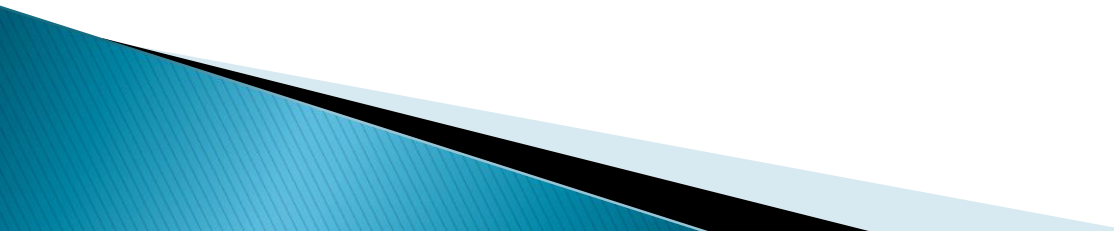


# The Importance of Indoor Air Quality When Building Energy Efficient Homes

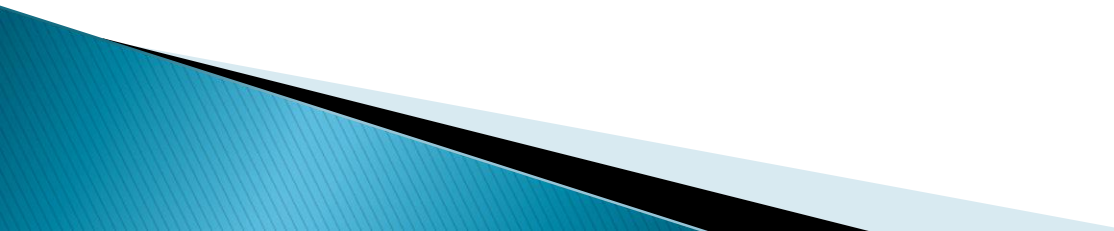
John Warren,   
SkyeTec Environmental



# Objectives

- ▶ Energy Efficiency Measures & the Impact on IAQ
  - ▶ Moisture Control & Prevention
  - ▶ Best Practices & Documentation
  - ▶ Liability Protection
- 

# EE Guidelines

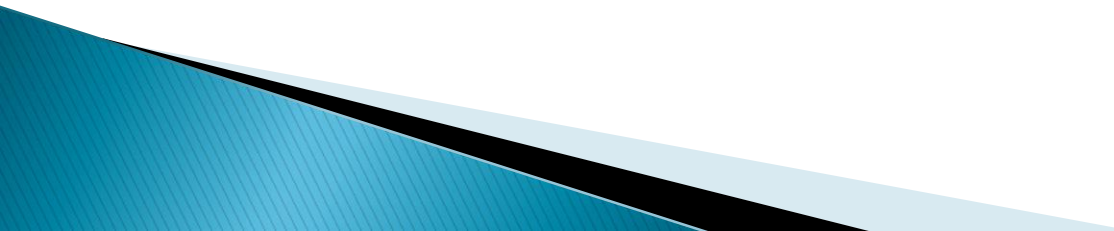
- ▶ ENERGY STAR<sup>®</sup> Certification
  - ▶ EPA Indoor airPLUS<sup>®</sup>
  - ▶ NAHB / NGBC
  - ▶ Local Building Codes
- 

# The Question...

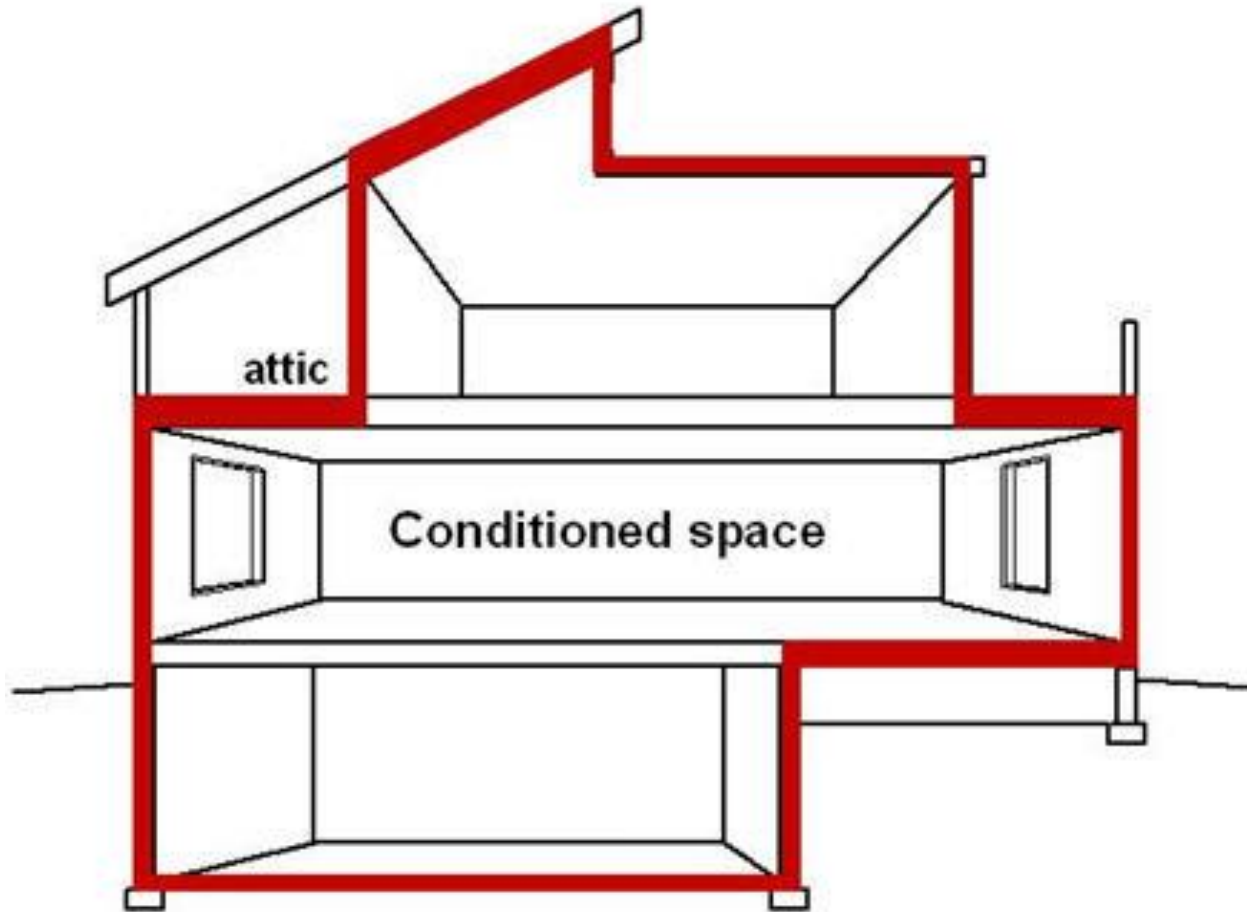
Energy Efficiency?

or

IAQ?



