Mold/Moisture Control Case Study

Presented by

Boggarm S. Setty, P.E., FASHRAE

Setty & Associates, Ltd.

Introduction

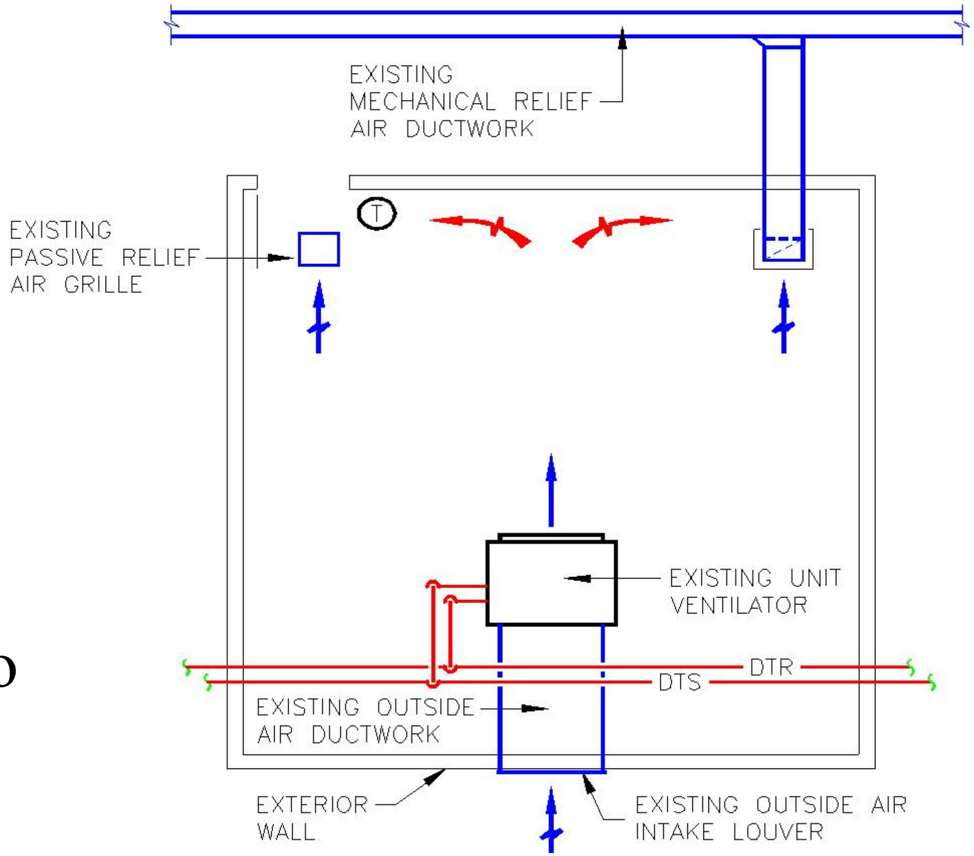
- Mold and mildew formation across the country
- Issues are costly in institutional and commercial buildings
- Optimum designs are pursued in envelope systems, dew point control and optimization of HVAC systems
- Paper discusses mold and moisture issues in a High School

Case Study-Liberty High School, Bealton, VA

- Located 30 miles southwest of Washington, DC
- Mold growth in classrooms, high latent heat
- Issues relating to mold, condensation, overcooling and localized cooling
- Moisture intrusion leading cause of mold growth
- HVAC system identified as promoter of mold growth

Existing Classroom Fan Coil Unit Configuration

- Ceiling mounted fan coil units
- Not capable of dehumidifying air
- Fresh air drawn through unit not properly dehumidified
- Control of units to promote fresh air into the building continuously
- Outdoor louvers connected to the fan coil unit leak
- Two-pipe system does not provide heating/cooling simultaneously

