Lorman Educational Services

Mold Remediation Practices

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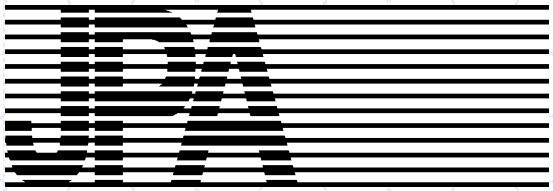

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Lorman Educational Services

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Remediation

To remove or clean contaminated materials in a way that prevents the emission of fungi or dust contaminated with fungi from leaving a work area and entering an occupied or non-abatement area, while protecting the health of the workers performing the abatement.

Guidelines Not Codes

EPA: "Mold Remediation in Schools and Commercial Buildings"

"…This document presents guidelines for the remediation/cleanup of mold and moisture problems in schools and commercial buildings; these guidelines include measures designed to protect the health of the building occupants and remediators."

NYCDOH: "Guidelines on Assessment and Remediation of Fungi in Indoor Environments"

"This document is not a legal mandate and should be used as a guideline. Currently there are no United States Federal, New York State, or New York City regulations for evaluating potential health effects of fungal contamination and remediation. These guidelines are subject to change as more information regarding fungal contaminants becomes available."

IICRC: “Standard and Reference Guide for Professional Mold Remediation,” S520

“This Standard describes the procedures to be followed and the precautions to be taken when performing mold remediation in residential, institutional and commercial buildings and on personal property contents of these structures.”

Determine Water Source

When addressing mold problems, don't forget to address the source of the moisture problem, concurrent or prior to remediation or the mold problem may simply reappear.

Check for source of intrusion, for high humidity, and condensation problems as well as actual water leaks, maintenance issues, and HVAC problems.

Revise and/or carry out maintenance plan if necessary. Revise remediation plan as necessary, if additional damage is discovered during remediation.

Water Intrusion Elimination

Fix the water intrusion source or high humidity problem. Repair or reconstruct as necessary to ensure the causation is eliminated. All repairs or reconstruction must be accomplished in excess of the minimum requirements of the Michigan Building Codes, 2003.

Hidden Mold

In many cases, indoor mold growth may not be obvious. It is possible that mold may be growing on hidden surfaces, such as the backside of drywall, wallpaper or paneling, the top of ceiling tiles, the underside of carpets and pads.

Some building materials such as drywall with vinyl paper over it or wood paneling, may act as vapor barriers, trapping moisture underneath their surfaces and thereby providing a moist environment where mold can grow.

Investigating hidden mold problems may be difficult and will require caution when the investigation involves disturbing potential sites of mold growth. EPA recommends the use of personal protection equipment (PPE).

If hidden mold is discovered, revise the remediation plan to account for the total area affected by mold growth.

Inspection of Wall Cavities

"Wall cavities can be observed by drilling small (typically 4-inch) diameter holes between structural members in the interior gypsum wallboard (GWB). During drilling and observation, a HEPA equipped vacuum is utilized to capture gypsum dust and any possible biological particulate, including mold spores, which might be released by drilling. In addition, a negative air machine equipped with a HEPA filter is located near the hole in the room during inspection activities to capture any dusts that might have resulted from the presence of the open hole in the wall."

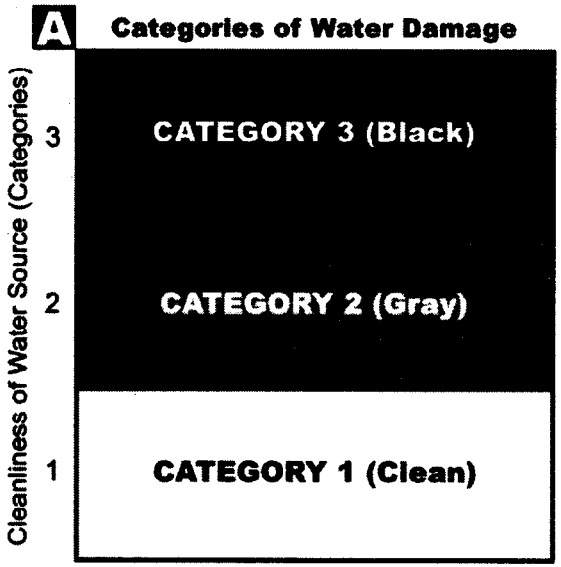
"These precautions are taken to ensure that investigation activities do not result in additional mold spore exposures to building occupants. Following observation and measurement, each hole is patched with the removed GWB plug, drywall tape, and drywall "mud" such that no air pathway remains from the wall cavity into the occupied building."

