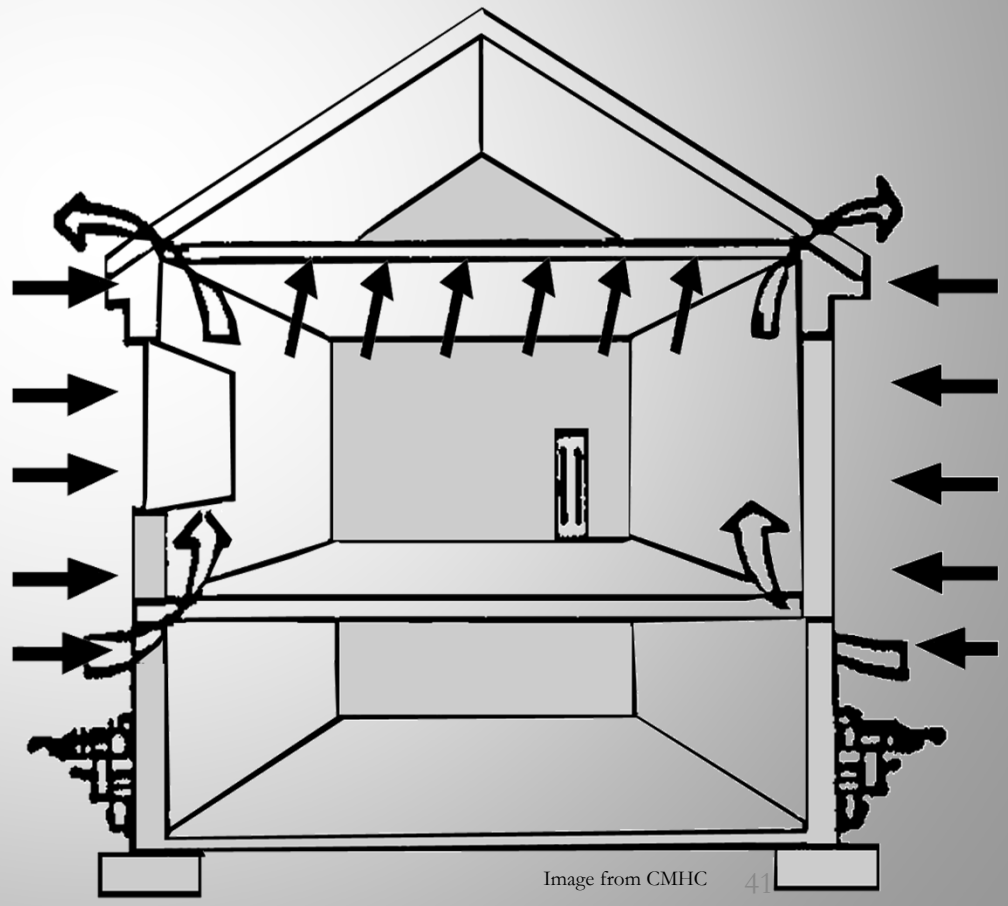
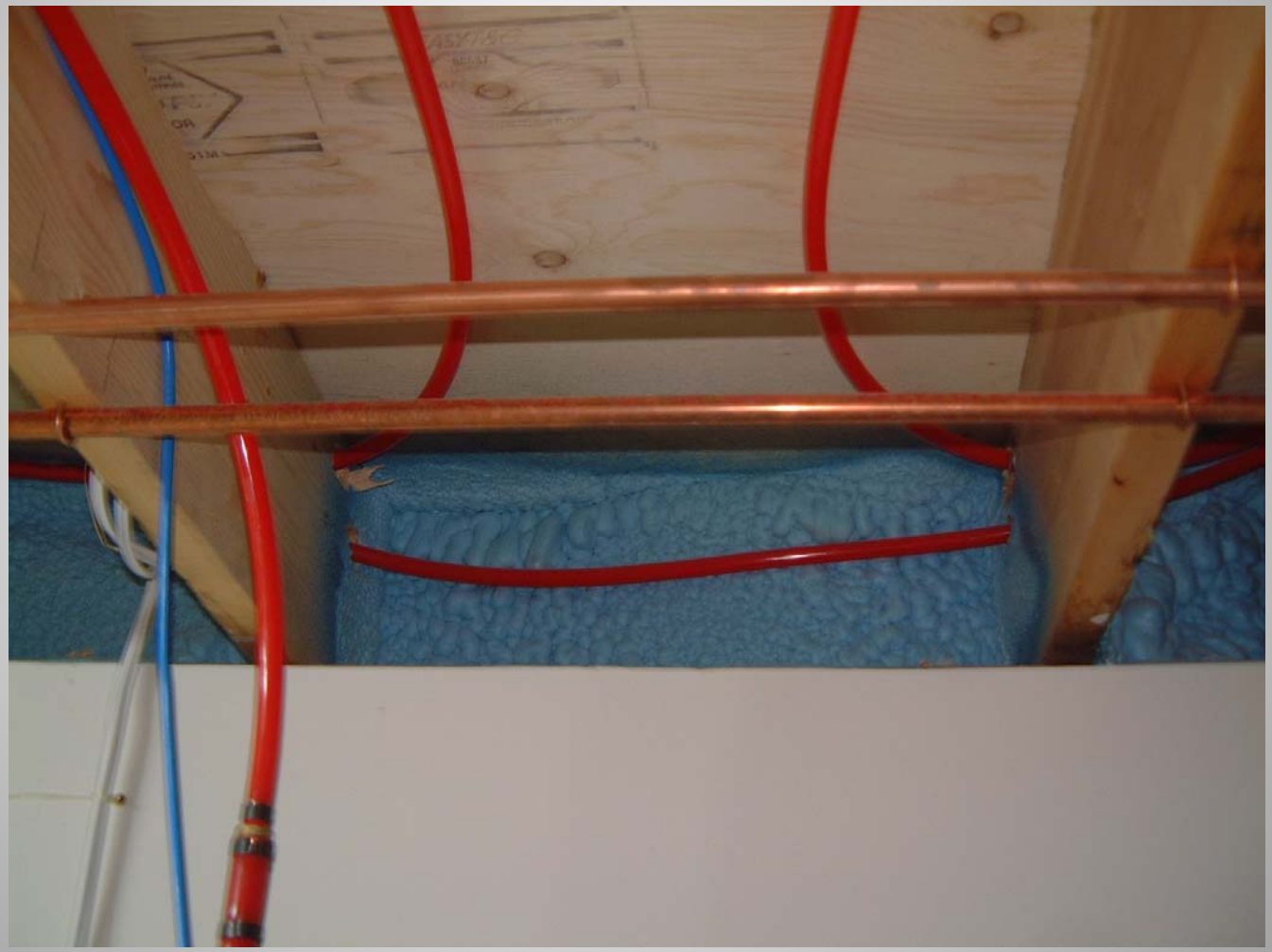


Image from CMHC

SEALING TECHNIQUES



Not Managing Air Well Means…

- Houses that are stuffy and damp (too little)
- Houses that smell, odours linger
- Condensation, mold
- Back drafting appliances like woodstoves
- Houses that are dry (too much)
- Drafts and chills