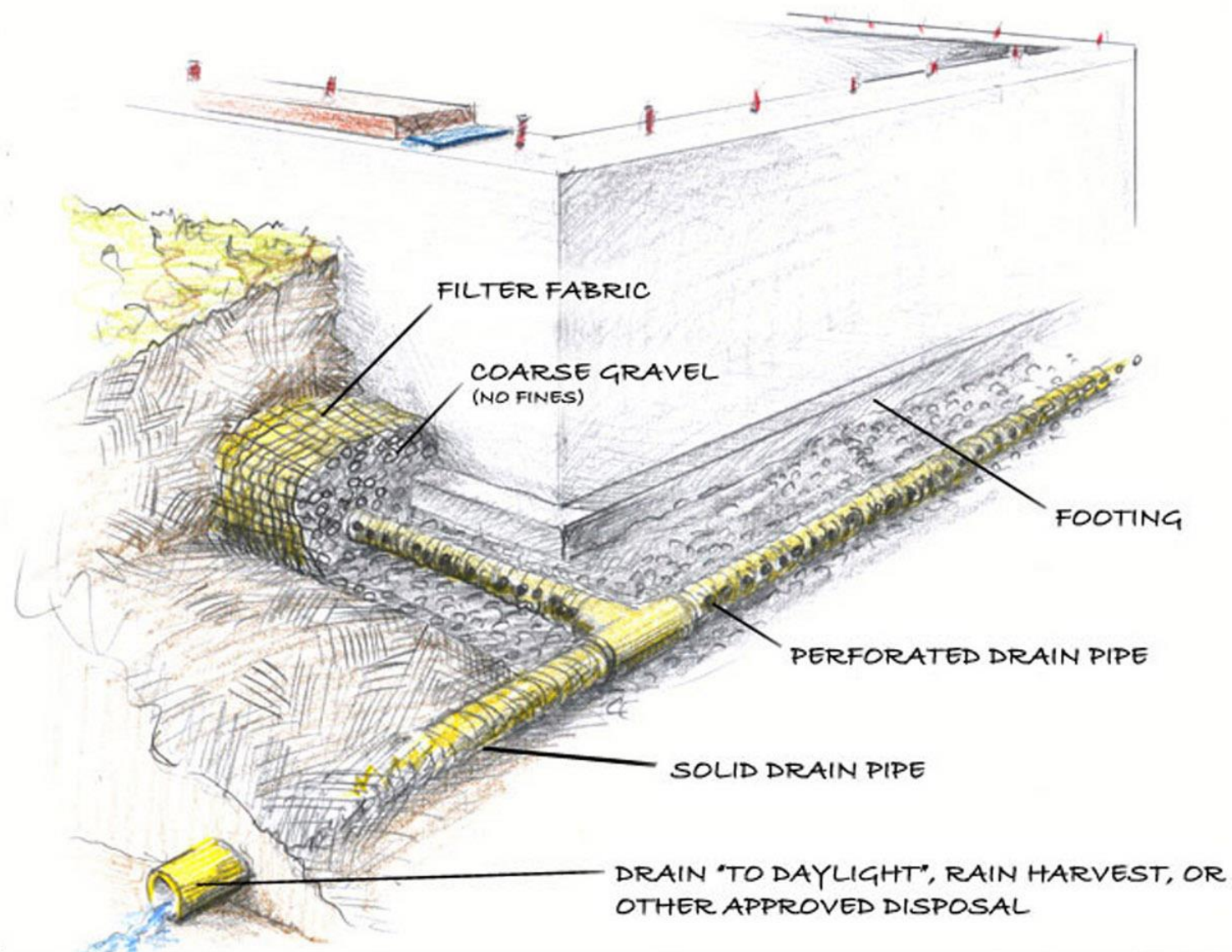
# Thermal Envelope



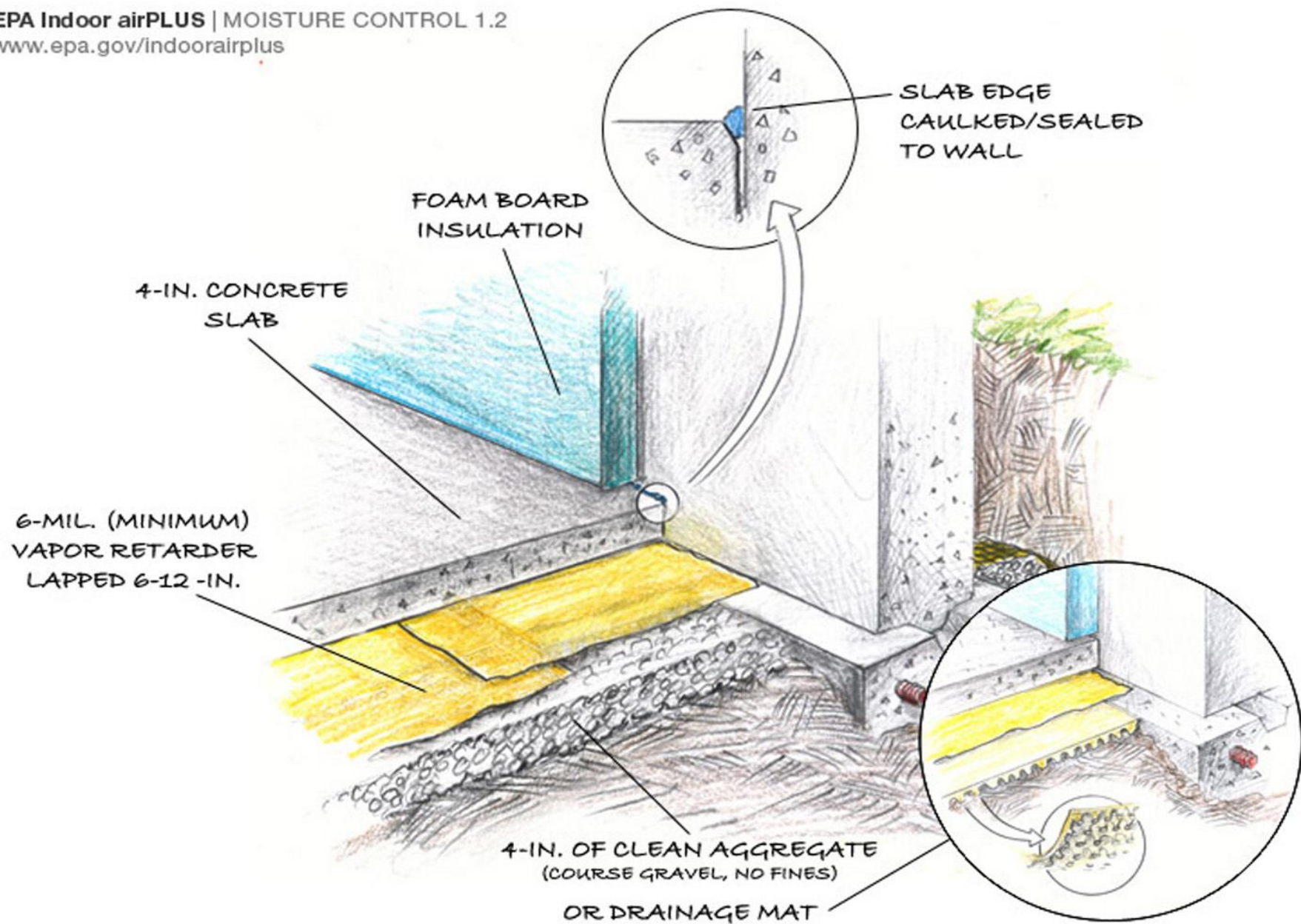
# Energy Efficiency Measures

## Caulking & Sealants

- ▶ Foundation Drains
- ▶ Floor/slab/foundation
  - Penetrations
  - Vapor Barrier