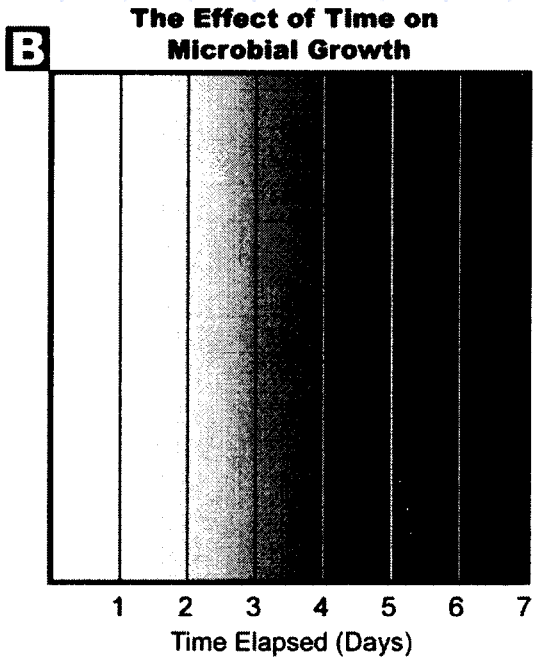
Rapid Response

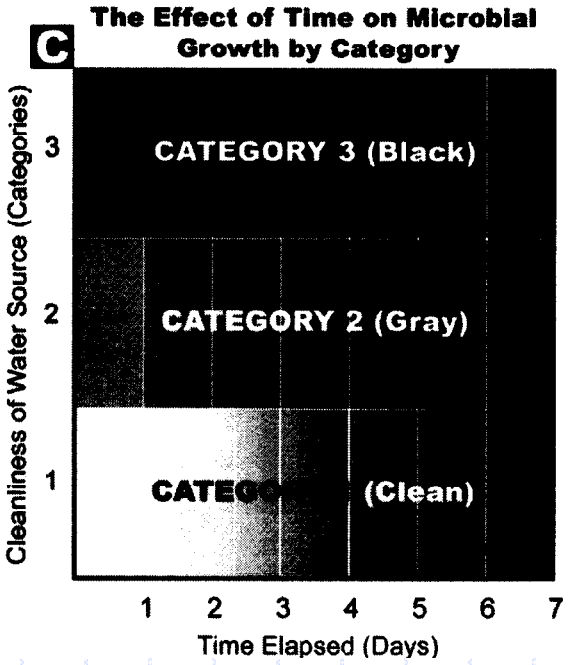
NYCDOH states: "Building materials supports fungal growth must be remediated *as rapidly as possible* in order to ensure a healthy environment."

IICRC S500: Figure 1 indicates the time period for clean water damage to hygroscopic material to develop the microorganism contamination equivalency to grey and black water.

Diagram B and C indicate microbial growth commencing at 48 hours and at 6 days the clean water is microbially equivalent to black water (sanitary affluents, ground surface water, rising water from rivers and streams).