- ERS is an energy rating system for new houses
- Uses HOT 2000™ energy modeling software and blower door testing
- The average new home has a rating of 72 – 75
- An R-2000 home is benchmarked as EG 80 or better, new R-2000 is ERS 86
- Houses that produce as much energy as they consume are ERS 100, CMHC calls them EQ

Insulating walls

Think insulation, reduced thermal bridging, air barrier, vapour barrier, weather barrier

1. Usually done in conjunction with windows and siding
2. You can insulate inside or outside, usually easier outside
3. Outside makes it easy to get a good air barrier while doing the weather barrier

Energy savings finance

- The cost of borrowing money is low
- The cost of energy is high
- Use energy saving to finance the upgrades
- Invest $5000 in energy efficiency
- Costs $5 / 1000 / month or $25 or $300 / year
- On older homes $5000 should save $1000 on energy
- The cost is $300 per year, saves $1000

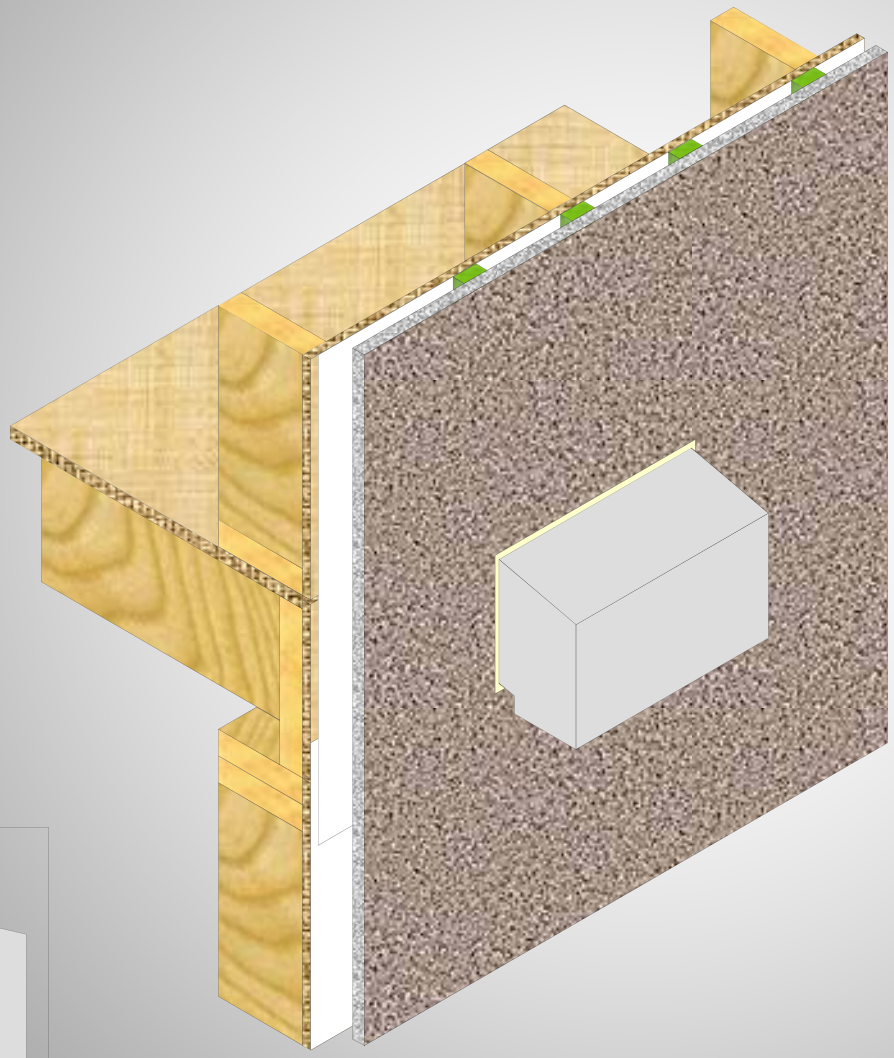
The Building Envelope:

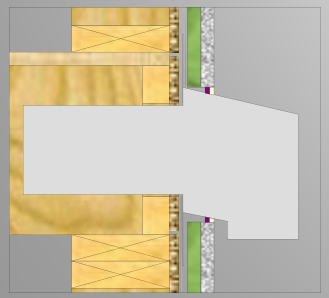
Air Tightness testing

Drainage Plane / Weather Barrier

- Continuous
- Air tight
- Resistant to liquid water flow
- Shingled
- Air space in front
- Durable
- Penetrations sealed

EXHAUST VENT

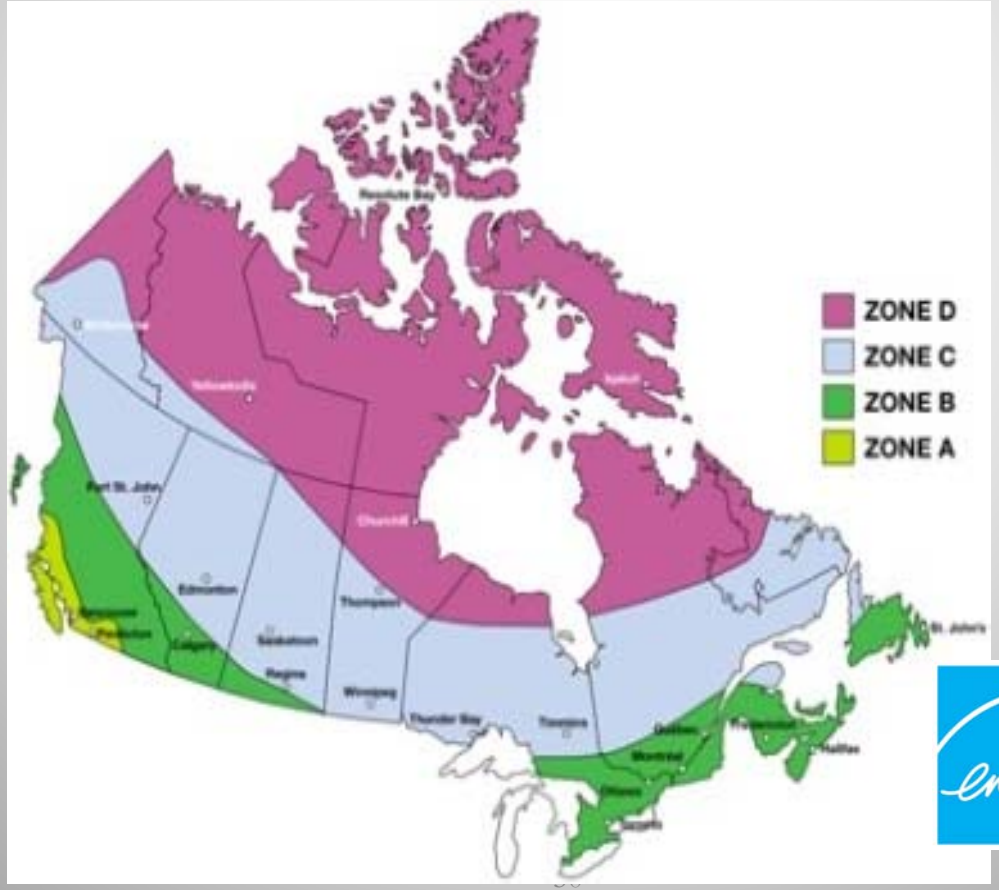




Floor & Wall Framing
Exterior Sheathing
Sheathing Paper
One Piece Vent Assembly
Sheathing Paper
P.T. Wood Strapping
Stucco Cladding
Backer Rod & Exterior Sealant

Windows and Glass Doors

- Canada has been divided into 4 Zones based on average seasonal temperatures and weather.
- Only windows appropriately labeled for your zone should be considered.