FOUNDATION DRAINAGE PIPES-"TO DAYLIGHT"



BASEMENT SLAB W/ CAPILLARY BREAK - GRAVEL AND GEOTEXTILE MAT (INSET)

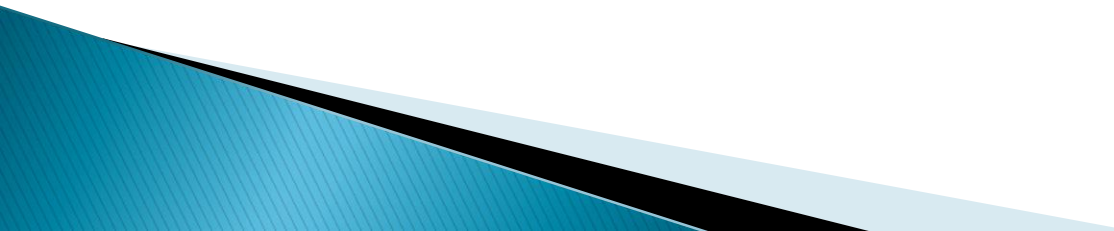


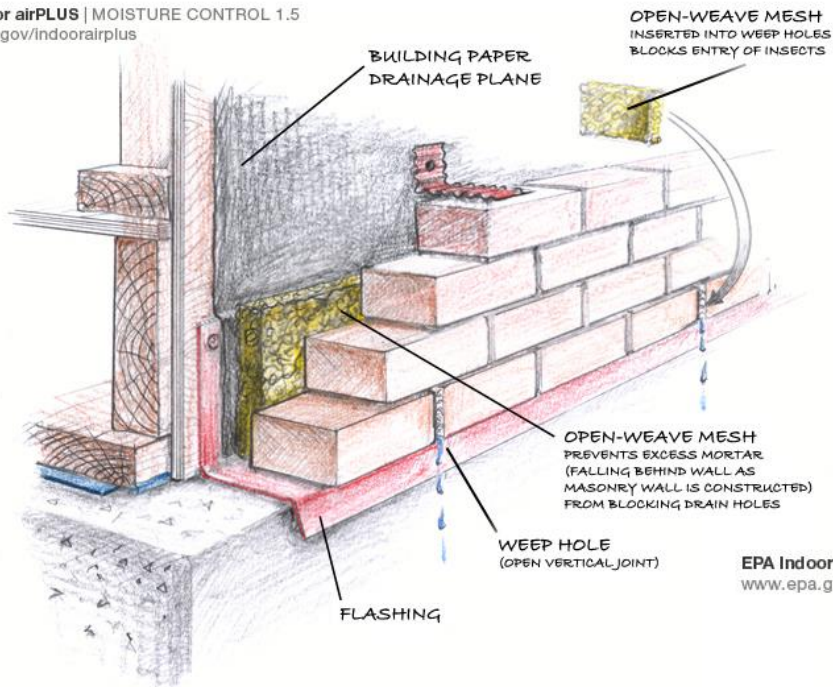
# Energy Efficiency Measures

## Exterior Walls

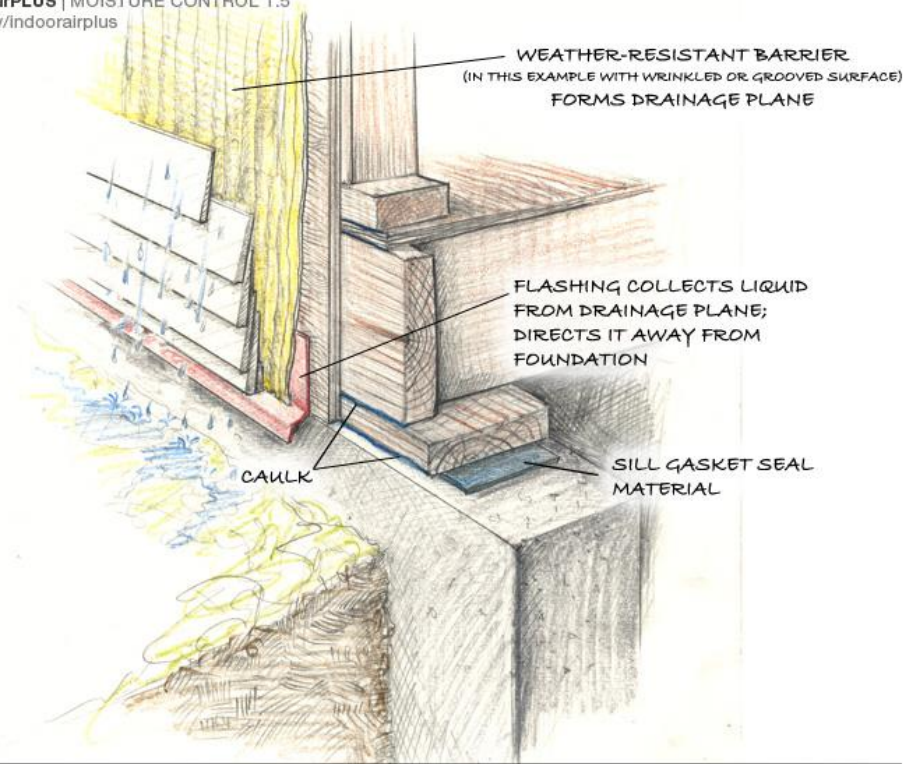
- ▶ Tape & seal sheathing
- ▶ Drainage plane
- ▶ Caulk sill plates
- ▶ Foam insulation

## Roofing

- ▶ Penetrations sealed
  - ▶ Secondary water barrier
  - ▶ Proper flashing
  - ▶ Foam insulation
- 