FACT: ***Microorganisms are always present*** *in the indoor environment.*

A ***Whether water is categorized*** *as clean, gray, or black, when there is a water intrusion and...*

B ***...if it is left unattended, microorganisms will amplify.*** *While the amplification will not be immediately noticeable, the greater the length of time, the greater the amplification.*

C ***With the passage of time,*** *microorganisms present in any category of water intrusion will begin to amplify.*

ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) technical paper presented at the ASHRAE-IAQ Conference in 2001 entitled "How Quickly Most Gypsum Board and Ceiling Tile Be Dried to Preclude Mold Growth After a Water Accident."

The results of their incubations provide empirical evidence that significant mold growth does occur within 2 to 3 days. This supports the "conventional wisdom" that 2 to 3 days is the relevant time frame. The humidity levels used in the study did not prevent mold growth, once materials were wet.

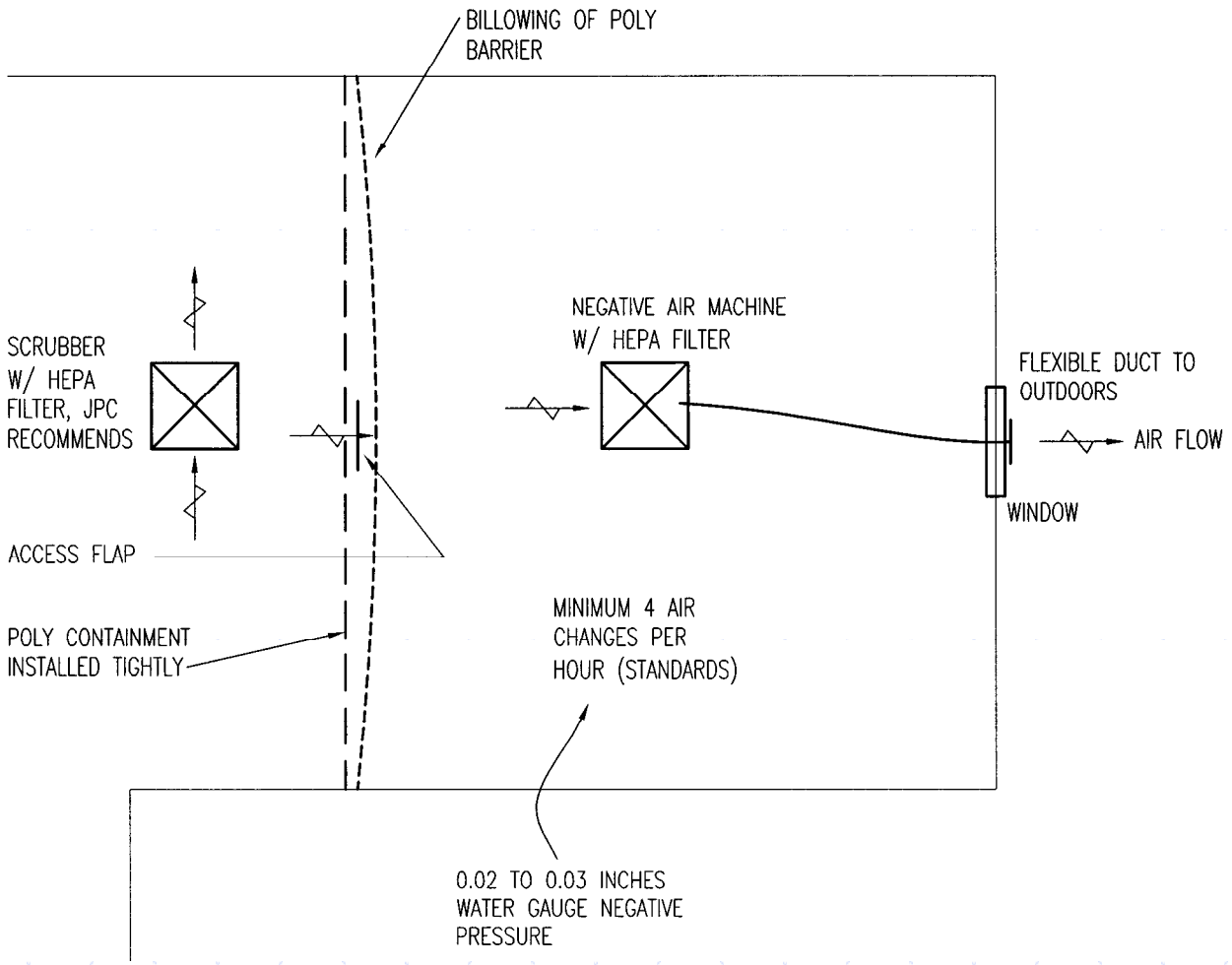
Pasanen et al. (2000) similarly found that drying at 50% RH had little detrimental effect on the molds and even 30% RH permitted some growth. Incubations in the IAQ Conference study also indicated that air in the range of 40% to 45% RH is inadequate to prevent growth on building materials in static conditions.