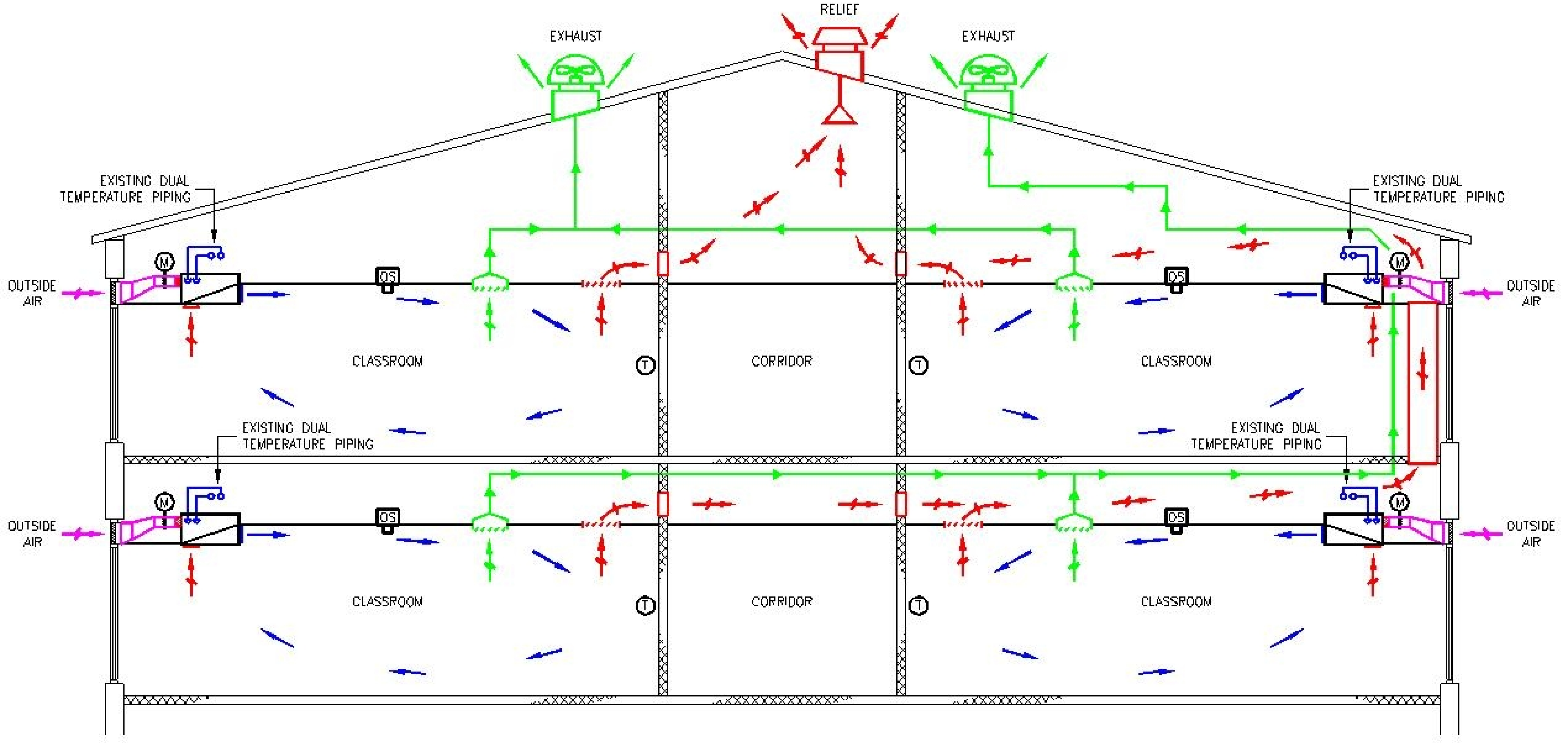


Existing Passive Air System

- Fresh air drawn from fan coil unit
- Outside air retrieved through gravity ventilator
- Promotes condensation in ceiling spaces and creates negative pressure in building
- Fresh air is dehumidified in ceiling space

