

OUR BUILDINGS . . . OUR HEALTH

Presented at the 2018 Conference on
Health, Environment and Energy



Learning Objectives

- Identify Chemicals of Concern
- Improve the built environment through Design & Construction
- Find Solutions through Building Science
- Recognize best Heating, Ventilation and Cooling strategies
- Make an Impact using Quantitative Research

Our Built Environment



- Tobacco smoke Cancer · Heart Disease · Respiratory Illness
- Biological contaminants Respiratory Illness · Lung Disease · Stress
- Combustion by-products Cancer · Respiratory Illness · Lung Disease
- Household products Cancer · Respiratory Illness · Diseases (neurological)
- Toxic materials Cancer · Respiratory Illness · Diseases (neurological)
- Radon Cancer
- Safety & security Stress
- Diet & Exercise Cancer · Heart Disease · Respiratory Illness

Avoid Chemicals of Concern



- Toxic materials
- Radon
- Safety & security
- Diet & Exercise

• Tobacco smoke

• Flame Retardants

• Products

• Phthalates

- Antimicrobials

- Flame Retardants

- Perfluorinated Chemicals (PFC)

Avoid Chemicals of Concern



Building Science Basics

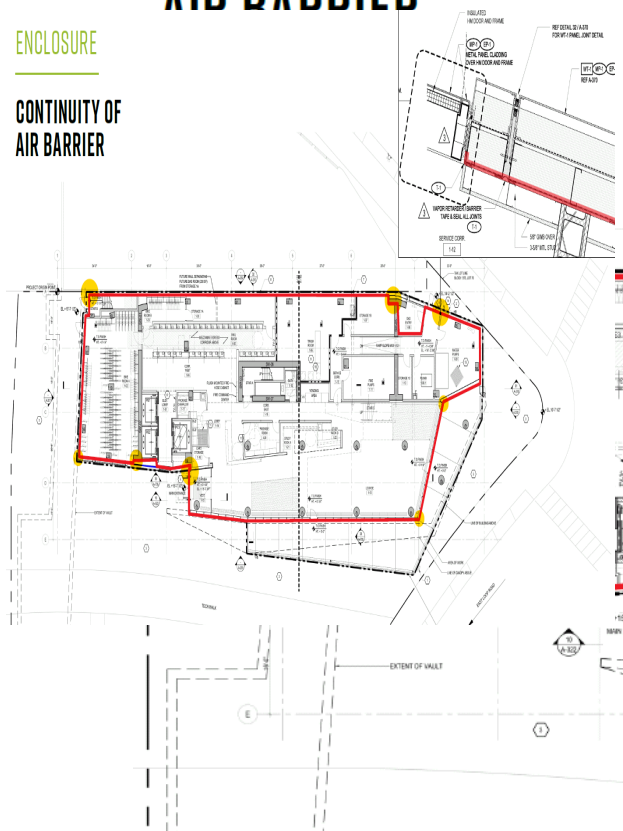