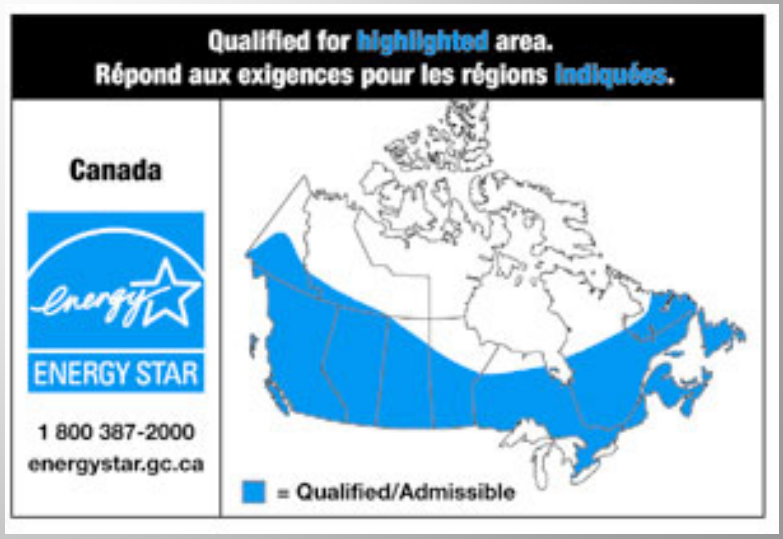


ENERGY STAR
HIGH EFFICIENCY
HAUTE EFFICACITÉ

www.energystar.gc.ca

Window details by make and model

- Type of spacer
- Type of gas fill
- Type of low E coating
- Location of Low E coating
- Solar heat gain coefficient
- U value



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information

building science.com provides objective, high quality information about buildings combining building physics, systems design concepts, and and awareness of sustainability to promote durable, healthy and economical buildings.

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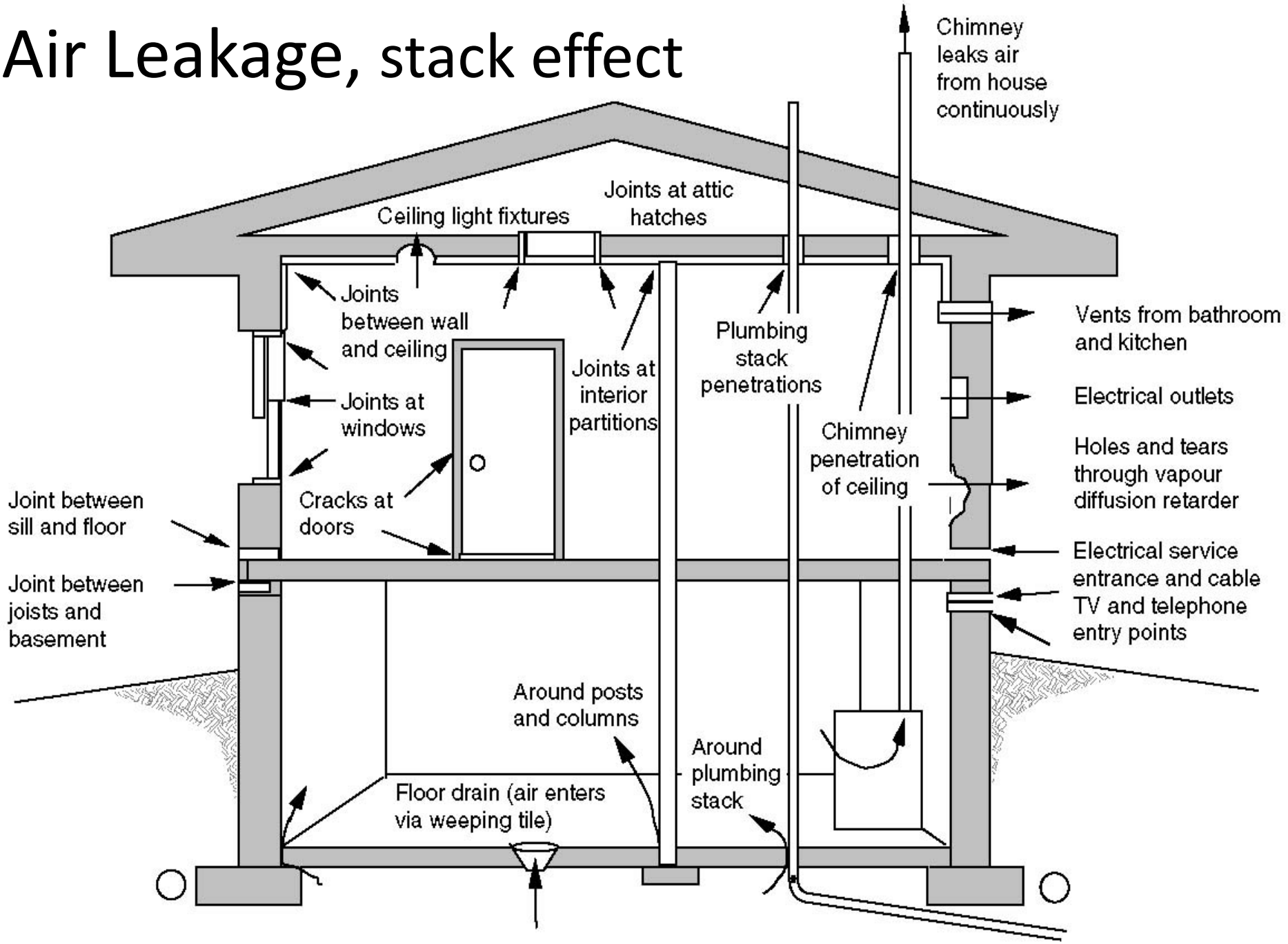
EQuilibrium™ Now House

