A Builder's Guide To
Reducing Mold Risk

ASHRAE Summer Meeting
Quebec City, June 2006

Lew Harriman
Mason-Grant Consulting
www.MasonGrant.com
Project Background

- **California Energy Commission**
  - Nancy Jenkins - Manager of Energy Efficiency Research
  - Ann Peterson - PIER Buildings Program Manager

- **Motivation:** Ensure that energy-saving measures do not grow mold in houses

- **Result:** No-cost Builder’s Guide as PDF at:
  - [www.gastechnology.org/moldresearch](http://www.gastechnology.org/moldresearch)
Project Team

- **Gas Technology Institute - Neil Leslie**
  - Lew Harriman - Mason-Grant
  - Doug Beaman, Beaman Associates
  - Carl Bergstrom, Magus Consulting
  - Charles Eley, Architectural Energy
  - Doug Kosar, Univ of Illinois, Chicago
  - Bud Offerman, Indoor Environmental Engineering

- **Builders**
  - Clarum Homes
  - John Lang Homes - Inland Division

- **Project advisory group (19 organizations)**
- **Donors of material and expertise (34 organizations)**
Project Phases

1. Research the moisture/mold-related problems in housing
   1. Insurance records - State of California
   2. Literature research
   3. Expert interviews with participating builders, plus 19 advisors and 34 donors of information/products/services

2. Lab research on problems uncovered

3. Field tests for practicality of possible solutions

4. Test practicality, through seminars for builders

5. Based on the above, produce “Builder’s Guide” to transfer information to users
Builder’s Guide basic approach... risk reduction

- Building codes allow moldy buildings - no government regulations - it’s in our hands
- Elimination of all risk is economically and culturally impractical
- Least expensive... biggest benefit.. first
- Three-part strategy:
  1. Keep the water away - reducing the water load
  2. Keep the water out - limiting water availability
  3. Limit growth until moisture dries out
Builder’s Guide Organization

- **Basic intention: Information delivered:**
  - ... to the decision-maker,
  - ... at the moment of decision
  - ... in a form which is actionable

- **Decision-maker changes over time:**
  - **Developer:** decides the perpetual mold risk
  - **Designer:** decides how to minimize the perpetual risk
  - **Builder:** controls the final mold risk
  - **Owner, who can increase or reduce risk**
For each decision maker, information organized into subsections:

1. Keeping water away
2. Keeping water out
3. Limiting mold growth, when things get wet in spite of best efforts
Developer controls the SIZE of the water load... the initial mold risk

- Keeping water away from the building
  - Site grading, lot coverage and drainage
  - Xeriscape alternative
  - Zero-setback lot lines mean increased risk

- Keeping water out
  - Roof line decisions which favor water exclusion
  - Progress payments that favor water-tight connections
  - Below-grade walls carry greater risk
Example: Site grading and hillside construction

- Where does the runoff go?
- Hillsides and cluster housing are denser, therefore riskier
- Plan (and budget) drainage accordingly
Developer’s roof line decision... to overhang? or not?

- Even small overhangs greatly reduce water load on the walls, therefore reduce risk
- No overhangs = larger water loads = increased risk
Designer will reduce (or increase) the underlying mold risk

- **Keeping water away**
  - Finish grading greatly increases, or reduces water load at the foundation

- **Keeping water out**
  - Minimizing valleys and dormers
  - “Kickout flashing” is essential
  - Vapor barrier in contact with foundation slab, not below sand
  - Two layers of housewrap/building paper behind stucco
  - Sill pan flashing for windows
Designer - Limiting mold growth

- Breathable interior finish
- AC system which dehumidifies
- Moisture-tolerant materials in wet areas
- Pans under washers and refrigerators
Designer, increasing and reducing risk

- Roof overhangs reduce risk
- Excellent drainage reduces risk
- Foundation plantings increase risk
- Lush irrigation increases risk
“Kickout” flashing...
Incredibly important, especially for stucco
Sill pans under windows (because water leaks around windows, eventually)
Most useful... clear integration diagrams

Joseph Lstiburek, Ph.D. P.Eng.
Water Management Guide
Building Science Press
Builder establishes the **final** baseline risk

- **Keeping water away**
  - Dry on site storage for lumber and wall board
  - Finish grading and irrigation direction are critical

- **Keeping water out**
  - Foundation - Vapor barrier in contact with slab
  - Measure moisture in framing before ‘rocking the walls
  - Supervision, supervision, supervision
Builder - Limiting mold growth

- Recognize the increased risk of wet materials
- Drying services to keep the project on schedule
- Consider mold-retarders to gain drying time
Supervision

Reverse lap increases risk

Alert supervisor reduces risk
Moisture content & mold growth

Less than 12% WME reduces risk

Over 14% WME increases risk

Over 19% WME greatly increases risk
Drying services to stay on schedule with less risk

Harriman, Schnell & Fowler
“Keeping construction dry”
ASHRAE Journal, Sept 2002
Owner controls ongoing risk

- **Keeping water away**
  - Preferring houses with roof overhangs
  - Preferring xeriscape
  - Preferring simple roofs

- **Keeping water out**
  - Highly permeable paint for exterior stucco
  - Use the shower and kitchen exhaust fans

- **Limiting mold growth**
  - Dry moist materials immediately
  - Understand that condensation = mold risk
  - When in doubt, measure moisture content of materials
Summary

- Reducing risk is economically and culturally more practical than eliminating risk
- All decision makers control risk, but...
- Earliest decisions establish baseline risk
- Builder’s Guide available at no cost at:
  - [www.gastechnology.org/moldresearch](http://www.gastechnology.org/moldresearch)

Thanks to the ratepayers of California, and to the California Energy Commission for making the Guide available at no cost.