MASONRY WALL WITH DRAINAGE PLANE, FLASHING, AND WEE



DRAINAGE PLANE AND DRIP-EDGE FLASHING WITH WOOD HORIZONTAL SIDING





WALL USE ONLY ESR-1474

WALL USE ONLY ESR-1474

WALL USE ONLY ESR-1474

WALL USE ONLY ESR-1474

WALL USE ONLY ESR-1474

WALL USE ONLY ESR-1474

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WALL USE ONLY ESR-1474

# Exterior Walls





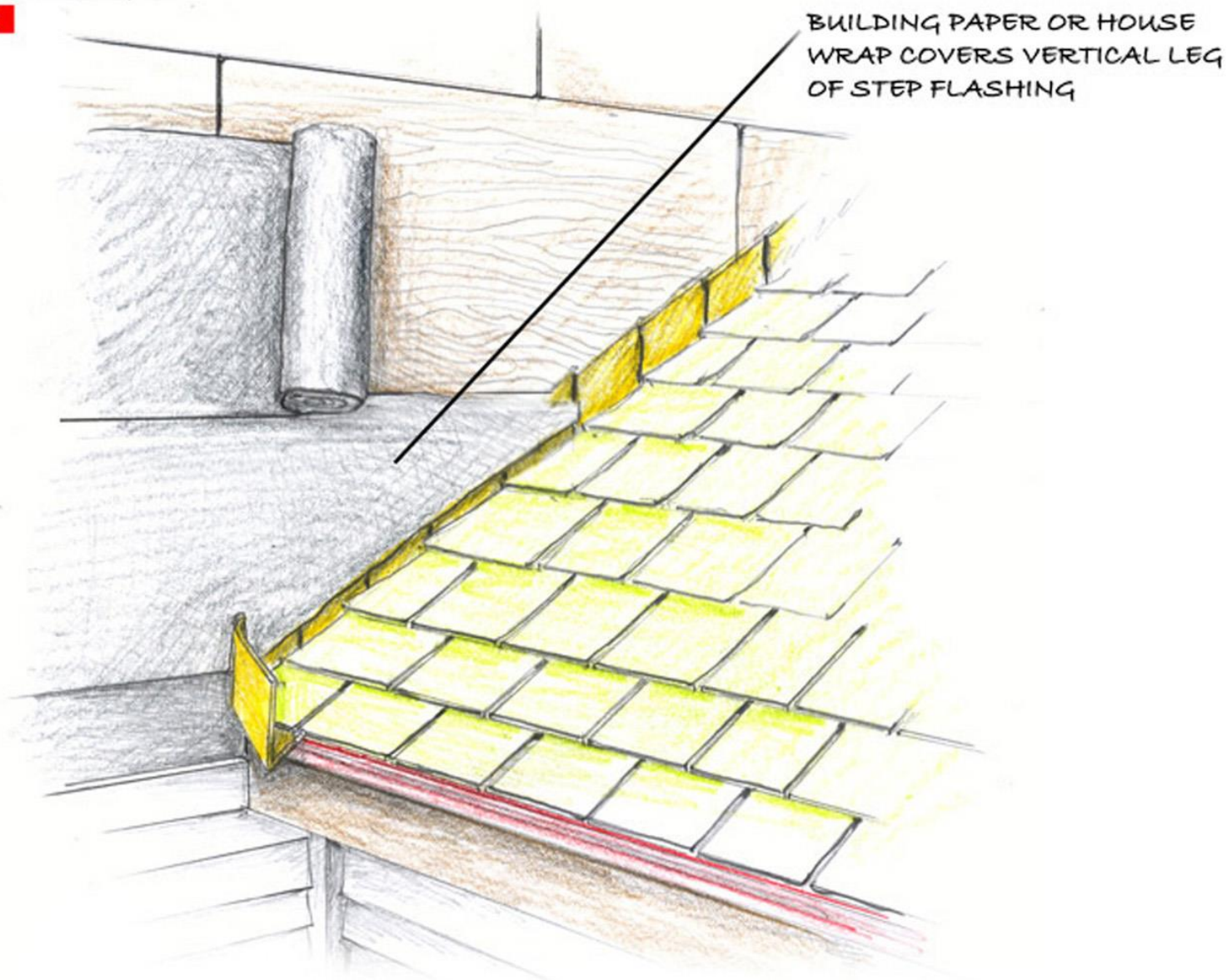
# Roofing







**STEP 3 OF 3**



DRAINAGE PLANE MATERIAL COVERS STEP FLASHING



# Energy Efficiency Measures

## Ductwork

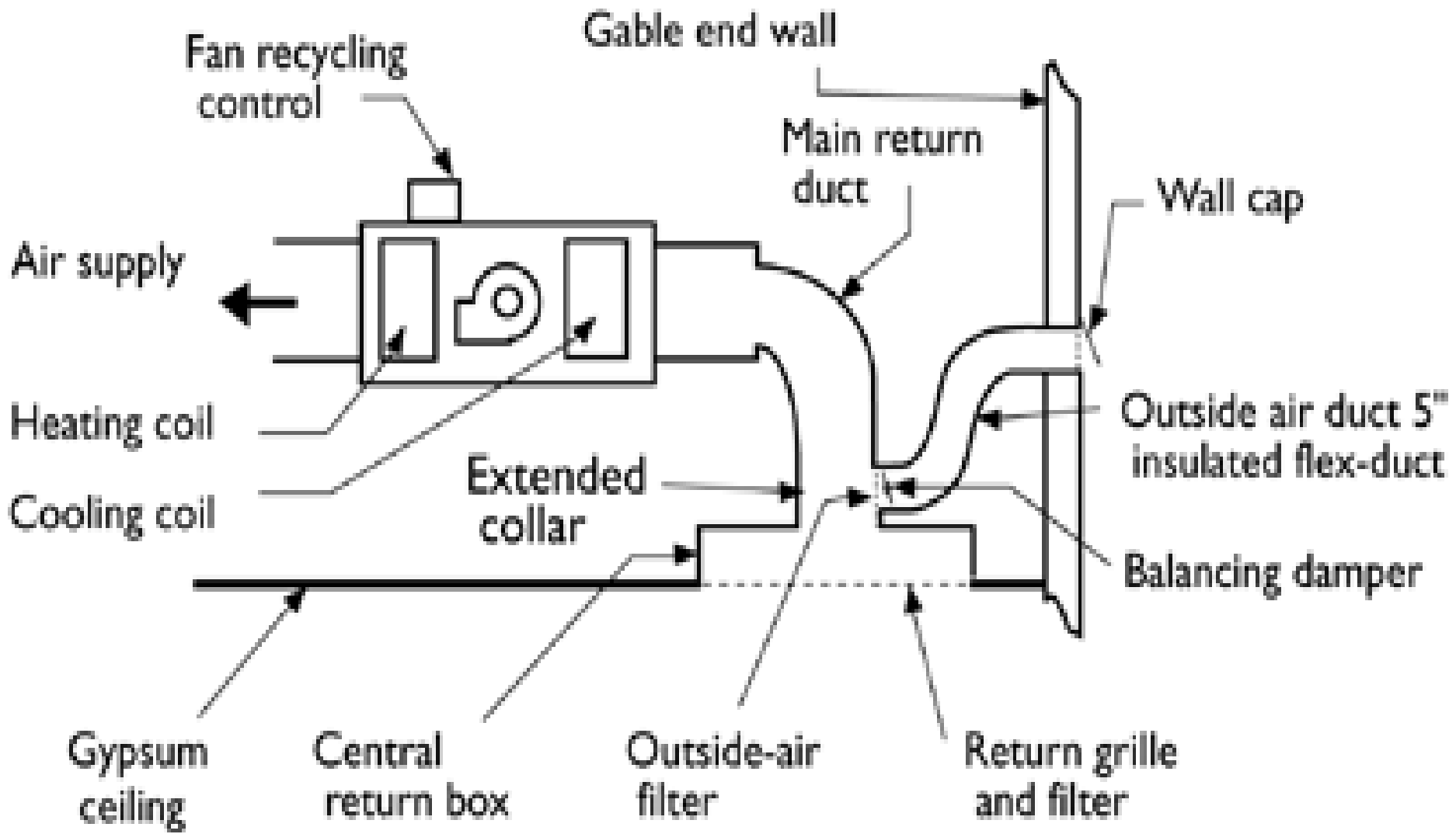
- ▶ Tape & seal
- ▶ Tears & holes
- ▶ Kinked or crushed flexible duct
- ▶ Protect ductwork

## Make-up Air

- ▶ (ES) Fresh air fan installed on return side
- ▶ Climate conditions









# General Measures

## Site Drainage

- ▶ Structural Wood Frame
- ▶ Keeping in-place material dry
- ▶ Lumber Yard Mold
- ▶ What do you do?