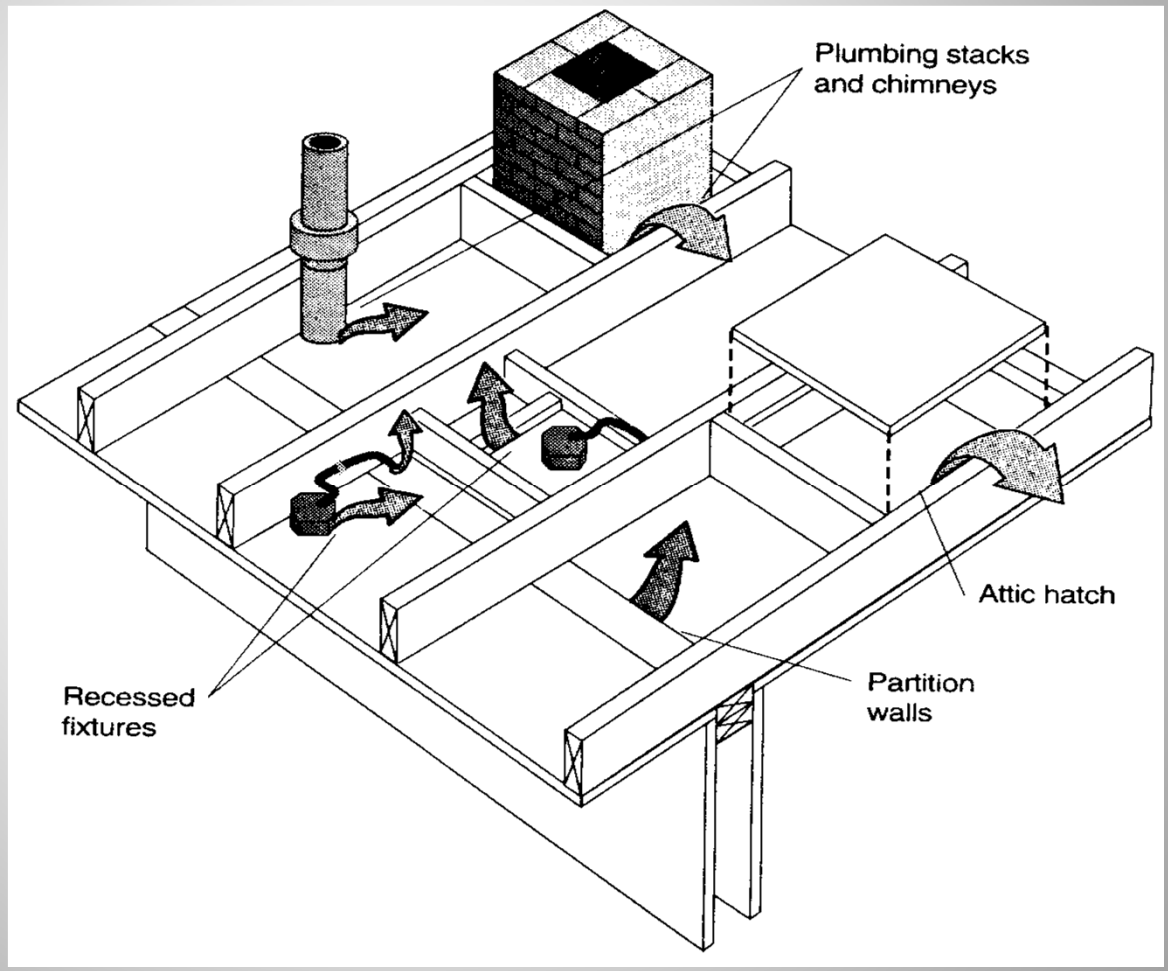
EQuilibrium™ Demonstration Project


Junior
Kindergarten

Air Leakage, stack effect



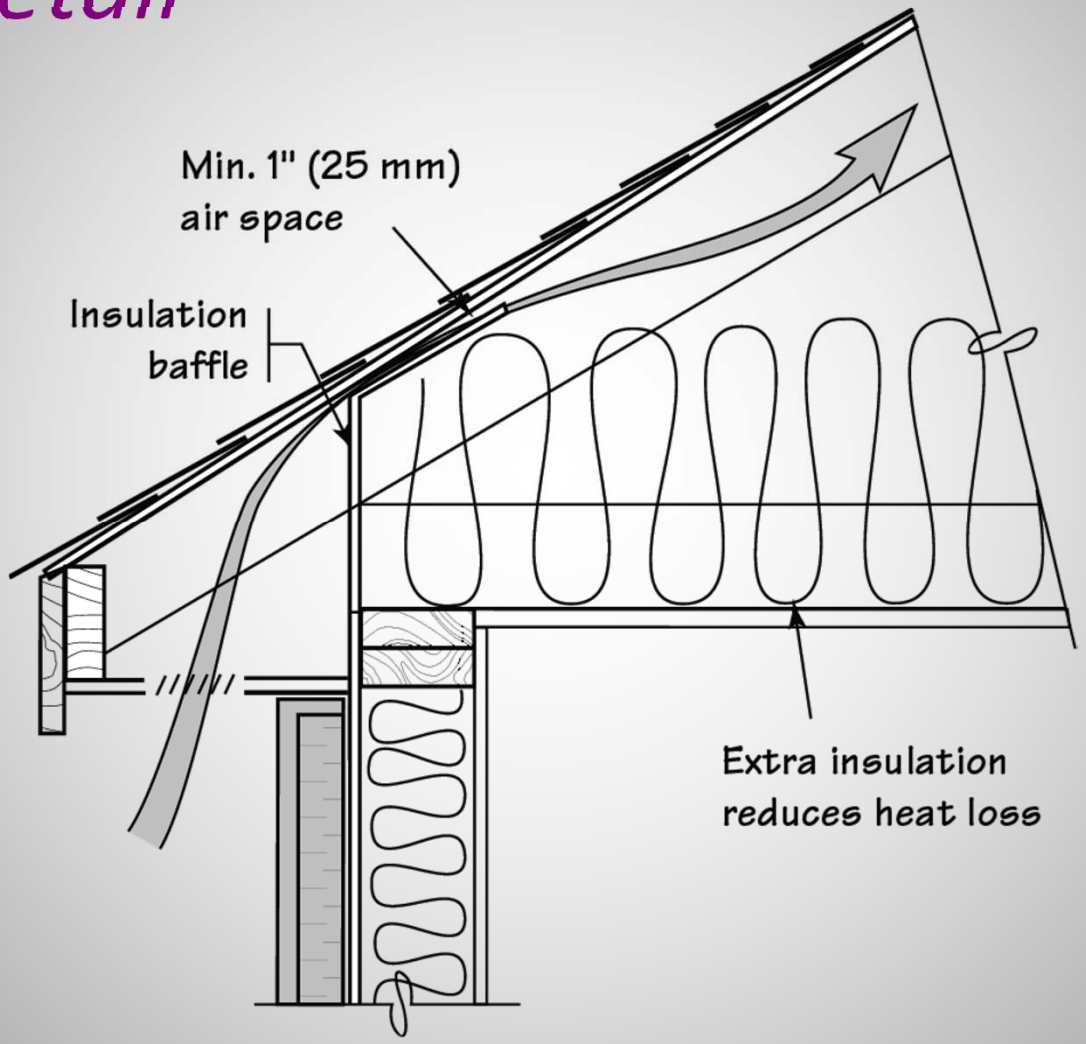
Ceilings and Roofs



Ceiling Air Leakage

- Dirty Insulation

Eave Detail

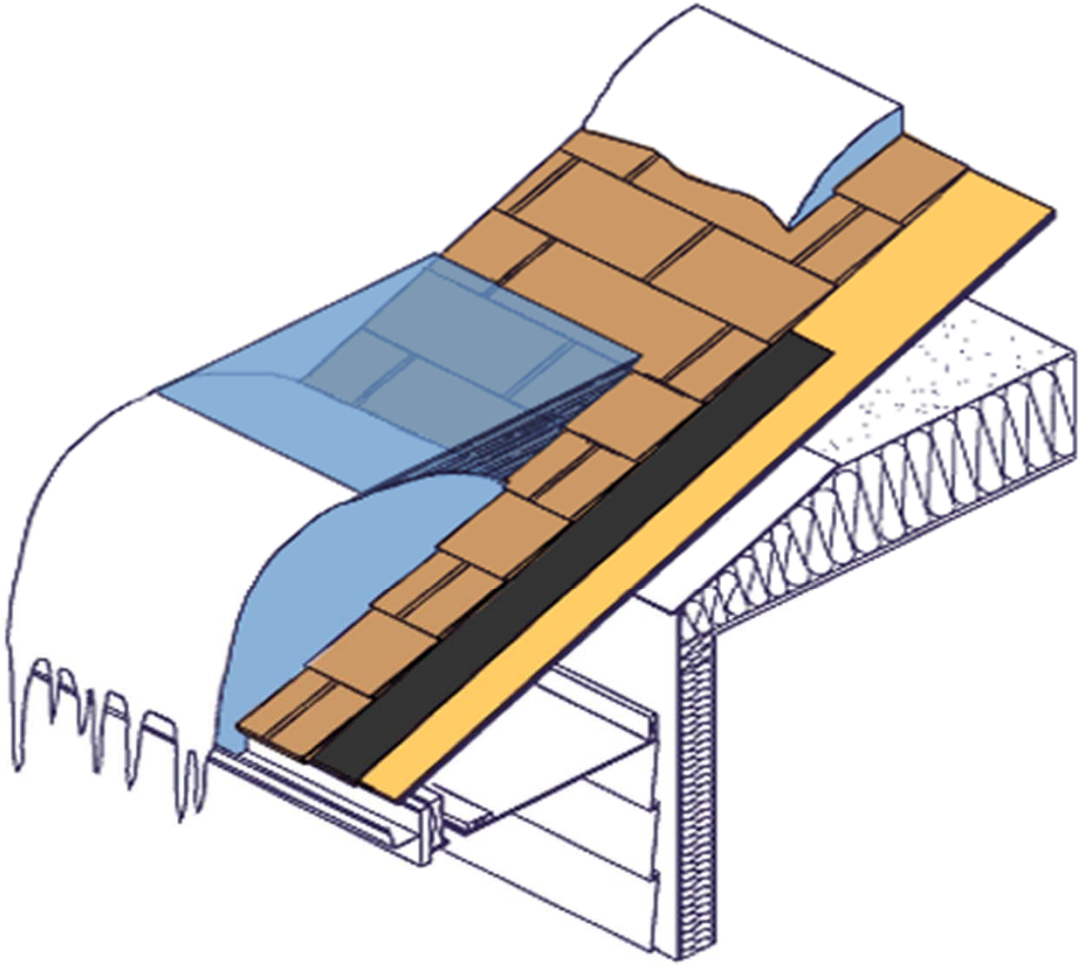

Min. 1" (25 mm)
air space
Insulation
baffle
Extra insulation
reduces heat loss

Ceiling and Roof Insulation