ENCLOSURE

CONTINUITY OF AIR BARRIER

ENCLOSURE

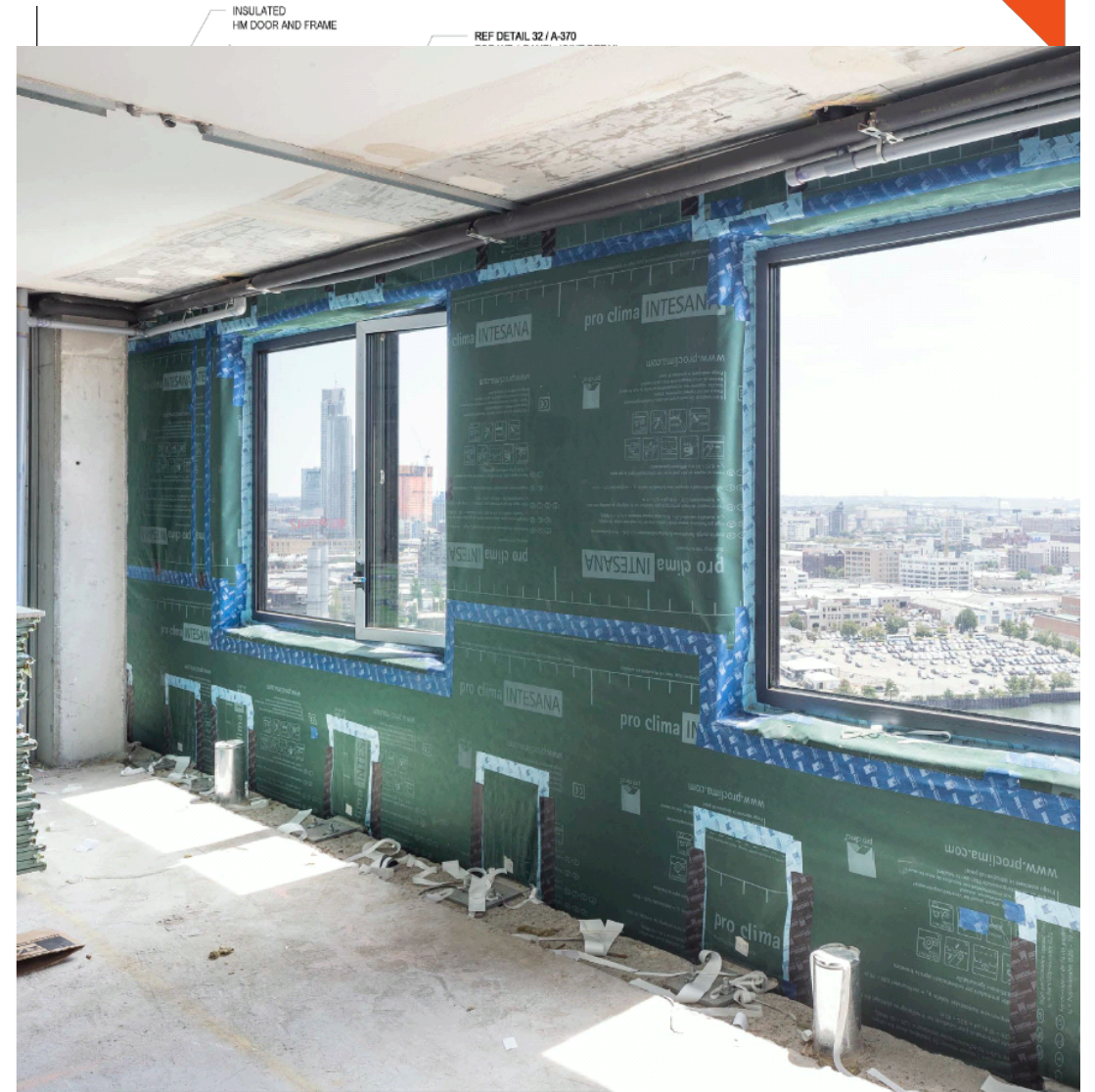
CONTINUITY OF AIR BARRIER



Air Barrier Drawing Set

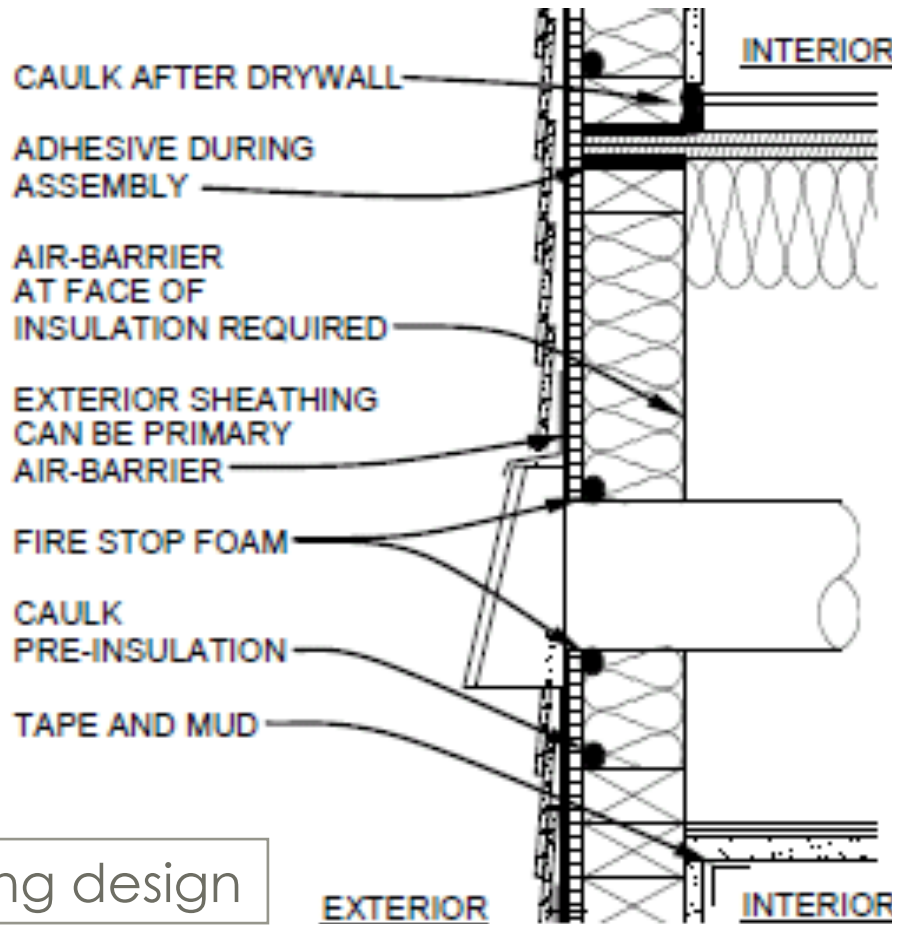


ENCLOSURE

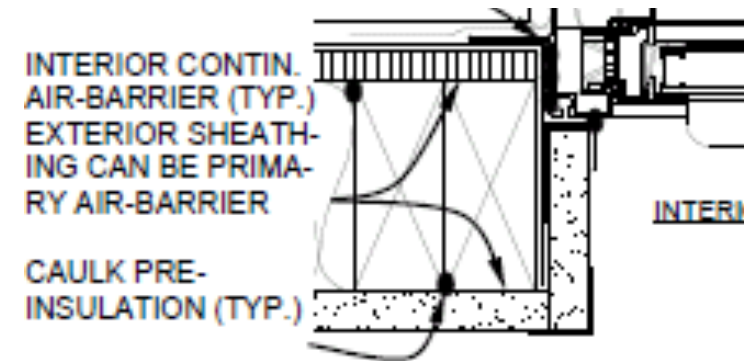


Air Barrier Installed

Building Science Basics



Air sealing during design



Air sealing during construction

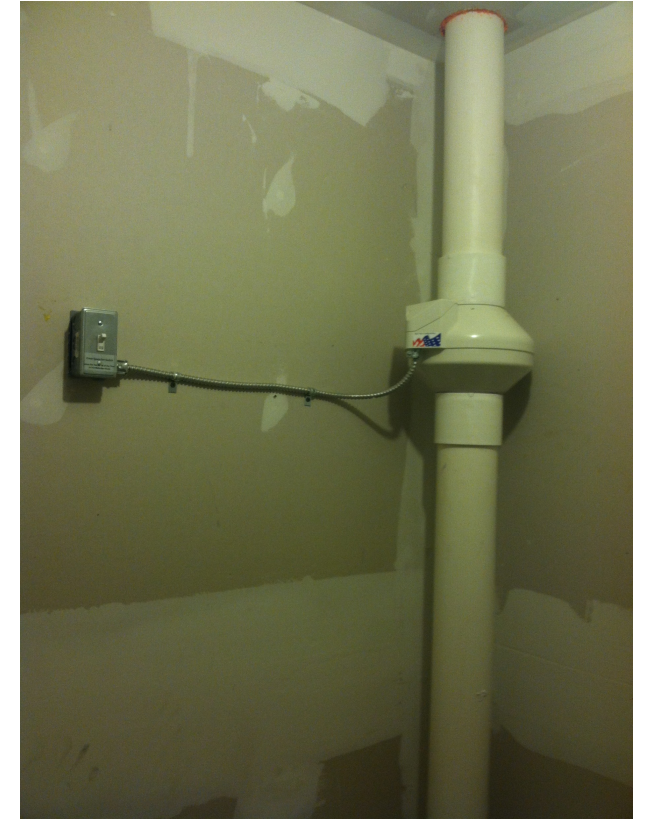
Building Science Basics



Existing · Crawl Space



New · Crawl Space



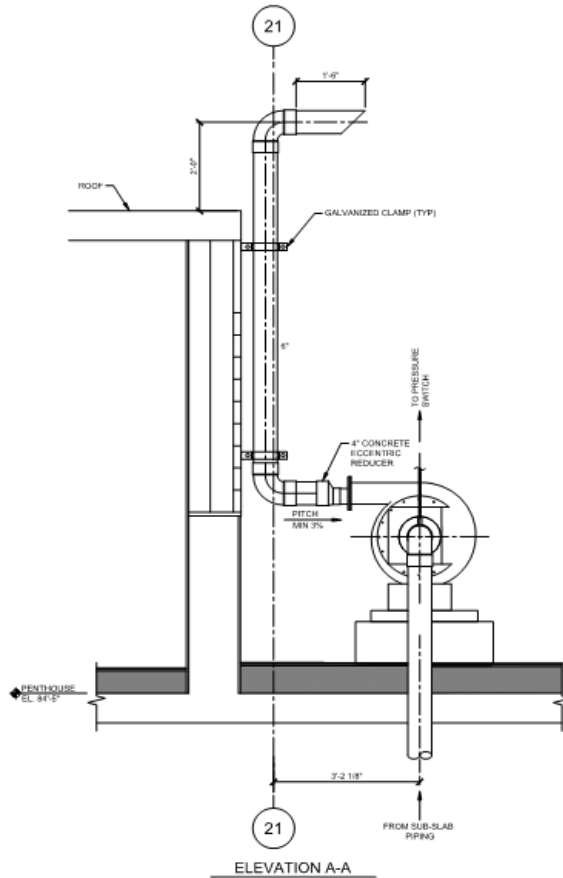
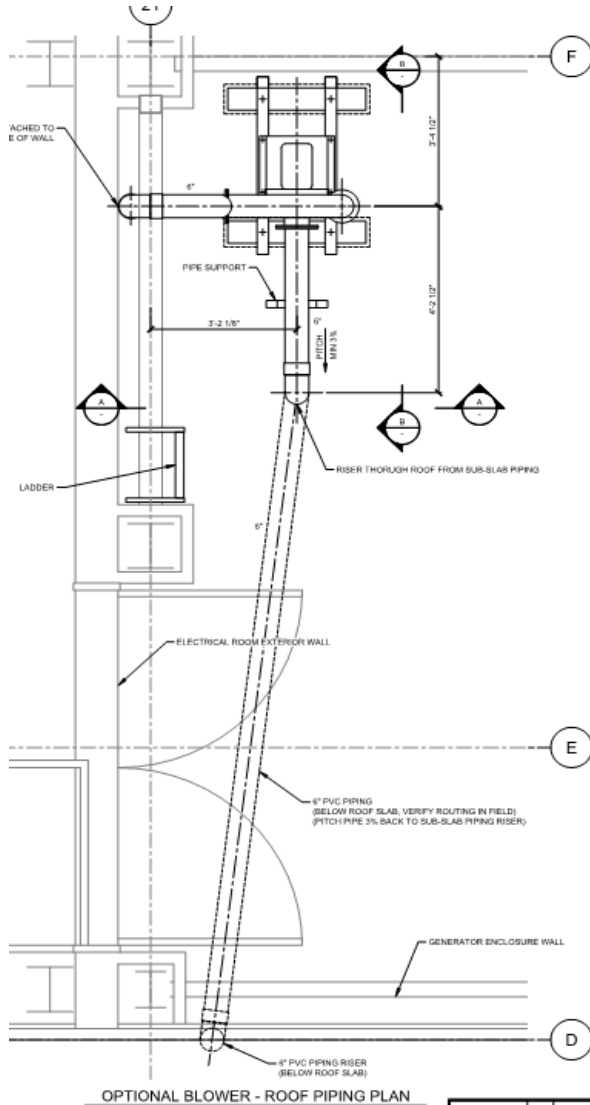
Crawl Space Exhaust Fan