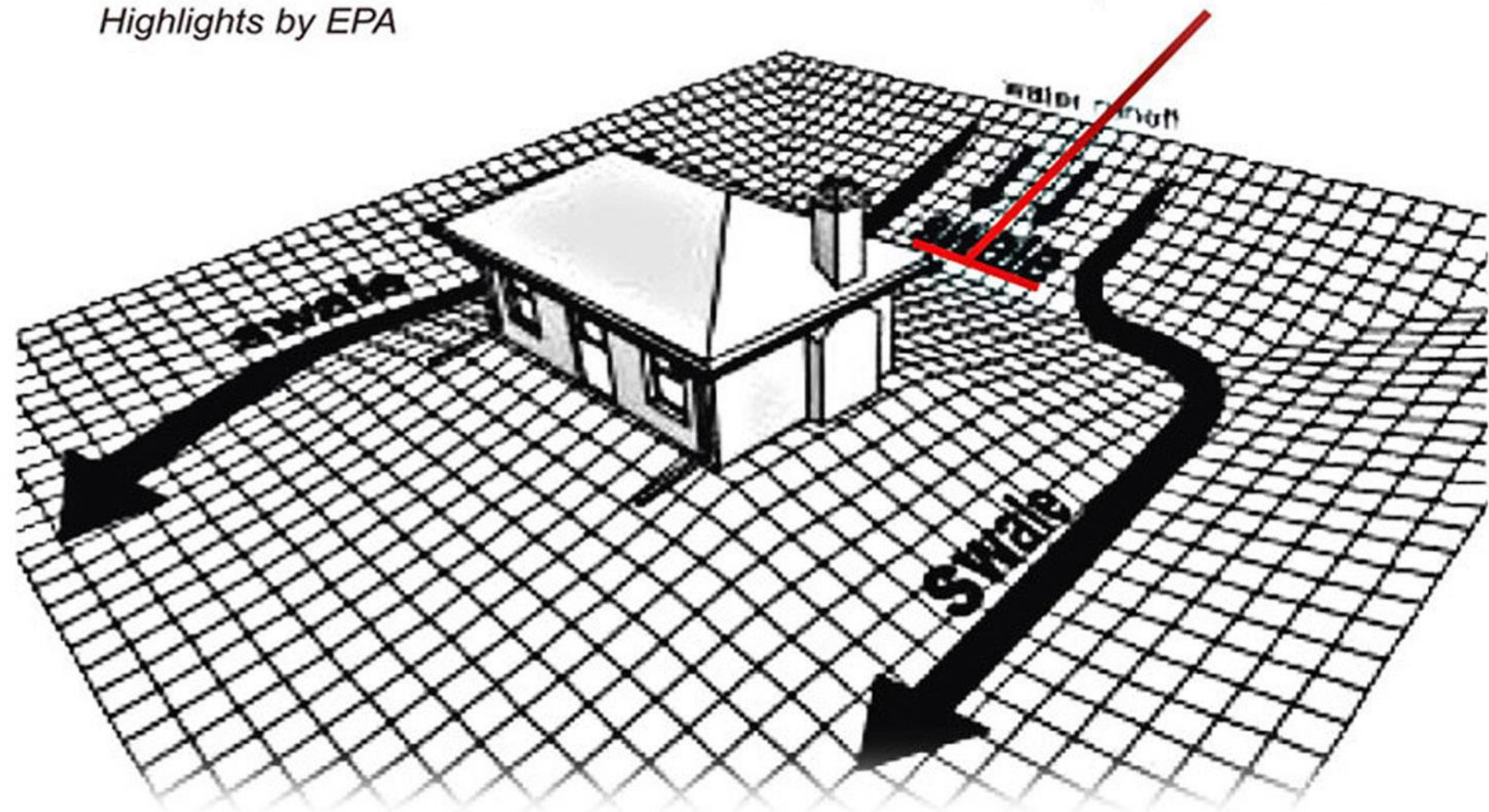
## Stored Material





*Highlights by EPA*

*Where setbacks limit space to less than 10 feet, provide swales or drains designed to carry water from foundation*