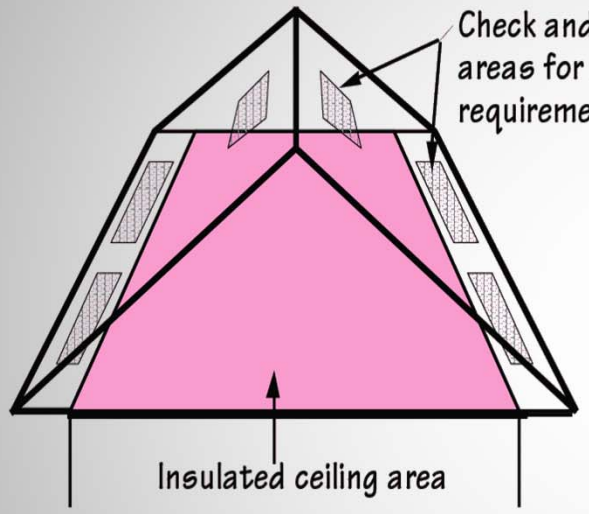

CONTENTS:
PACKAGED BY:
BUNDLE#:
Made in Canada.


EPOISE LTD
S US
30905
TCH
STOP

Ice Damming



Attic Ventilation



Roof slope greater than 1 in 6:

Insulated ceiling area = 150 sq m (1615 sq ft)

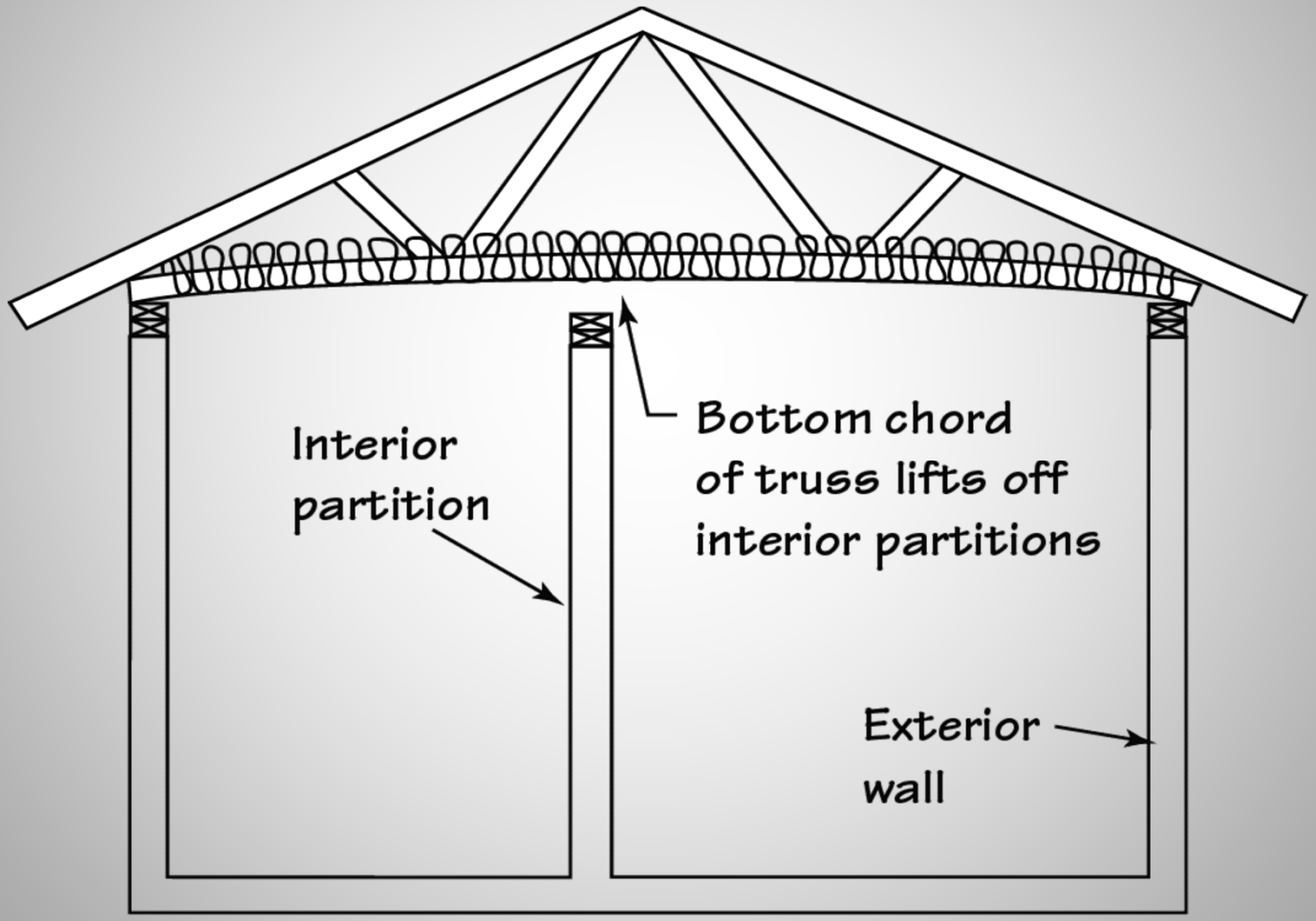
Total required unobstructed vent area = 1/300 of ceiling area
= 0.5 sq m (5.4 sq ft)