During Design & Construction



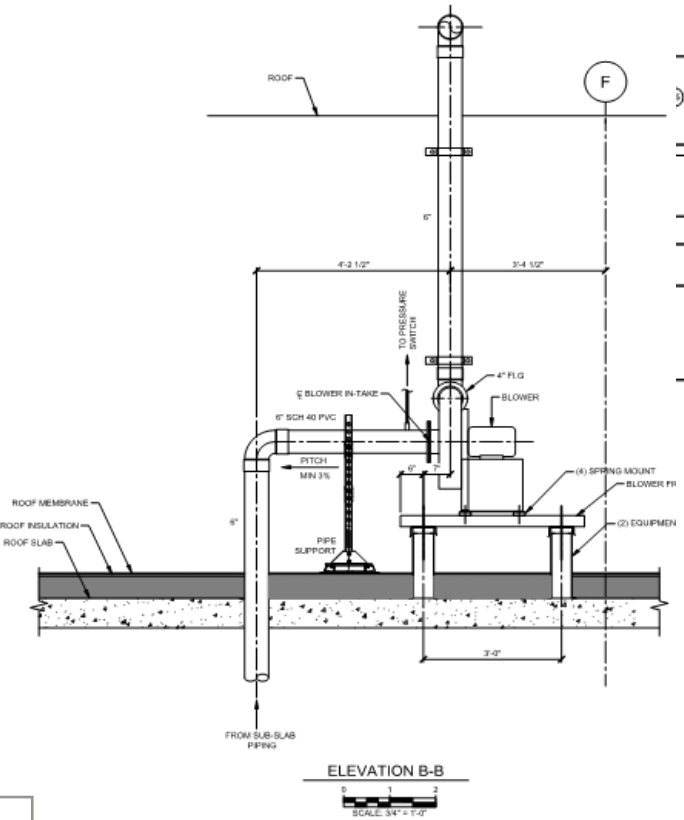
New · Full Foundation

During Design & Construction

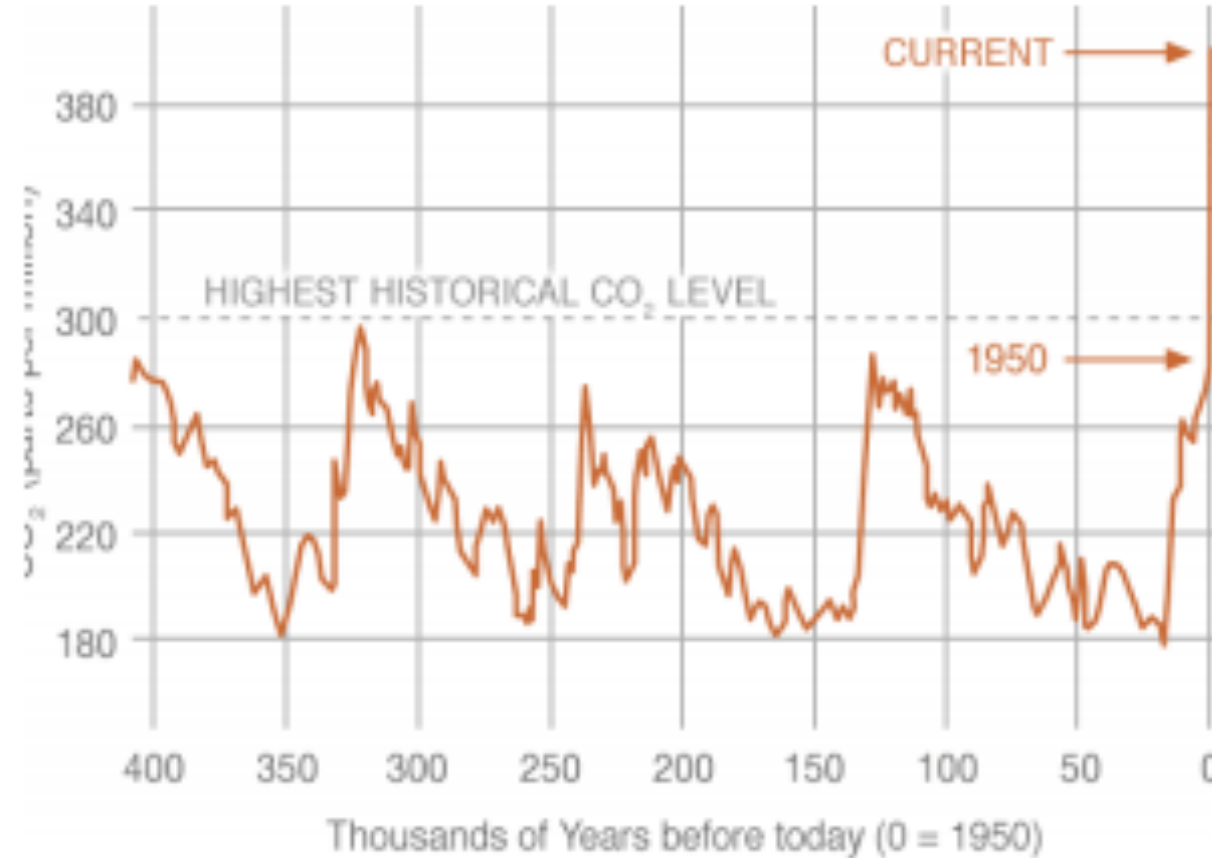


Radon Mitigation Plans

1. ALL COMPONENTS SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS AND THE NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) 969 STANDARD FOR THE INSTALLATION OF EXHAUST SYSTEMS.
2. INSTALL ALL SYSTEM COMPONENTS IN ACCORDANCE WITH ALL APPLICABLE MASSACHUSETTS BUILDING CODES.
3. BLOWER: RADIAL BLADED PRESSURE BLOWER BY CHINCOTTI FAN HP SERIES 8, MODEL HP-4417, ARRANGEMENT 4, TOP HORIZONTAL DISCHARGE, MOTOR: 3 HORSEPOWER, 3000 RPM, 480V, 3 PHASE, 208 TOU, PREMIUM EFFICIENCY, FRAME 180T, CAPACITY: 500 CFM AT 30 INCHES WATER COLUMN STATIC PRESSURE AT STANDARD CONDITIONS. BLOWER SHALL BE TEST RUN AT FACTORY BEFORE SHIPPING. THE FOLLOWING MANUFACTURER ACCESSORIES SHALL BE INCLUDED: 1\"/>
- 4. BLOWER FRAME: DESIGN AND EQUIPMENT TO BE PROVIDED BY CONTRACTOR. GALVANIZED STEEL 6 GAUGE (MINIMUM) 300 LB LOAD CAPACITY (MINIMUM). MOTOR AND BEARING VIBRATION LEVELS SHALL NOT EXCEED 1.5 MILS DISPLACEMENT AT 200 RPM.
- 5. SUBMIT SHOP DRAWING OF BLOWER FRAME ASSEMBLY FOR APPROVAL.