Thus, the industry standard of reducing moisture levels to 40% as rapidly as possible may not be adequate to prevent mold growth on ceiling tile and drywall. Mitigating the loss can be accomplished by a rapid response, maximizing mechanical water extraction and desiccant dehumidification.

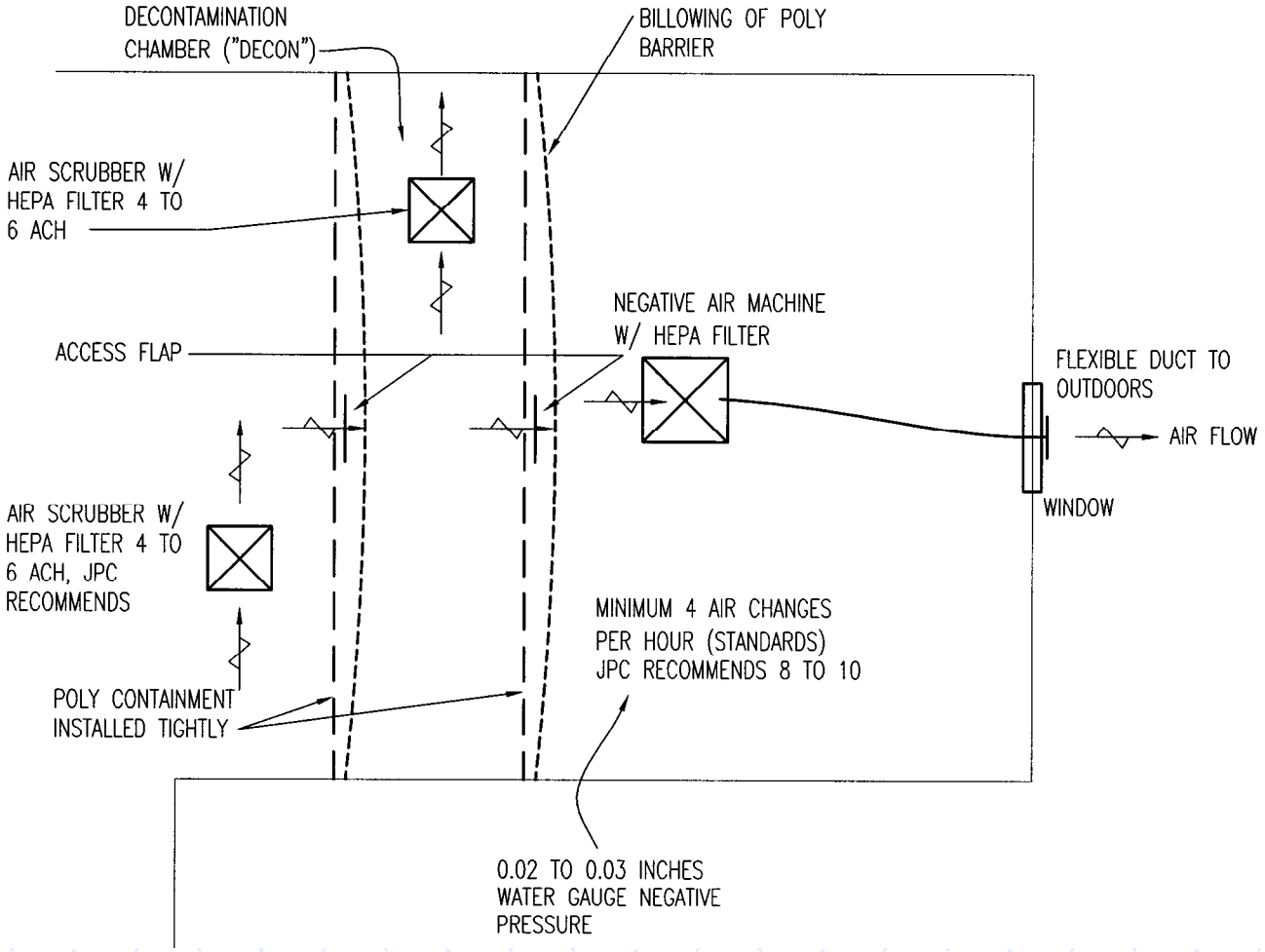
Containment

A precaution used to minimize cross-contamination from affected to unaffected areas by traffic, material handling or airborne distribution. Containment normally consists of 6-mil polyethylene (“poly”) sheeting often in combination with negative air pressure to prevent cross-contamination.

Barriers (NYCDOH: Levels I, II, and III)



Barriers (NYCDOH: Level IV)



Air Flow & Air Exchange Rates

Negative Air

Because the negative air machines actual air flow rate in cubic feet per minute (cfm) is lower than the factory rating, due to resistance in the filter elements, attached ductwork, and the tightness of the building beyond the containment area, I recommend using 8 to 10 air changes (AC) per hour to allow for accidents and loose containment in lieu of the minimum 4 ACH in Standards.

$$\text{CFM REQUIRED} = \frac{\text{ROOM VOLUME (FT3)} \times \text{NUMBER OF ACH}}{\text{60 minutes/hour}}$$

$$= \frac{L \times W \times H \times 10}{60}$$

$$= L \times W \times H \times 0.166$$

Therefore the cfm should be 13% to 17% of the area volume.

BUT if the outdoor air has a high relative humidity in the summer months, reduce negative air exchange and double or greater the decon and adjacent space scrubber air volumes.