Insulated ceiling area = 150 sq m (1615 sq ft)

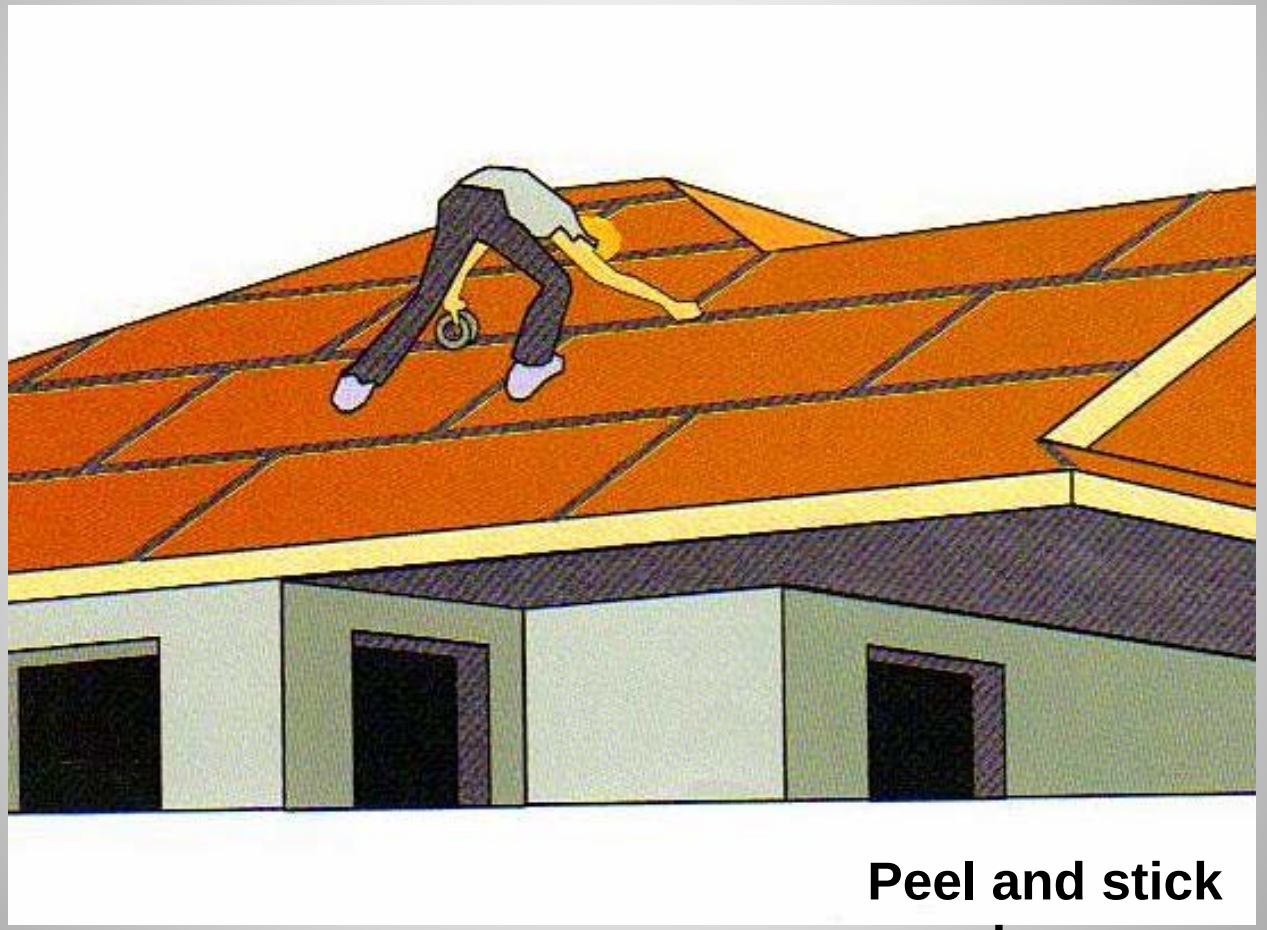
Total required unobstructed vent area = 1/150 of ceiling area
= 1 sq m (10.8 sq ft)

NBCC 9.19

Truss Uplift



Keeping Dry



Peel and stick membrane over joints in roof deck

Insulation Essentials

- Insulation must be continuous and of uniform depth - eliminate voids
- Minimize thermal bridging
- Eliminate wind washing
- Compare options based on cost per installed R value


SK
S.K.
SK
Junior Kindergarten

Water resistant bathrooms

- One piece tub > one piece bathroom
- Manage water better, plan for it
- Install new drywall that won't grow mold
- Protect under washer, water heaters

Plumbing Considerations

- Minimize Risk of Water Leak /Damage by:
  - Keeping all piping inside the envelope
  - Open web floor joist systems can help
  - or …… insulate any piping in outside walls
  - Locate water heaters by drains or use catch pans
  - Install water resistant board behind tub and tile enclosures (cement board, paperless drywall)