Mold and Moisture Control – Case Study

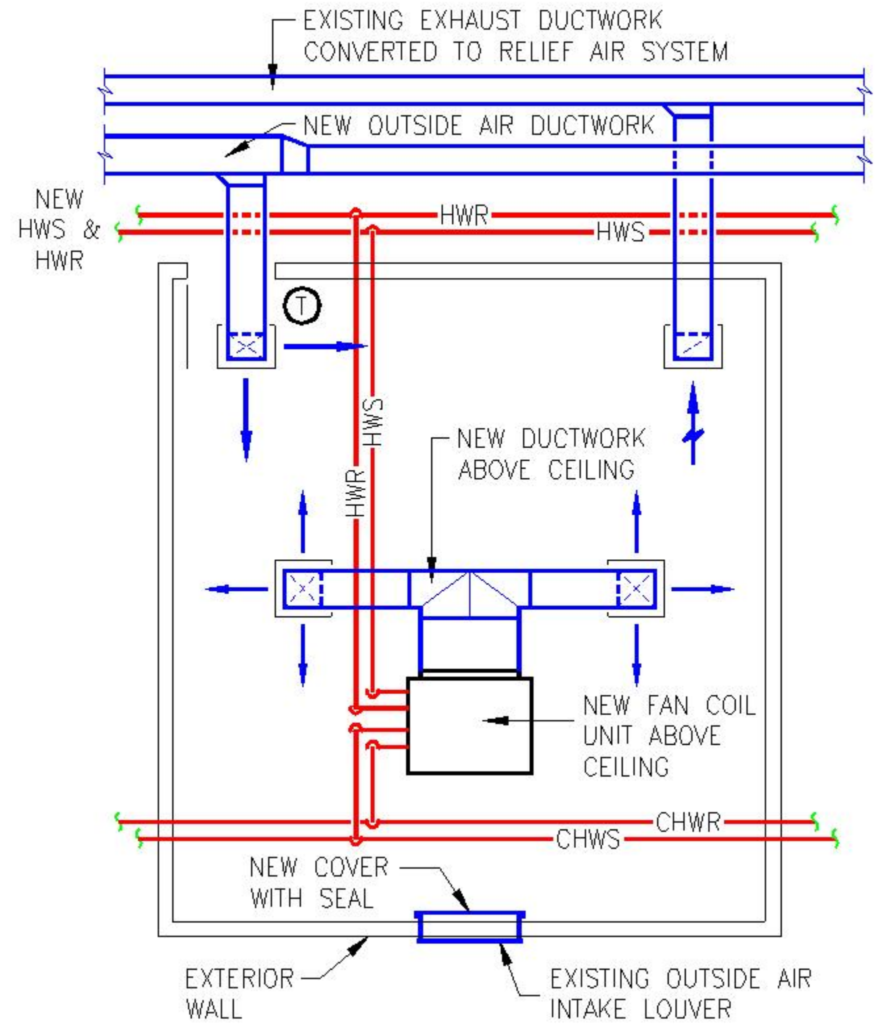
Existing Passive Air Relief System



Mold and Moisture Control – Case Study

Fan Coil Retrofit

- Turn pipe chilled water cooling coil with electric heat
- Convert existing two-pipe system to four pipe system
- Locate electric heating coil downstream of the cooling coil
- Retrofit ductwork for proper air circulation