- 6. PROVIDE VARIABLE FREQUENCY DRIVE (VFD) WITH NEMA 4 ENCLOSURE, COMPATIBLE WITH THE BLOWER. INTERLOCK THE BLOWER VFD TO THE BUILDING FIRE ALARM SYSTEM, TO SUSPEND ELECTRICAL POWER TO THE BLOWER DURING AN ACTIVE FIRE ALARM. INSTALL VFD ON BLOWER FRAME, OR ALTERNATIVELY ON EXTERIOR WALL OF ELECTRICAL ROOM.
- 7. PROVIDE SHUTOFF SWITCH ON THE BLOWER FRAME FOR THE BLOWER ELECTRICAL SUPPLY, WITH LOCK-OUT/TAG-OUT CAPABILITY. PROVIDE OUTDOOR 115V DUPLEX RECEPTACLE ON THE BLOWER FRAME.
- 8. CONNECT BLOWER TO VFD, AND VFD AND DUPLEX RECEPTACLE TO ROOFTOP ELECTRICAL RACKS-RISERS PANELS.
- 9. ALL ROOFTOP ELECTRICAL EQUIPMENT SHALL BE RATED FOR CONTINUOUS EXPOSURE OR PROTECTED IN ENCLOSURES DESIGNED FOR OUTDOOR USE.
- 10. PRESSURE SWITCH: NEGATIVE AIR PRESSURE SENSING SWITCH, FIELD ADJUSTABLE SETPOINT RANGE FROM 1.0 TO 1.07 IN. C. C., MAX. VACUUM RATING 1.0 PSB (MINIMUM), OPERATING TEMPERATURE RANGE -40F TO 100F, NEMA 4 ENCLOSURE. CONNECT PRESSURE SWITCH OUTPUT TO BMS ROUGH-IN.
- 11. HORIZONTAL PIPE SUPPORT: DURA-BLOWER BR. 20 SERIES, OR EQUIVALENT.
- 12. INSULATE ALL EXTERIOR PIPING WITH OUTDOOR RATED, CLOSED CELL FOAM PIPE INSULATION, MINIMUM ONE INCH THICK, WITH A WEATHERPROOF AND UV RESISTANT JACKET OR FINISH, WITH 6\"/>
- 13. ALL PIPING SHALL USE LONG RADIUS FITTINGS UNLESS OTHERWISE NOTED, OR APPROVED IN ADVANCE BY ENGINEER.