BUILDING SITE DRAINAGE



EXTREME

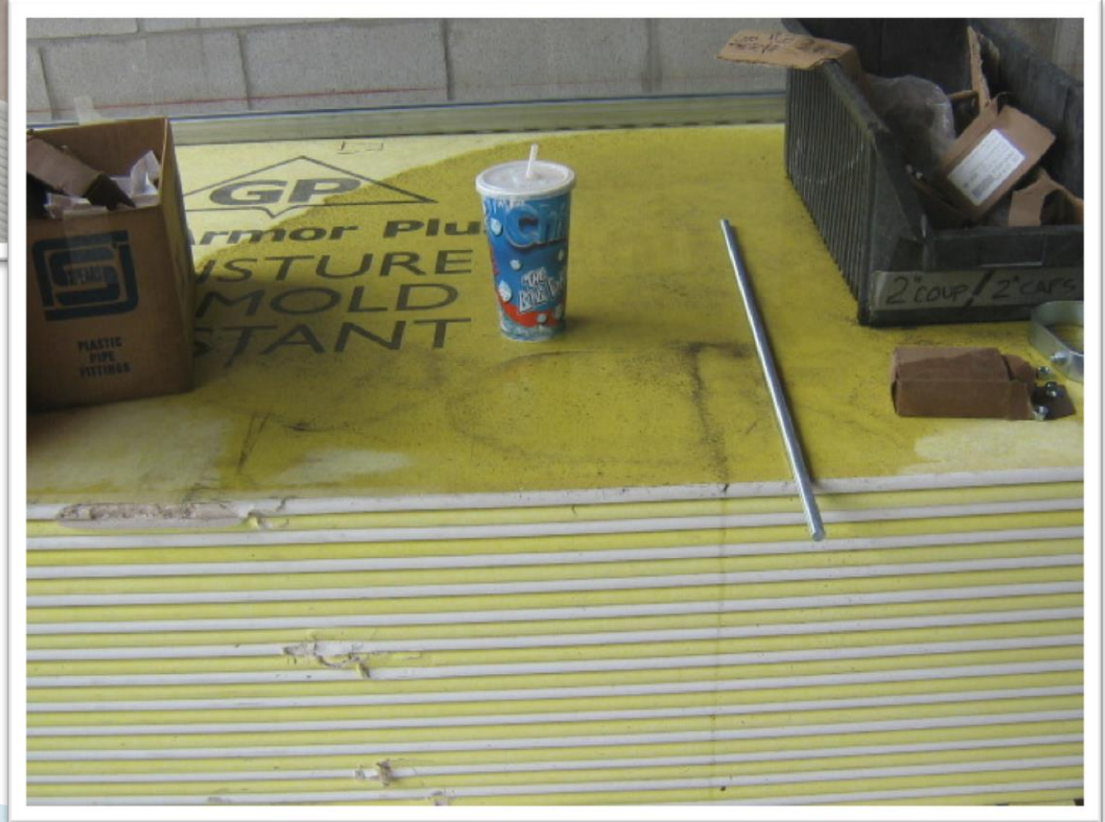
19.8

MODE ON OFF



ON

SPK. No. 2  
DIN 120

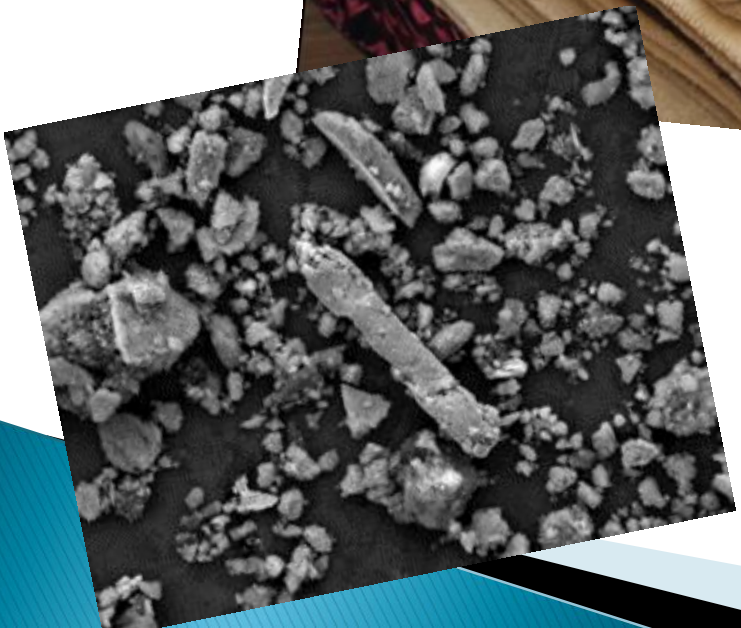
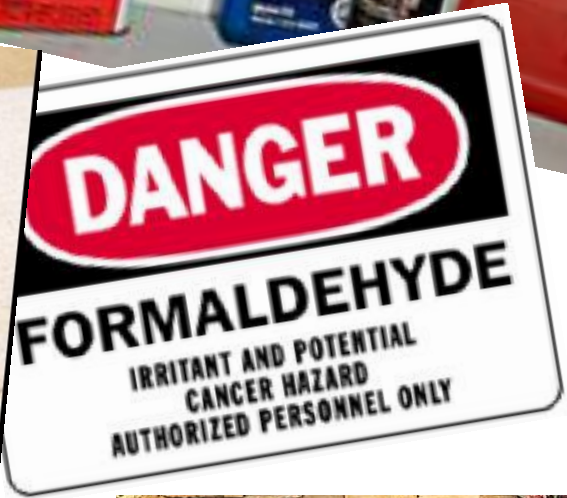


# Stored Material



# Most Common IAQ Issues

1. Dust & Dirt
2. VOC's
  - Formaldehyde
  - Chemicals/Pesticides
  - Combustion Gases
  - Radon



# Most Common IAQ Issues

- ▶ Dust & Dirt
  - ▶ VOC's
  - ▶ Formaldehyde
  - ▶ Chemicals/Pesticides
  - ▶ Combustion Gases
  - ▶ Radon
  - ▶ **MOLD**
- 



# Moisture Control & Prevention

Mold growth occurs because of moisture intrusion, so..... how do moisture issues happen?

- ▶ Outside-leaks in walls, roofs, and floors
- ▶ Inside-plumbing
- ▶ HVAC- filtration, condensation
- ▶ Both during and after construction

***So what can you do??***



# Moisture Control & Prevention

*“An ounce of prevention is worth a pound of cure.”*

## Quality Assurance Inspections

- ▶ Periodic Site Visits
  - ▶ Document Consistency
  - ▶ Reduce Risk & Liability
- 

# Documentation

- ▶ Pre-Work Meeting onsite
- ▶ Perform QA inspections throughout the project
- ▶ Use 3<sup>rd</sup> party trained analysts
- ▶ Objective reporting
  - Concise checklist reports
  - Database of items grouped by sub trade
  - Punchlist capability

# Quality Assurance Inspections

## Rough-In Inspection

Identify conditions prior to cover-up that may lead to future issues.

- ▶ Plumbing
- ▶ HVAC
- ▶ Floor penetrations
- ▶ Wall penetrations
- ▶ Stocked materials











(C) 2006-1991 Daniel Friedman







# Quality Assurance Inspections

## Dry-In Inspection

After Dry-in, determine status of interior moisture content, exterior air infiltration and possible leaks using Infrared Thermal Imaging.

- Interior/ Exterior Wall Cavity
- Cabinets/Trim
- Plumbing Connections
- Moisture Content
- Temperature & Humidity
- Maintain Air Circulation



