

Building Science 102

Beyond the Granite

Course Outline • 3-Hour Continuing Education

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Instructor Credentials

- GA State Licensed General Contractor (Residential)
- GA Certified Renovation Firm License (RRP)
- BPI – Certified Building Analyst
- Council – Certified Mold Remediation Supervisor, ACAC
- Certified Water Damage Restoration Technician, IICRC
- Certified HERS Rater, RESNET
- Certified Fire & Smoke Damage Restoration, IICRC
- NRPP Radon Measurement Provider
- Certified Applied Structural Drying Technician, IICRC
- Certified Odor Control Technician, IICRC

Introduction: What is Building Science?

Building Science studies the relationship of all building systems and their effect on:

- Energy Efficiency
- Moisture Management
- Indoor Air Quality (IAQ)

Building Science Services

- Mold Inspections & Remediation
- Radon Mitigation
- Lead Paint (Pb) Testing & Renovation
- Testing: Asbestos, VOCs, Carbon Monoxide & other contaminants
- General Contracting / Renovation

Module 1: Moisture Management & Indoor Air Quality

Frequently Asked Questions

- Is it THE Black Mold? Is it the toxic mold?
- Is it mold or mildew?
- If I dry it out, will it go away?
- What's that smell?
- Can mold make me sick?
- Do I have to throw my personal belongings away?
- Can I clean it myself?
- How do I identify a qualified mold specialist?

Mold Health Effects

- Most molds produce allergens
- Some molds produce mycotoxins (toxigenic)

- Allergenic / toxic response depends on:
 - Genetic predisposition
 - Degree of contamination
 - Length of exposure
- Per EPA/CDC: ~80% of children are allergic to mold
- Allergic responses: headache, sneezing, skin/nose/throat irritation, difficulty breathing, aggravated asthma, opportunistic infections in immunocompromised individuals

Mold Biology: The Fungi Kingdom

- Mold can be found almost anywhere
- Three ingredients required for mold growth:
 - Organic food source
 - Oxygen
 - Sufficient moisture
- Mold growth can ONLY be controlled by controlling moisture

Moisture Sources

- Vapor
 - High relative humidity (approx. 65%+)
 - Insufficient ventilation
 - Oversized HVAC systems
 - Georgia's climate
- Liquid
 - Plumbing leaks
 - HVAC condensate line leaks
 - Moisture intrusion: gutters/downspouts, improper grading, clogged foundation drains

Relative Humidity (RH) Explained

- RH = the amount of moisture in the air, relative to temperature
- The Psychrometric Chart: tool for visualizing air and moisture properties

Below-Grade Areas: Basements

- Common reasons for mold growth in basements:
 - No dehumidifier (recommended in every basement)
 - Improperly sized HVAC systems
 - Bulk water seepage through foundation walls
 - Older homes with no foundation drain; newer homes with malfunctioning drains

Crawl Spaces

- Traditional (vented) construction has been problematic for decades
- Characteristics of older vented crawl spaces:
 - Open exterior vents
 - 6-mil plastic sheeting on floor only
 - Insulation in the floor system above
 - HVAC/water heater often located in crawl space
 - No dehumidification or conditioning of air
- Sealed/Encapsulated crawl spaces (recommended):
 - Vapor barrier sealed to walls
 - Vents sealed

- Walls insulated
- Dehumidifier installed
- Up to 50% of air on the main level comes from the crawl space (Stack Effect + HVAC leaks)

Mold States

- Mold Spores: reproductive units, microscopic (2–20 microns), present in virtually all environments
- Active Mold Growth: sufficient moisture present for active colonization
- Dormant Mold: alive but not actively growing; still allergenic; can reactivate when moisture returns
- Dead Mold: cannot reproduce, but still allergenic

Mold Inspections & Remediation

- Inspect: identify moisture sources, assess contamination, define remediation scope
- Testing: air and surface sampling
- Remediation: physical removal per IICRC standards
- Prevention: moisture control and long-term solutions
- Water Damage Restoration

Common Misconceptions

- "Dry it out and the mold goes away" – FALSE
- "That's just mildew" – often incorrect
- "Just bleach it" – not effective for porous materials
- "It's just an old house smell" – may indicate active contamination
- "It's never hurt me before" – chronic exposure can cause cumulative harm

Module 2: Radon Measurement & Mitigation

Key Facts About Radon

- Colorless, odorless, tasteless – cannot be detected without testing
- Radioactive soil gas from the decay of Uranium
- Action levels: 2.5 pCi/L (some standards) & 4.0 pCi/L (EPA)
- Causes approximately 21,000 deaths/year in the U.S.; ~800/year in Georgia
- Second leading cause of lung cancer after smoking
- Results vary by home – neighbor's results are irrelevant to your home
- EPA recommends every home be tested

Radon Risk Table (EPA)