Comparison of Industry Standards of Care

I Total Surface Area Affected (Less Than 10 square feet)			
	EPA (1,2)	NYCDOH	IICRC/S520 (3)
Remediation Conducted by Maintenance Personnel	-	X	X
Respiratory Protection, Gloves and Eye Protection	X	X	X
Containment Required	N	N	X
Work Area Should Be Unoccupied	-	-3	-
Contaminated Material Removed in Plastic Bags	X	X	X (4)
Egress Work Area Cleaned	X	X	-
Scrubbers Recommended	-	-	X
Area Left Dry and Visibly Free of Contamination and Debris	-	X	-
Shut Down HVAC Systems	Not addressed - Recommended by JPC		

NOTES:

1. Remediating Building Materials with Mold Growth Caused by Clean Water.
2. If Water Damage by Other Than Clean Water then OSHA requires PPE and containment.
3. Surface Mold Growth - Standard does not categorize based on Affected Area.
4. Waste Materials removed to waste container in a manner that minimizes the possibility of cross-contamination.

\- Not Addressed
X Recommends
N Not Required

Comparison of Industry Standards of Care

II Total Surface Area Affected (10 - 30 square feet)			
	EPA (1,2)	NYCDOH	IICRC/S520 (4)
Remediation Conducted by Maintenance Personnel	-	X	-
Remediation Personnel Trained	X	X	X
Respiratory Protection, Gloves and Eye Protection	X	X	X
Work Area Unoccupied	-	X	-
Containment	X	X	X
Dust Suppression Or Scrubbers	-	X	-
Contaminated Material Removed in Plastic Bags	X	X	X (5)
Egress Work Area HEPA Vacuumed and Cleaned	-	X	-
Negative Pressure Exhaust Fan	X	-	-
Area Left Dry and Visibly Free of Contamination and Debris	-	X	-
Shut Down HVAC Systems	X	(3)	(3)