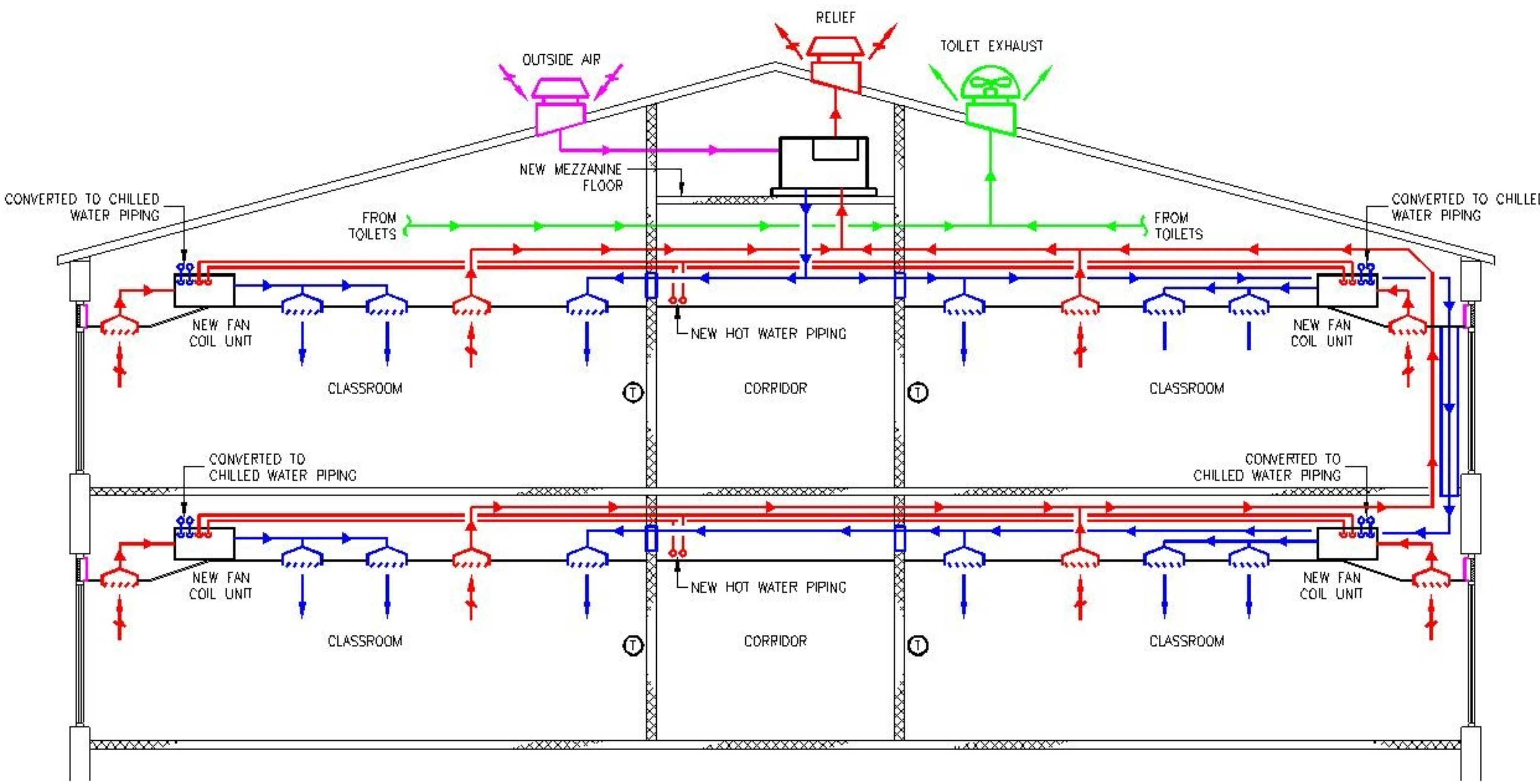
Dedicated Outside Air Unit

- Conditions fresh air 100%, up to 50^{o}F / +10^{o}C dew point
- Hot water reheat to heat the air up to 70^{o}F / +21^{o}C
- Separate duct system supplies air to individual classrooms
- Intakes with relief and exhaust fans
- Self-contained controls maintain 2 Pascal's position pressure in space

