LESSONS LEARNED IN A LARGE MOLDY BUILDING

By Larry Spielvogel, PE
Consulting Engineer
King of Prussia, PA
spielvogel@comcast.net

PURPOSES

- Describe why and how the problems occurred
- Describe what was done to remedy the problems

EVIDENCE OF THE PROBLEMS

- Mold
- Clammy conditions
- High humidity
- Sagging ceiling tiles
- Employee complaints
- High CO2 readings

ARCHITECTURAL DESIGN
EXTERIOR

- Overhangs and shading
- Thermal bridges
- Wall dampproofing vs. vapor retarder
- Water leaks
  - Roof
  - Windows
  - Flashings

ARCHITECTURAL DESIGN
INTERIOR

- Uninsulated walls above ceilings
- Unconditioned interior spaces
- Vinyl wall covering
- Wall cavity drainage
- Openings in block walls
  - At slab above
  - At columns
  - Blocks missing

MECHANICAL SYSTEMS

- Gas boiler and electric chillers
- 65 AHU's, 53 VAV, 10 SZ, 2 MZ
- Outdoor air
- Exhaust balance
- Minimum airflow settings
- No humidity control
- HVAC oversized by a factor of 2
- Building too efficient

APPROACH TO DETERMINING CAUSES OF PROBLEMS

- Review of design
- Review of construction
- Review of operation and maintenance

NO COST AND LOW COST ATTEMPTS AT TEMPORARY SOLUTIONS

- Record and monitor T & H
- Change CHW and CCD temperatures
- Leave lights on around the clock
- Install heating coils and dehumidifiers
- Operate HVAC around the clock

Results – Improved conditions, but not resolved

EVALUATION OF PERMANENT SOLUTIONS

- What should have been done in the first place
  - Why wasn't it done
- What is required to do it right
- Are there less expensive solutions
  - Degree of certainty they will work
- Opportunity to correct unrelated defects

REPORT CONCLUSIONS

- Principal causes
  - Inability to control humidity
  - Inability to preclude moisture accumulation
- Contributing factors
  - Inadequate vapor retarder
  - Air leakage
  - Water leakage
  - Inadequate outdoor air
- Related problems
  - Employee health

SOLUTIONS

- Eliminate wall, window, and roof leaks
- Install vapor retarder
  - Required removing exterior walls
- Provide specific humidity control
  - Replace all AHU's
  - New controls
- New outdoor air systems

DEFENSIBILITY OF SOLUTIONS

- Taxpayers
- Building occupants
- Defendants
- Insurance carriers
- Staff
- Industry standards
- Why these problems don’t always occur

WHAT CAN BE DONE TO PRECLUDE THESE PROBLEMS IN OTHER BUILDINGS

- In new construction
  - Follow accepted practices
  - Make certain construction is proper
- In existing buildings
  - Pay careful attention to O & M
  - Verify that capability exists to deal with these types of problems

CONCLUSIONS

- Odyssey for all involved
- Architects and Engineers
  - Professional embarrassment
  - Insurance carriers paid limit of policies
- Contractors and subcontractors
  - Paid settlements of many times what saved
- Taxpayers
  - Will never recover total cost
- Elected officials
  - Political embarrassment

CONCLUSIONS - CONTINUED

- Employees
  - Suffered health problems and dislocation
- Facilities staff
  - Endless grief
- Consultants
  - Additional problems discovered at every turn
- Remediation contractors
  - Will think twice before doing a similar project
- Rest of the world
  - I hope you never have to experience something like this