NOTES:

1. Remediating Building Materials with Mold Growth Caused by Clean Water.
2. If Water Damage by Other Than Clean Water then OSHA requires PPE and containment.
3. Recommended by JPC.
4. Limited Mold Growth - Standard does not categorize based on Affected Area.
5. Waste Materials removed to waste container in a manner that minimizes the possibility of cross-contamination.

\- Not Addressed
X Recommends
N Not Required

Comparison of Industry Standards of Care

III Total Surface Area Affected (30 - 100 square feet)			
	EPA (1,2)	NYCDOH	IICRC/S520 (3)
Health and Safety Professional Consulted	-	X	X
Remediation Personnel Trained	X	X	X
Respiratory Protection, Gloves and Eye Protection	X	X	X
Work Area Unoccupied	-	X	-
Areas Directly Adjacent Unoccupied	-	X	-
Containment	X	X	X
Negative Pressure Exhaust Fan	X	-	-
Dust Suppression Methods		X	-
Contaminated Material Removed in Plastic Bags	X	X	X (4)
Work Area and Surrounding HEPA Vacuumed and Cleaned	-	X	-
Area Left Dry and Visibly Free of Contamination and Debris	-	X	-
Dust Generation, Heavy Fungi Concentration, then Increase Remediation Procedure to IV	-	X	-
Shut Down HVAC Systems	X	X	X

NOTES:

1. Remediating Building Materials with Mold Growth Caused by Clean Water.
2. If Water Damage by Other Than Clean Water then OSHA requires PPE and containment.
3. Extensive Mold Growth - Standard does not categorize based on Affected Area.
4. Waste Materials removed to waste container in a manner that minimizes the possibility of cross-contamination.

- Not Addressed
X Recommends
N Not Required

Comparison of Industry Standards of Care

IV Total Surface Area Affected (Greater than 100 square feet)			
	EPA (1,2)	NYCDOH	IICRC/S520 (3)
Health and Safety Professional Consulted	-	X	X
Remediation Personnel Trained	X	X	X
Full Face Respirators, Gloves, Eye Protection, Disposable Protective Clothing covering Head and Feet	X	X	X
Containment - Complete Isolation of Work Area	X	X	X
Negative Pressure Exhaust Fan	X	X	X
Air Lock and Decontamination Room	X	X	X
Areas Directly Adjacent Unoccupied	-	X	-
Contaminated Material Removed in Plastic Bags, Outside of Bags HEPA Vacuumed in Decontamination Chamber	X	X	X (4)
Contained Area and Decontamination Room HEPA Vacuumed and Cleaned Prior to Barrier Removal	-	X	-
Air Monitoring Prior to Occupancy	-	X	-
Shut Down HVAC Systems	X	X	X

NOTES:

1. Remediating Building Materials with Mold Growth Caused by Clean Water.
2. If Water Damage by Other Than Clean Water then OSHA requires PPE and containment.
3. Extensive Mold Growth - Standard does not categorize based on Affected Area.
4. Waste Materials removed to waste container in a manner that minimizes the possibility of cross-contamination.

- Not Addressed
X Recommends
N Not Required

Comparison of Industry Standards of Care

V Remediation of HVAC Systems			
	EPA (1,2)	NYCDOH	IICRC/S520 (3)
- Consult Health and Safety Professional; beyond the scope of this presentation -			

Recommend incorporating the most stringent requirement of each standard therby minimizing the potential for cross-contamination.

Sanitary Sewage Backflow or Discharge Into Buildings

Assessment: The assumption must be that potential pathogens are present in the contamination. Such microbial contamination includes bacteria, fungi, viruses, and parasites.

