Desiccant Dehumidification - Effective Strategy for Drying Concrete Slabs

Rick Toman
Business Development Strategist
Polygon US Corporation
314-914-1256
richard.toman@polygongroup.com

July 2016
Presentation Objectives

• Consequences of Excessive Slab Moisture
• Moisture measurement techniques
• Non-desiccant methods available to mitigate moisture
• Understanding desiccant slab drying technology
• Conditions needed to improve slab drying success
Consequences of Excessive Slab Moisture

- Hydrostatic pressure (moisture vapor) under flooring
- Flooring chemical cure failure (saponification)
- Mechanical bond flooring failure
- Excess condensation accumulation
- Moisture migration; mold behind walls and other interstitial spaces
Measuring Moisture in Slabs – Four Methods

- Plastic Sheet Method (ASTM D-4263)
- Electronic Meters
- Calcium Chloride, Moisture Vapor Emission Rate, MVER (ASTM F-1869)
- Relative Humidity Probe (ASTM F-2170)
Electronic Meter Testing

- Electrodes measure conductivity from the top layer of the slab
- Results measured in percentage of moisture
- Non-destructive and best used for quick baseline measurements
- Recommended follow up with a qualitative ASTM test method
Tramex Moisture Meter
Calcium Chloride Test

- Measures moisture vapor emission rate from the top layer of the slab
- Results reported in lbs. / 1,000 sq. ft. / 24 per hour period
- Very common qualitative test dating back to the 1960’s
- Limited to measuring top ½ - ¾ inch of slab thickness
- Measuring emission rates under ambient air conditions only
Place the Calcium Chloride Disk and Seal
One Test Every 1,000 Sq. Ft. (per ASTM)
Measuring Moisture Vapor Emission Rate (MVER)
(weight of absorption after 48, 60, or 72 Hours)
Relative Humidity Test

- Measures moisture **within** the slab as a percentage of relative humidity
- ASTM recommends probes embedded to 40% of the slab depth
- Common target performance ranges, 75% - 90% RH
- Test originated in Europe. Becoming more common in the US
- Tools & equipment requirements greater than other methods
Relative Humidity Test
Relative Humidity Test Meters
What is Being Done Besides Desiccant Slab Drying

• Lower water ratio – moisture suppression with barrier additives
  1. Costly
  2. Concrete finishing workability
  3. No ancillary benefits for other jobsite moisture challenges; millwork, drywall, moisture-sensitive coatings, and mold.

• Topical moisture suppression systems and sealers
  1. Costly
  2. Traps moisture within the slab to migrate who knows where
  3. No ancillary benefits (see above)
Desiccant Slab Drying – A Superior Approach

- Cost effective under most applications. Sometimes dramatic
- Pro-actively removes moisture; not just trap it
- Provides a climate controlled environment benefiting other moisture-sensitive materials relating to storage, placement, and finished quality control
- Desiccant technology treated air space creates the optimal vapor transmission environment to maximize moisture migration from within the slab
- House air conditioning systems can not match desiccant dehumidification performance
Science Behind Desiccant Slab Drying

- Desiccant dehumidification dramatically lowers vapor pressure above the slab, extracting moisture from the slab.
- Air movement can speed evaporation.
How does concrete dry?

- Moisture moves through the slab seeking to equalize vapor pressure
- Vapor pressure naturally moves from HIGH to LOW
- Larger vapor pressure differences means faster drying
Ideal Slab Drying Conditions

• Very low humidity levels
• Very low vapor pressure
• Desirable elevation in temperature
• Air flow exchanges across the slab
Desiccant Key Performance Indicators

- Processed air space relative humidity - target 30% or less
- Air movement – across the top of the slab
- Air temperature - warmer is better on thinner or layered materials.

Remember: The air conditions on top of the slab is most important
Desiccant Dehumidification Equipment in Action
Heart and Soul – The Desiccant Wheel

- Allows continuous dehumidification
- Extreme dry air (<10% RH)
- Operates at low temperatures
The Desiccant Wheel - How it Works

Patented HoneyCombe® wheel design provides a vast surface area for desiccant.
Ambient Air Conditions are Important

- Cold Conditions
- Mild Conditions
- Hot, Humid Conditions
Process Air Distribution is Essential
Air Movement Across the Floor Helps
Monitoring Desiccant RH % Performance
Case Study: Flooring Problem at a Best Buy

- Cold, damp weather
- More than one acre of slab
- Problem: 6.6 lbs. / 1000 sq. ft. / 24 hrs.
- Target: 5 lbs. / 1000 sq. ft. / 24 hrs.
- Floor Covering: carpet and VCT tile
Best Practices Toward Success

- Optimal design and sizing of equipment array
- Establish and communicate target conditions
- <30% RH, maintain 70-75°F, with consistent airflow
- Raise temperature ~10-15° to promote vapor emission
How Long Does it Take – Several Factors

- Beginning and specified end target for slab moisture
- Integrity of the building space enclosing the slab
- Design and reliability of the sub-slab vapor barrier
- Topical slab cure sealers

Proven dry slab performance history for MVER (calcium chloride) tested slabs (3-5 lbs.), 7 to 37 days. Typical slab dry times, 13 – 17 days.
How Much Does it Cost – Several Factors

- Availability of house power
- Beginning and end target for slab moisture conditions
- Concrete mix water-cement ratio
- Sub-slab vapor barrier Integrity
- Topical slab cure sealers

<table>
<thead>
<tr>
<th>Area</th>
<th>12’ Ceiling</th>
<th>24’ Ceiling</th>
</tr>
</thead>
<tbody>
<tr>
<td>~10,000 sq. ft.</td>
<td>$0.45 / sq. ft.</td>
<td>$0.55 / sq. ft.</td>
</tr>
<tr>
<td>~25,000 sq. ft.</td>
<td>$0.35 / sq. ft.</td>
<td>$0.45 / sq. ft.</td>
</tr>
<tr>
<td>~50,000 sq. ft.</td>
<td>$0.25 / sq. ft.</td>
<td>$0.35 / sq. ft.</td>
</tr>
</tbody>
</table>

*Budget ranges do not include power*
What is needed to ensure success on site?

- Tight building envelope
- Evenly distribute the air - temporary duct
- Supplemental fans for air movement
- Inspect the jobsite to maintain controls

More Best Practices
What We Need to Know About Your Project

• Current moisture condition of slab
• What is the target (RH % or lbs.)
• Time line to perform
• Building dimensions
• Tightness of the (air) space
• Other air controls in use
• Moisture vapor barrier design
• Cure in seal in place
• Who is performing slab testing
• Available power
Questions?
Thank You
Rick Toman
314-914-1256
richard.toman@polygongroup.com