# Equipment





61.6<sup>+</sup>

71.7<sup>+</sup>

70.0<sup>+</sup>

74.6 °F



64.9



big-a-direct





# Quality Assurance Inspections

## Final Inspection

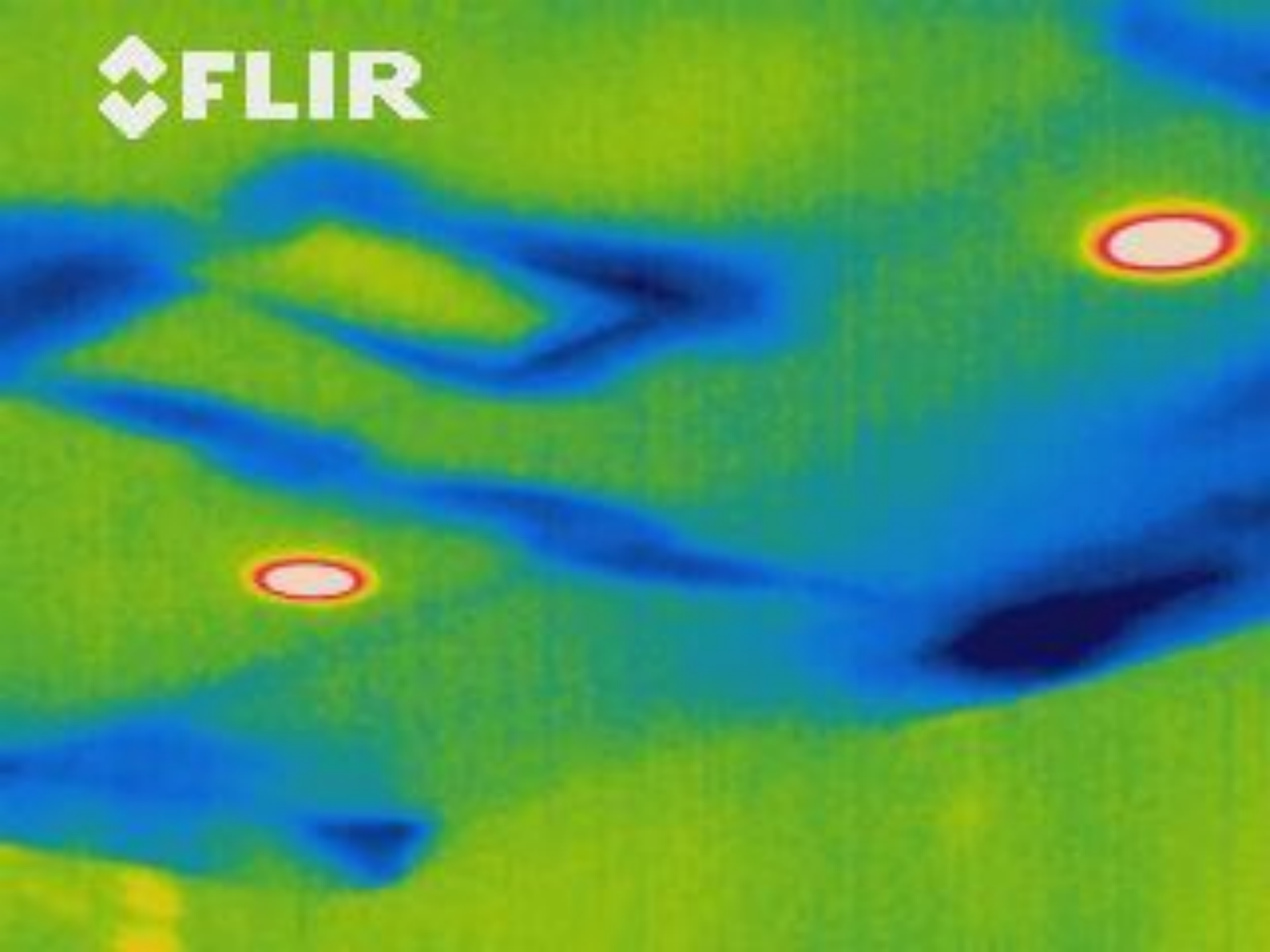
Visually inspect interior and exterior walls utilizing Infrared Thermal Imaging. Check for leaks in plumbing connections and confirm HVAC system function.



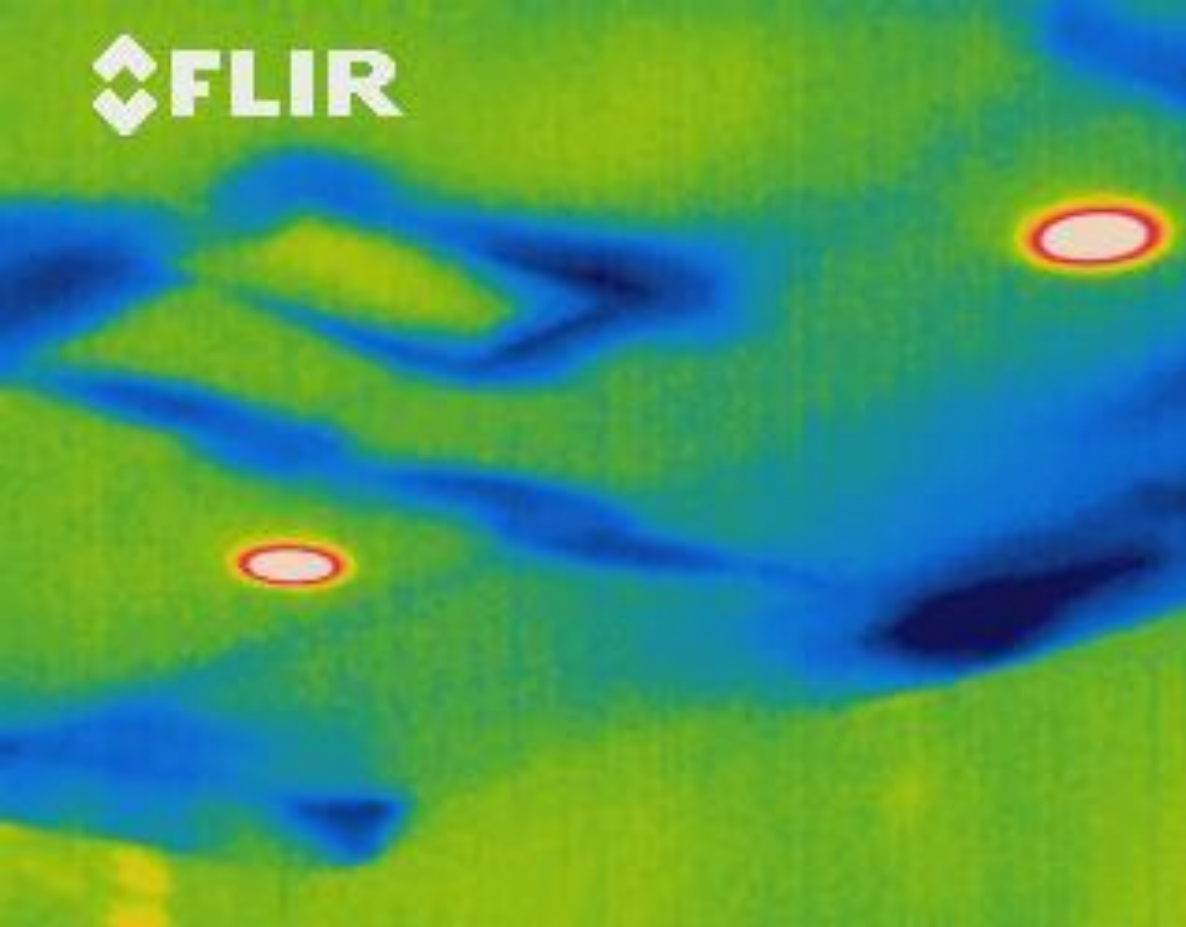
- Plumbing
- HVAC
- Interior/ Exterior Walls
- Appliances/Equipment



 **FLIR**



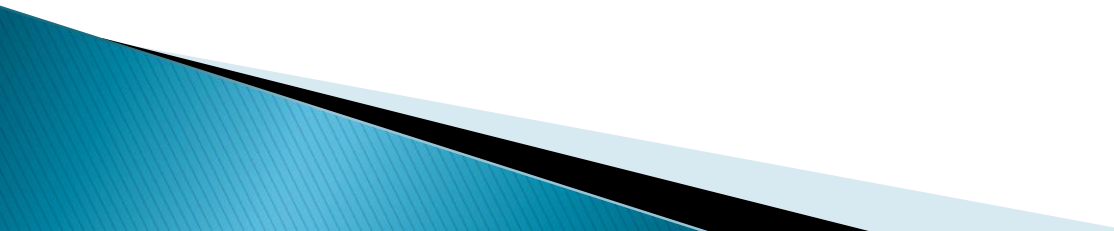
 FLIR







# Documentation

- ▶ Clear, concise reports
  - ▶ Consistency
  - ▶ Specific location
  - ▶ Responsible party/ document
  - ▶ Follow-up inspections
- 