Mold and Moisture Control – Case Study

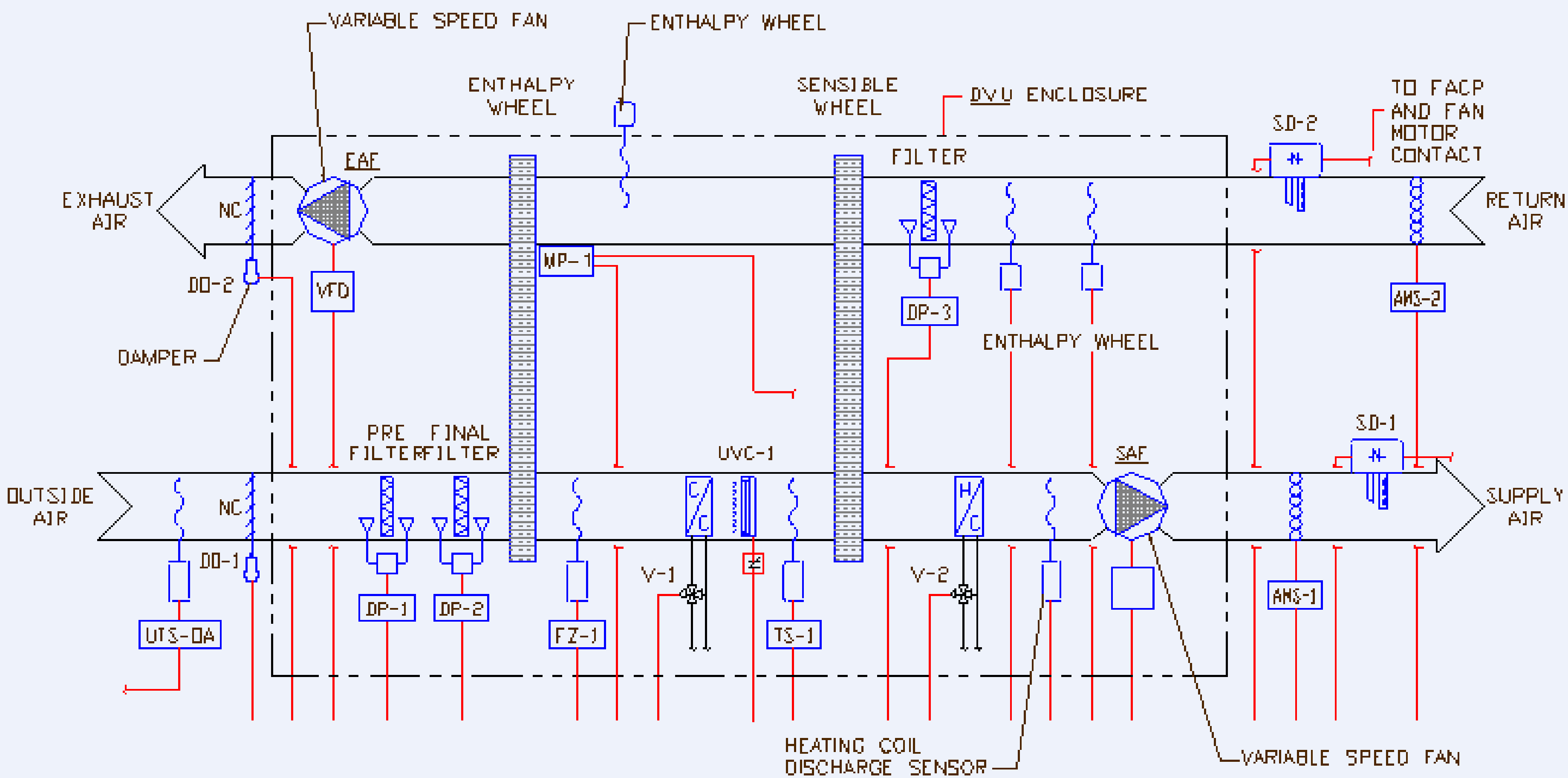
Dedicated Outside Air Unit

- Run around coil provides necessary reheat to space
- Discharge sensor maintains 50°F / +10°C dew point



Mold and Moisture Control – Case Study

Run Around Heat Recovering Units



Mold and Moisture Control – Case Study

Moisture Reduction Calculations

- Window and door infiltration
  - Total LF crack = 2,100
  - Use 50% of total LF crack = 1,050
  - CFM/LF = 77 ft^3/hr-LF = 77/60 ft^3/min – LF
  - Q = 77/60 ft^3/min – LF x 1050 LF = 1,348 cfm

- Leakage through FCU O.A. intakes – 77 louvers
  - Wind velocity = 16 mph Use 8 mph
  - ASHRAE 2001 Chapter 26 Eq. 29
    - $Q = C_A C_U A U$ = Airflow through air inlet
    - Q = Airflow in cfm
    - C_U = Effectiveness of opening (C_U assumed .25)
    - A = Free area
    - U = Wind speed, mph
    - C_U = Conversion of units = 88.0

Moisture Reduction Calculations

- Q = 88.0 x .25 x 10.64 ft^2/louver x 8 mph = 1,873 cfm/louver
- Each louver has a damper therefore assume 15% leakage
- 1,873 x .15 x 77 louvers/2 = 10,817 cfm
- Therefore front lobby infiltration
  - Assume doors are 100% open during peak use
  - Four sets of doors, each 6 ft x 7 ft high
  - Total open area: 4 x 6 ft x 7 ft = 168 ft^2
- Q = 88.0 x .25 x 10.68 ft^2 x 8 = 29,568 cfm

➢ The new design eliminates the O.A. through the FCU therefore, 10,817 cfm infiltration has been eliminated.

➢ The pressure inside the school building will be maintained positive to the O.A. Therefore, the infiltration will be reduced essentially to zero.

Conclusions

- Design of a separate fan coil system
- DOAS system with 100% fresh air capability
- Proper dew point control
- Maintain positive pressure of 2 Pascal's in building
- Commissioning to keep building dry during construction
- Minimize moisture intrusion and eventually mold growth

Mold and Moisture Control – Case Study

Questions and Answers

Setty & Associates, Ltd.

www.setty.com