MOISTURE

is the key to

MOLD GROWTH

Control MOISTURE

to control MOLD

To control moisture in basements

Ventilate in Winter

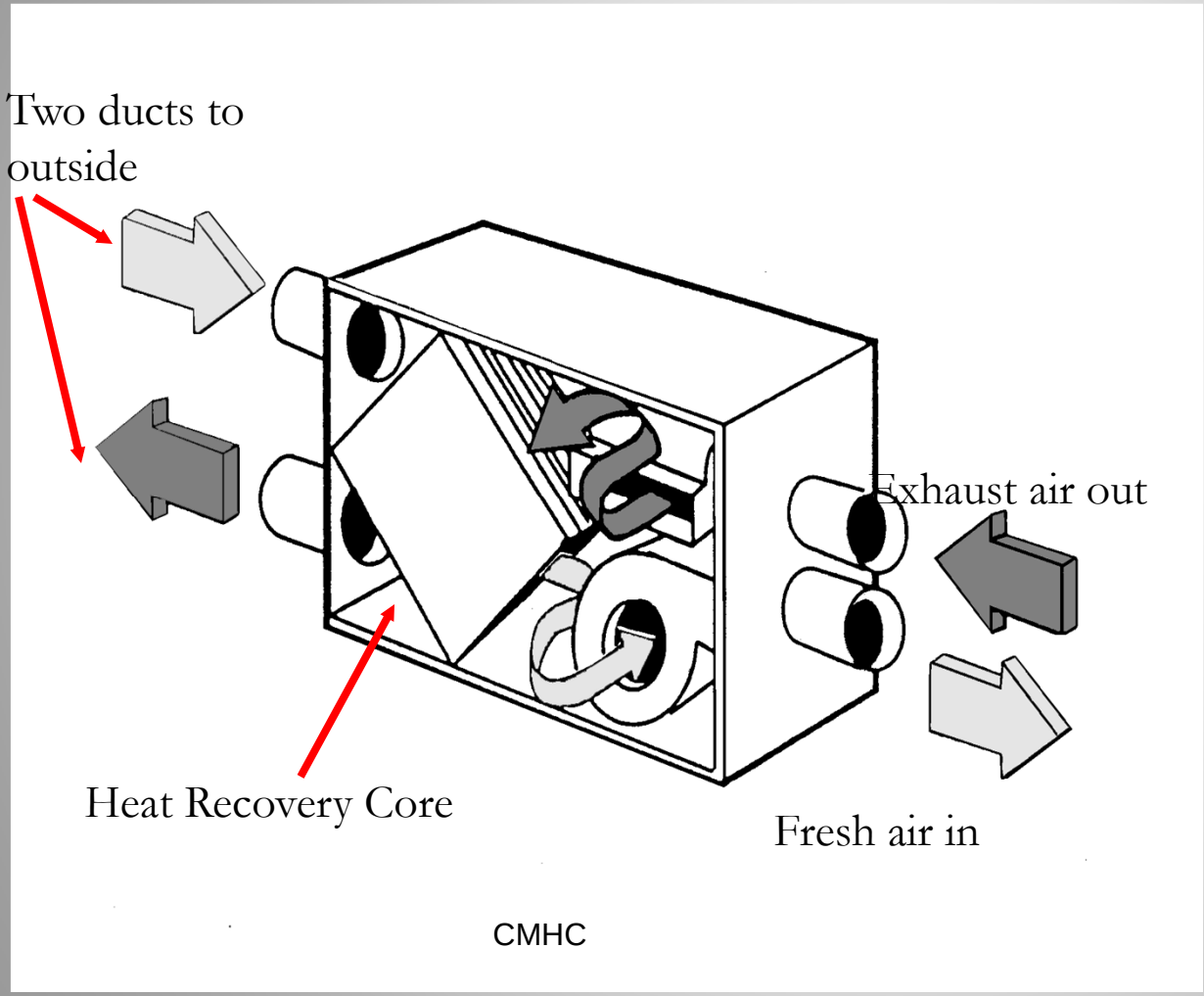
Dehumidify in Summer

- Important strategy to reduce moisture in basements and crawlspaces in summer
- Look for cool weather operation, EnergyStar rated

Why Ventilate?

- Exhaust excess moisture and contaminants
- Provide fresh air to dilute indoor pollutants
- Required by Code
- It is necessary and it works!

Heat Recovery Ventilators (HRVs)



- Two fans in a box
- One exhausting air out
- One bringing air in

AIR IN = AIR OUT

- Recovers energy from exhaust and transfers it to the fresh incoming air

Why HRVs Fail

Incorrectly installed

- System not balanced
- Use trained installer
- Have the system inspected

Lack of maintenance

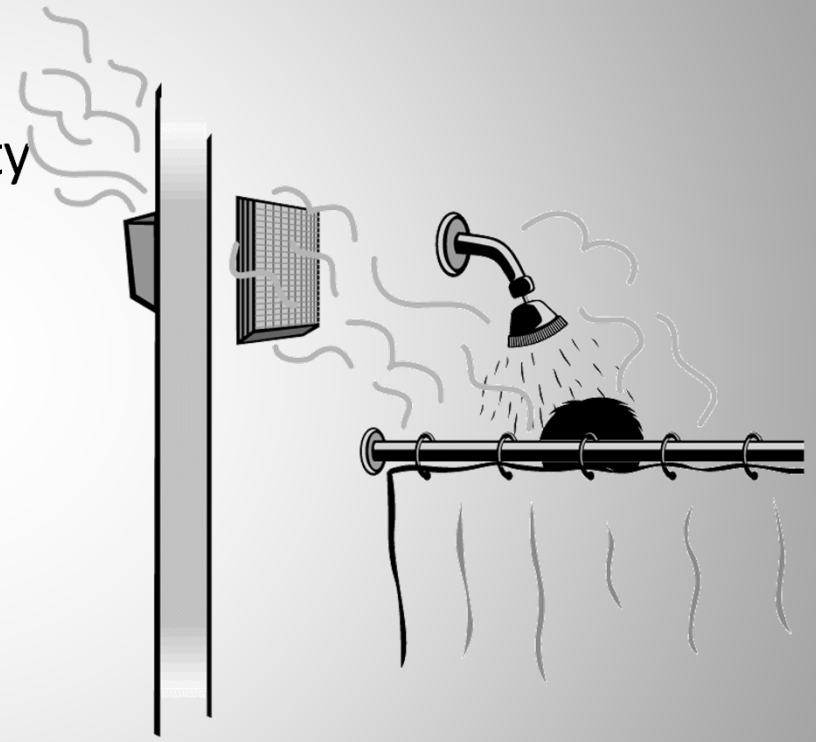
- The homeowner must be shown how to operate and maintain the unit

Wrong unit

- Too large / too small for the job

Minimum Bathroom Fan Specifications

- Has an HVI (Home Ventilating Institute) rated airflow capacity of not less than 25L/s (50cfm)
- Has an HVI sound rating not greater than 2.0 sones
- A sound rating of 1.0 sone is much better and not that much more expensive



CMHC

Recommended Radon Guideline

Remedial measures should be undertaken in a dwelling whenever the average annual radon concentration exceeds 200 Bq/m³ in the normal occupancy area.