Provide Efficient HVAC



HISTORY OF ATMOSPHERIC CO₂


SOURCE: NOAA

Provide Efficient HVAC



MERV RATING CHART

14						tic media, 12-36 in. deep, 6- ockets
13						Filter- Rigid Style Cartridge 6 to 12" deep may use or paper media.
12						Filter- Nonsupported fine fiberglass or etic media, 12-36 in. deep, 6- ockets
11						
10						Filter- Rigid Style Cartridge 6 to 12" deep may use or paper media.
9						
8	30-35%	>90%	3.0-10.0 pm Particle Size	Commercial Buildings		Filtered Filters- Disposable, extended surface area, thick with cotton-polyester blend media

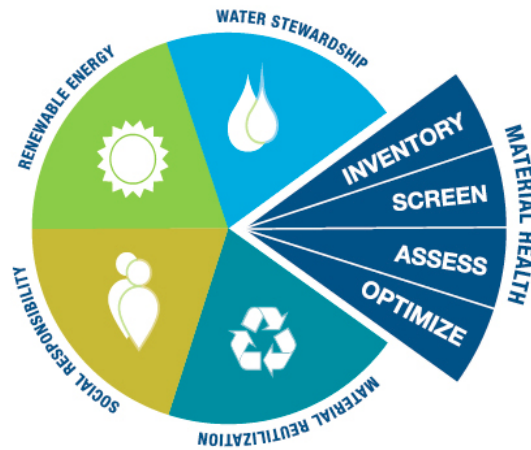


Avoid Chemicals of Concern



- Asbestos
- Cadmium
- Chlorinated Polyethylene & Chlorosulfonated Polyethylene
- Chlorofluorocarbons (CFCs)
- Chloroprene (Neoprene)
- Formaldehyde (added)
- Halogenated Flame Retardants
- Hydrochlorofluorocarbons (HCFCs)
- Lead (added)
- Mercury
- Petrochemical Fertilizers and Pesticides
- Phthalates
- Polyvinyl Chloride (PVC)
- Wood treatments with Creosote, Arsenic or Pentachlorophenol

Avoid Chemicals of Concern



Declare.



Avoid Chemicals of Concern



Assembly	Component	Location	Occupant Exposure	Materials to Avoid	Concerns	Alternatives	Brand
<u>Foundation</u>	Concrete	Exterior	Negligible		Cement: CO2 & heavy metal emissions, airborne pollution, quarrying	Superior Wall (extruded polystyrene foam insulation)	
	Waterproofing	Exterior	Negligible		Styrene-butadiene (possible carcinogen)	Drainage Boards/Mats	
	Drainage Mat	Exterior	Negligible				
	PVC Drainage	Exterior	Negligible	Polyvinyl Chloride (PVC)	Manufacturing Concerns		
	Masonry	Exterior	Negligible				
	Masonry Ties	Exterior	Negligible				
<u>BG Walls</u>	Slab Insulation	Interior	Negligible	EPS, XPS, Polyiso	(MDI) methylene diphenyl diisocyanate	Cellular Glass Insulation	FoamGlas
	Studs	Interior	Moderate				
	Insulation	Interior	Moderate	Spray Foam Insulation	Isocyanates, MDI, polyols (catalysts)	mineral wool	
	Drywall	Interior	Certain	paper faced	mold/moisture	paper-less board	Dense Shield
	Drywall Sealant	Interior	Certain		toluene diisocyanates (TDIs)	California Air Resources Board (CARB) compliant	

Avoid Chemicals of Concern



Assembly	Component	Location	Occupant Exposure	Materials to Avoid	Concerns	Alternatives	Brand
<u>Floor</u>	Floor Joists	Interior	Moderate		Urea Formaldehyde Binders	Methal diisocyanate (MDT), Phenol-resorcinol Formaldehyde	Timberstrand
	Floor sheathing	Interior	Moderate	OSB	Formaldehyde	HPVA compliant (meets CARB)	Plywood, AdvanTech
	Subfloor Sealant	Interior	Certain		toluene diisocyanates (TDIs)	California Air Resources Board (CARB) compliant	Armstrong
	Rim Joist Insulation	Interior	Moderate	Spray Foam Insulation	Isocyanates, (MDI) methylene diphenyl diisocyanate; polyols (catalysts)	blown fiberglass w/ low VOC sealant	Johns Manville, Knauf
<u>AG Walls</u>	Cavity Insulation	Interior	Moderate	Spray Foam Insulation	Isocyanates, MDI, polyols (catalysts)	blown fiberglass w/ low VOC sealant	Johns Manville, Knauf
	Continuous Insulation	Exterior	Negligible	EPS, XPS, Polyiso	MDI	mineral wool	Insulated ZIPS
	Sheathing/Air Barrier	Exterior	Negligible	Particle Board	Binders	Hardwood sheathing	ZIPS
	Drywall	Interior	Certain	paper faced	mold/moisture	paper-less	

Avoid Chemicals of Concern



Assembly	Component	Location	Occupant Exposure	Materials to Avoid	Concerns	Alternatives	Brand
<u>Roof</u>	Rafters	Interior	Moderate				
	Sheathing	Exterior	Negligible			Hardwood sheathing	ZIPS
	Cavity Insulation	Interior	Moderate	Spray Foam Insulation	Isocyanates, (DMI) methylene diphenyl diisocyanate; polyols (catalysts)	blown fiberglass w/ low VOC sealant	
	Continuous Insulation	Exterior	Negligible	EPS, XPS, Polyiso	MDI		
	Ice & Water Shield	Exterior	Negligible	Petroleum, Asphalt	polynuclear aromatic compounds (PACs) Possible Carcinogen		
	Roofing	Exterior	Negligible	Asphalt	PACs		
	Penetration Sealant	Exterior	Moderate				
<u>DHW</u>	Pipe	Interior	Certain		ethyltertbutyl ether (ETBE)	NSF's Standard 61 tested PEX	
	Insulation	Interior	Moderate			low VOC	Armacell

What Determines Health Outcomes?



It's not your genetic code...

it's your zip code!