Thursday, July 20, 2006

South Atlantic Avenue  
Daytona Beach Shores, FL 32118

**Property:**  
OV 402

Daytona Beach Shores, FL 32118

Findings Report:

**Date** 7/6/2006  
**Assignment** #114778  
**Service** Certification w/ Infrared  
**Weather** Clear  
**Results** Failed  
**Notes**

Failure(X)	Area	Category	Trade	Description	Notes
	Bath #3	Tub	Plumbing	Tub spout not sealed	
	Entry/Foyer	Interior Wall Surface	Plumbing	Wall penetrations not sealed	
	Bedroom #3	Window	Painting	Window frame not sealed to drywall	
	Family Room	Window	Painting	Window frame not sealed to drywall	
	Powder Bath	Sink	Plumbing	Pipe penetrations not sealed	
X	General Interior	HVAC - Heating, Ventilation, & Air Conditioning	HVAC	Elevated Relative Humidity above 60%	
X	Laundry-Utility	Washer/Dryer	Plumbing	Active supply leak	
X	Bath #3	Shower	Plumbing	Active supply leak	tub spout leaks from bottom when shower is on
X	Laundry-Utility	Sink	Plumbing	Active drain leak	
	Master Bath	Tub	Electrician	No electricity to item- unable to test	jets, plus on/off button stuck in
	Bath #2	Shower	Plumbing	Shower valve not sealed to tile	
	Bath #3	Shower	Plumbing	Shower valve not sealed to tile	
	Master Bath	Shower	Plumbing	Shower valve not sealed to tile	
	Master Bath	Shower	Tile	Shower/Tub tile corners not sealed	by ledge
	Master Bath	Tub	Tile	Shower/Tub tile corners not sealed	and around access panel not sealed
	HVAC Closet	HVAC - Heating, Ventilation, & Air Conditioning	Primary	Other	float switch stuck, could not test
	Bedroom #3	Window	Painting	Window sill not sealed to drywall	
	Master Bath	Shower	Plumbing	Shower head escutcheon not sealed	



**PLUMBING PUNCH LIST for the Period 6/4/2006 Through 8/4/2006**

JobSite	Finding	Area	Category	Note	Date	Sign-Off Initials
OV 307	Shower head escutcheon not sealed	Master Bath	Shower			
OV 308	Shower head escutcheon not sealed	Master Bath	Shower			
OV 308	Shower head escutcheon not sealed	Bath #2	Shower			
OV 308	Shower head escutcheon not sealed	Bath #3	Shower			
OV 308	Active supply line leak	Laundry-Utility	Washer/Dryer			
OV 401	Active overflow drain leak	Master Bath	Sink	left sink, from crack beneath bowl, dripping into cabinet		
OV 401	Active supply line leak	Laundry-Utility	Washer/Dryer			
OV 401	Shower head escutcheon not sealed	Bath #2	Shower			
OV 401	Shower head escutcheon not sealed	Master Bath	Shower			
OV 402	Shower head escutcheon not sealed	Bath #3	Shower			
OV 402	Active supply line leak	Laundry-Utility	Washer/Dryer			
OV 402	Active drain leak	Laundry-Utility	Sink			
OV 402	Active supply line leak	Bath #3	Shower	tub spout leaks from bottom when shower is on		



Environmental Solutions For Life

Tuesday, August 15, 2006

**Property:**

OV 402

Daytona Beach Shores, FL 32118

Daytona Beach Shores, FL 32118

Findings Report:

**Date** 8/14/2006

**Assignment** #120819

**Service** Follow-up

**Weather**

**Results** **Passed**

**Notes**

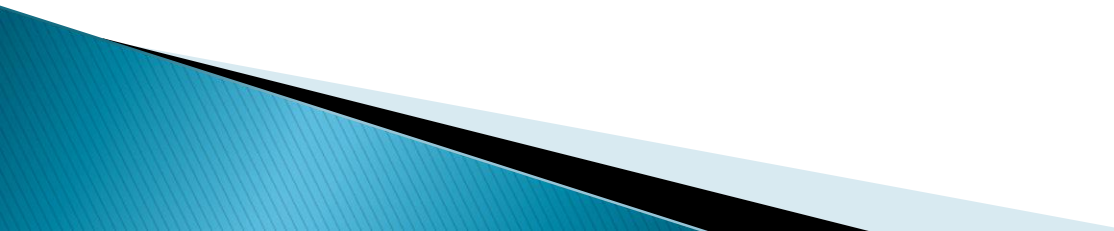
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Major(X)	Area	Category	Trade	Description	Notes
	Laundry-Utility	Sink	No Sub Needed	Follow Up Inspection - No conditions noted	
	Bath #3	Sink	No Sub Needed	Follow Up Inspection - No conditions noted	

# Case Study

- ▶ 79 unit, 11 story Condominium in Florida
- ▶ 3 weeks from Certificate of Occupancy

## **69 units Failed Inspection**

- 87% failure rate
  - 70% active water leaks in supply & drains
  - 40% high elevations of moisture in materials
  - 18% microbial growth
- 

# Mold Sampling

When is air sampling beneficial?

- ▶ Health effects reported
- ▶ Severely immuno-compromised persons occupy the building
- ▶ After remediation

Currently there are no EPA regulations or standards for airborne mold contaminants.

# Liability Issues

## Actual Damage

*Cost of materials*

*Loss of use*

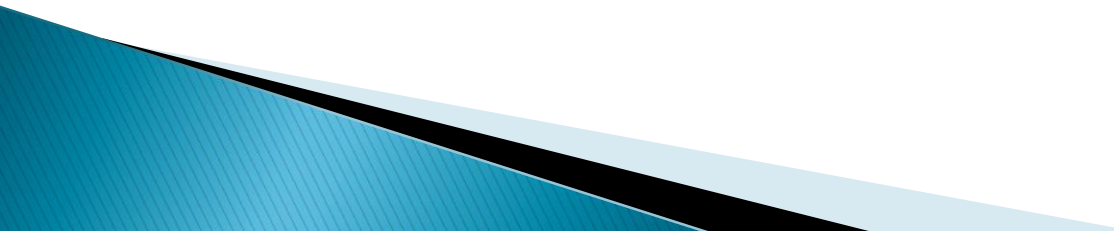
vs

## Punitive Damage

*Negligence*

*Bad Faith*

# Recap

- ▶ IAQ can be directly impacted by well-intentioned Energy Efficiency measures
  - ▶ Prepare & protect substrates
  - ▶ Look for specific items that may cause potential IAQ issues
  - ▶ Clear documentation for liability protection
- 

# Questions?

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*904/821-3144*

*[jwarren@skyetec.com](mailto:jwarren@skyetec.com)*