- 20 pCi/L: ~36 out of 1,000 smokers could develop lung cancer – FIX HOME
- 10 pCi/L: ~18 out of 1,000 – FIX HOME
- 8 pCi/L: ~15 out of 1,000 – FIX HOME
- 4 pCi/L: ~7 out of 1,000 – FIX HOME
- 2 pCi/L: ~4 out of 1,000 – Consider fixing between 2–4 pCi/L
- 1.3 pCi/L: U.S. average indoor level
- Radon risk is significantly higher for smokers (up to 9x greater)

Testing Methods

- Continuous Radon Monitor (CRM): electronic, real-time measurement
- Charcoal Canister: passive, lab-analyzed

Testing Protocol

- Test at the lowest occupiable level of the home
- Test duration: 48–72 hours
- Place device away from windows, doors, and direct exhaust
- Closed house conditions required
- Normal entry/exit and HVAC use permitted
- Do NOT disturb the testing device
- Result at or above 4.0 pCi/L requires mitigation

Common Myths

- Myth #1: "I only need to worry about radon if I live near Stone Mountain" – FALSE
- Myth #2: "My neighbor's results were low, so I don't need to test" – FALSE

Radon Mitigation

- Sub-slab depressurization systems (most common)
- Radon-Resistant New Construction (RRNC) features
- Only use a firm certified and registered with AARST
- Re-test recommended every 2 years (EPA)

Module 3: Energy Efficiency

Home Energy Services

- Home Energy Audits & Diagnostics
- Energy Efficient Mortgage support
- HERS Ratings (Home Energy Rating System)
- Thermal Imaging
- Blower Door Testing (new and existing homes)
- Duct Blaster Testing (new and existing homes)

Blower Door Testing & Air Infiltration

- Measures the airtightness of a home's envelope
- Identifies leakage pathways for targeted air sealing
- Most common cause of failure: inadequate post-drywall sealing
- Leakage occurs 24/7/365 – on the hottest AND coldest days

Why Air Leakage Matters

- HVAC Leakage:
 - Return-side leaks = IAQ problems (drawing air from unconditioned spaces)
 - Supply-side leaks = wasted energy
- Envelope Leakage:
 - Moisture-laden air infiltration
 - Air enters from crawl spaces, unfinished basements, attics

HERS Index (Home Energy Rating System)

- Comparable to MPG for a car – the lower the score, the more efficient the home
- Factors into Total Cost of Ownership: Mortgage + Taxes & Insurance + Utility Costs
- HERS Score Benchmarks:
 - 125 – Typical 15-year-old resale home
 - 81 – Typical new construction in GA
 - 77 – EarthCents Home
 - 74 – EarthCents (GA Power)
 - 62 – Energy Star
- Programs using HERS Index: EarthCents (GA Power), Environments for Living, Energy Star, EarthCraft, LEED
- 23% of new U.S. homes were HERS rated in 2017 (NREL)

Benefits of High-Performance Homes

- Healthier Air
- Greater Comfort
- Increased Durability
- Lower Operating Costs

Module 4: Lead Paint Renovation & Other IAQ Concerns

Lead Paint (Pb) Overview

- U.S. was the last industrialized nation to ban lead paint (1978); all others banned it in 1928
- Approximately half of all pre-1978 U.S. homes contain lead paint
- ~300,000 cases of lead poisoning in the U.S. each year
- The body confuses lead for calcium
- Children are most at risk: nervous system, brain & kidney damage; learning disorders; high blood pressure
- Lead poisoning effects are permanent

EPA RRP Rule – It's the Law

- Pre-1978 homes must be tested prior to renovation when:
 - Interior: more than 6 sq. ft. of painted surface is disturbed
 - Exterior: more than 10 sq. ft. of painted surface is disturbed
- Fines up to \$37,500 per offense

Abatement vs. Renovation

- Abatement = complete removal of lead paint
- Renovation = stabilization only (areas being cut, scraped, or sanded)
- Lead paint CAN be painted over if not disturbed
- Containment of dust is the critical factor
- Disposal: contact local jurisdiction and waste removal company

Asbestos

- Mineral mined from the earth; valued for tensile strength and heat resistance
- Regulated in every state; must be certified and insured to inspect or sample
- Common asbestos-containing materials (ACMs):
 - Insulation (1935–1970)

- Plaster; Roofing felts (1910–1970s)
- Drywall joint compound (1920–1978)
- Flooring tile (1920–1978)
- HVAC tape (1920–1978)
- Health risks: asbestosis, lung cancer, mesothelioma; risk increases with smoking

Module 5: General Contracting & Renovation Services

- Custom home construction
- Full-service renovations
- Home energy improvements
- Room additions and elevation changes
- Mold remediation
- Odor control (ozone treatment): follow-up to remediation; also eliminates bedbugs, fleas, and pests
- Radon mitigation system installation

Course Summary & Key Takeaways

- Building science integrates energy efficiency, moisture management, and IAQ
- Moisture is the root cause of most mold problems – control moisture to control mold
- Every home should be tested for radon; test every 2 years
- Air sealing is as important as insulation for energy performance
- HERS ratings quantify efficiency and factor into total cost of ownership
- Lead and asbestos in pre-1978 homes are governed by strict federal law
- High-performance homes deliver healthier air, greater comfort, durability, and lower costs