Source: <https://www.cdc.gov/nchhstp/socialdeterminants/faq.html>

- >5%** Genetics/biology
- ~20%** Lifestyle/behavior
- ~20%** Medical care
- ~55%** Physical & social environment

Health and Well Being



Top Places to Live

Health and Well Being



Dirtiest Places to Live

Solutions



Mineral Wool



Foam Glass



CARB Compliant

Solutions

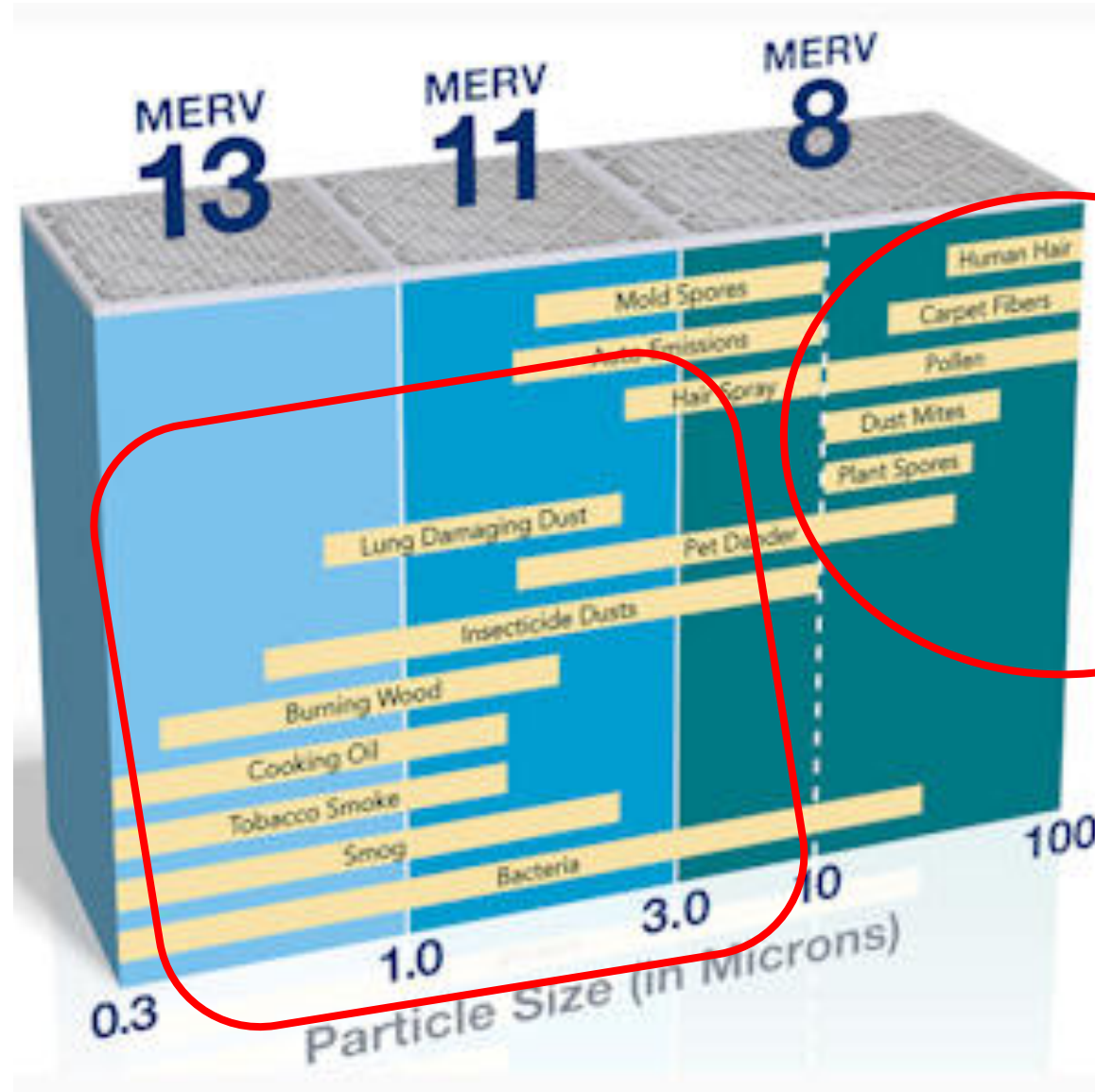


Energy Recovery Ventilation

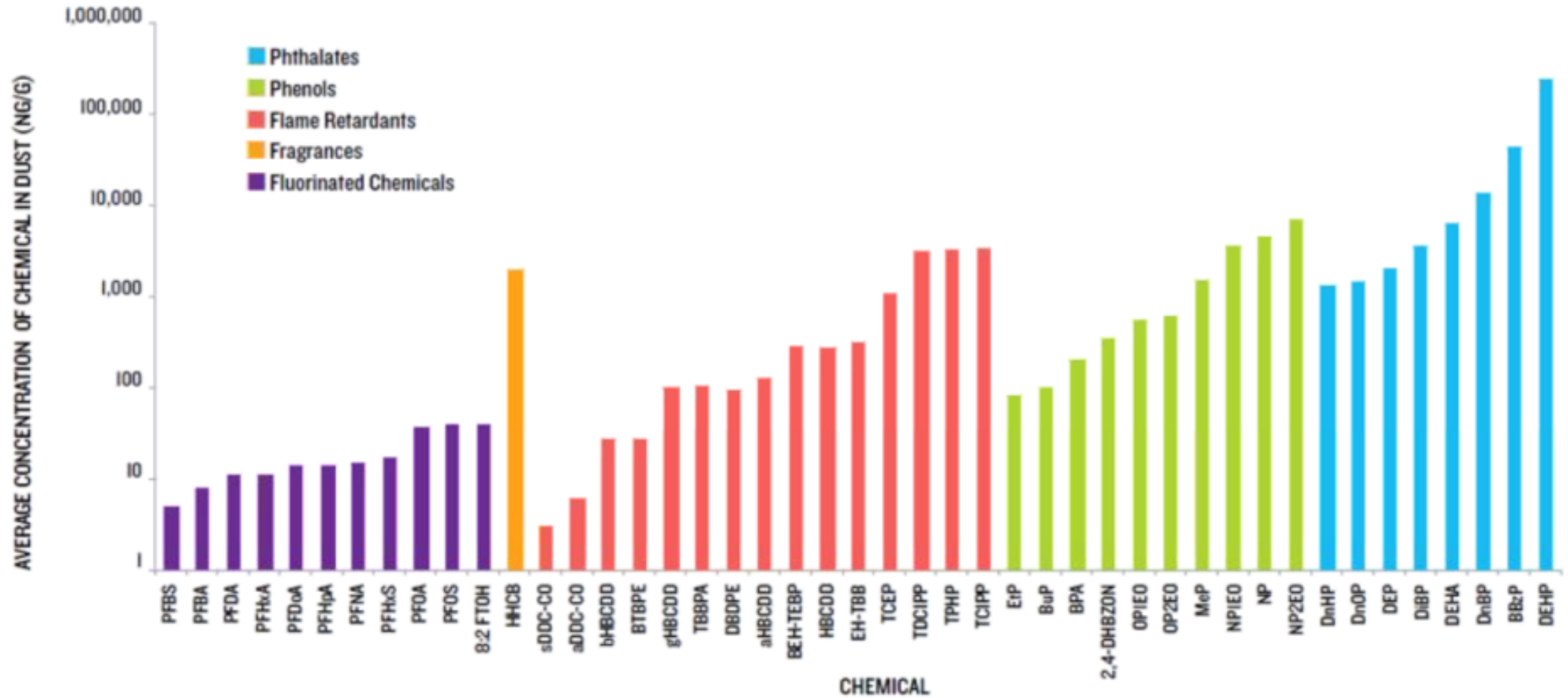


Ductless Mini-Split

Solutions



Because it's Not Just Dirt

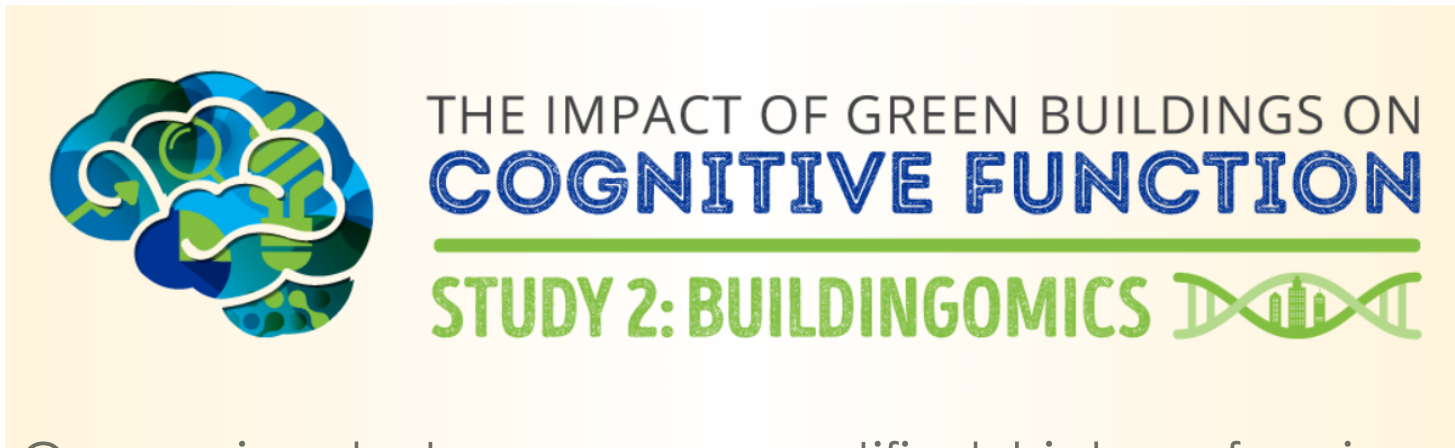


Average (geometric mean) dust levels in nanograms of chemical per gram of dust for the 45 chemicals reported in at least three data sets. The average concentration of DEHP is about 45,000 times higher than PFBS.

Solutions



- 61% higher in green building conditions
- 101% higher in enhanced green building conditions
- 26% higher cognitive function scores
- slept better
- reported fewer health symptoms



Comparison between green certified, high performing buildings & similar high performing building not green certified

<http://naturalleader.com/thecogfxstudy/>

In Summary



- Identify and avoid chemicals of concern
- Good indoor air quality begins at design development
- Balanced, intentional, filtered ventilation is imperative
- Use research to make change



QUESTIONS?

OUR BUILDINGS . . .
OUR HEALTH