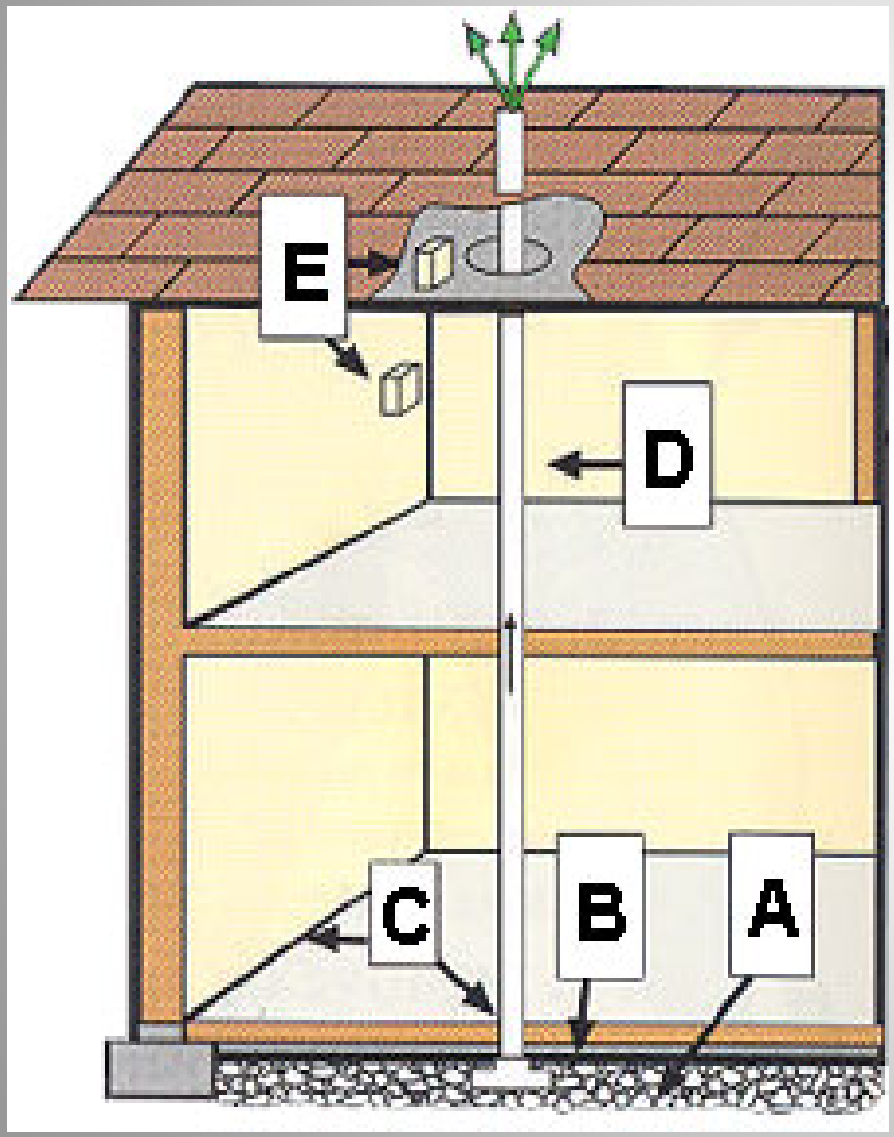
The higher the radon concentration, the sooner remedial measures should be undertaken. At levels of 800 Bq/m³ or above, these measures should be completed within one year.

When remedial action is taken, the radon level should be reduced to a value as low as practicable.

The construction of new dwellings should employ techniques that will minimize radon entry and will facilitate post-construction radon removal, should this subsequently prove necessary.

Radon Control

– an example of seal and ventilate strategies



A. Gas Permeable Layer
(4” clean gravel)

B. Plastic Sheeting
(under slab or over crawl space)

C. Sealing and Caulking
(all openings in concrete floor)

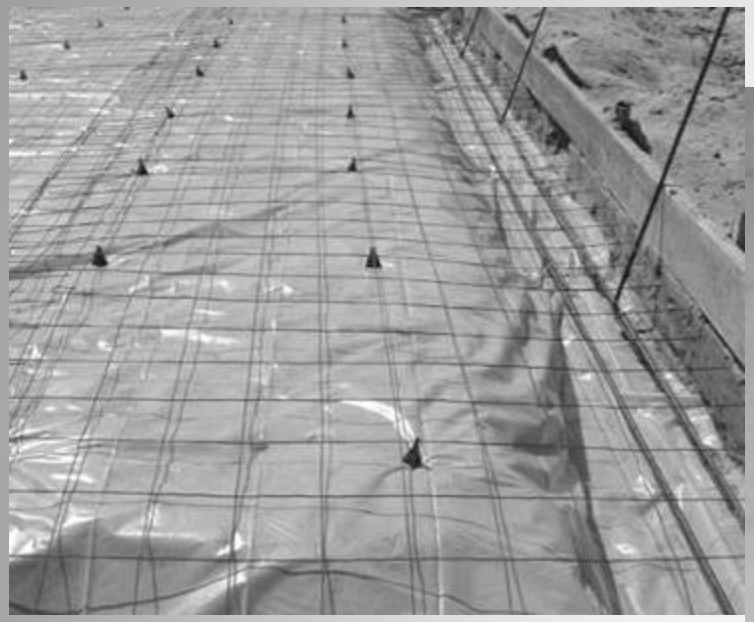
D. Vent Pipe
(3 or 4 inch PVC pipe)

E. Junction Box
(if fan needed later)

Provide test kits to homeowners

Radon Strategies

Seal the slab and any penetrations



Make provisions for ventilation and install fan if needed

Radon control also helps foundation moisture issues

How can you apply the information from this workshop to your community?

texmc @ sympatico.ca

10 points to remember

Full Depth Basement Insulation, Best Practice Guide, Ontario

1) Backfill early and slope grade around the foundation to manage surface water
2) To reduce wicking of water apply a capillary break on the top of the footing
3) Careful installation of the drainage tile, sloped to provide proper drainage
4) Cover the granular layer with a geo-textile
5) After placing the wall, apply a slip layer to prevent adfreezing (can be as simple as a layer of poly)

6) Apply a capillary break on the interior to prevent wicking of moisture to wood or other materials

7) Allow time for construction moisture to dry out before insulating and applying vapour barrier, consider using a low permeance insulating board on the inside of the foundation wall

8) Vapour barriers should be applied to all insulated surfaces

9) Insulation should be installed with no gaps nor overly compressed

10) Air tightness is extremely important – especially header areas, think continuous air barriers

Essential learnings….

1 – if what you are doing isn't working, stop doing it

2 – consider building on the ground, not in the ground

3 – use frost protection, building slab on grade or basement entry housing

4 – whatever you choose, you've got to transform "cold and damp" into "**warm and dry"**

5 – always remember water runs downhill

(think high and dry)

6 – building up means a smaller footprint, more efficient, more affordable

7- Electric heat with a wood back-up – move to EPA stoves and inside chimneys

8 - Build to the sun

9 - NO skunks allowed. Leave the stinky materials out

10 – Make housing your engine of growth; training, jobs, professional development

11 – Educate the occupants and maintain your houses

12 – help your community to love their houses