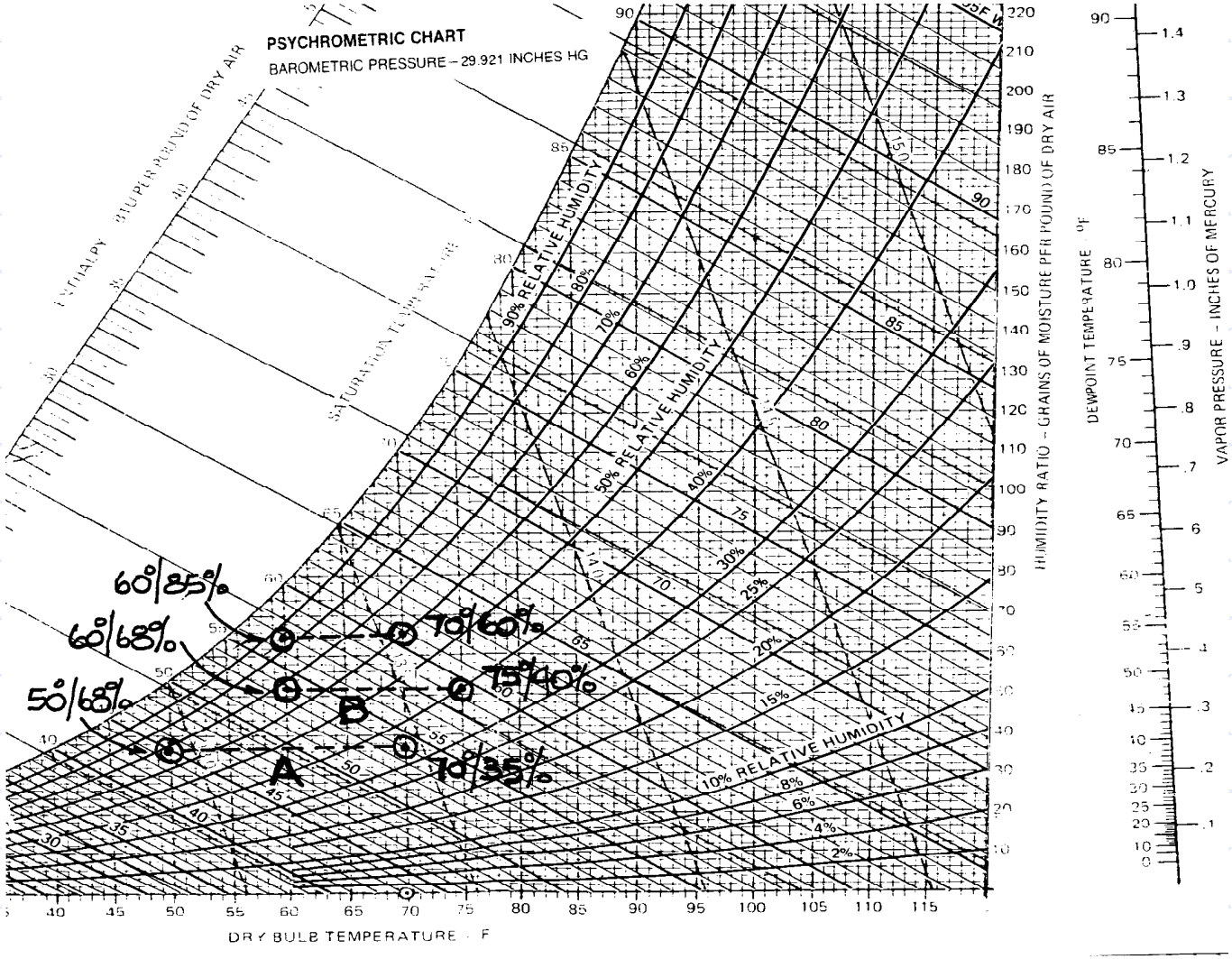
Another aspect of health impact is that the conditions caused by sewage backflow or flooding are conducive to the growth of nonsewage microorganisms.

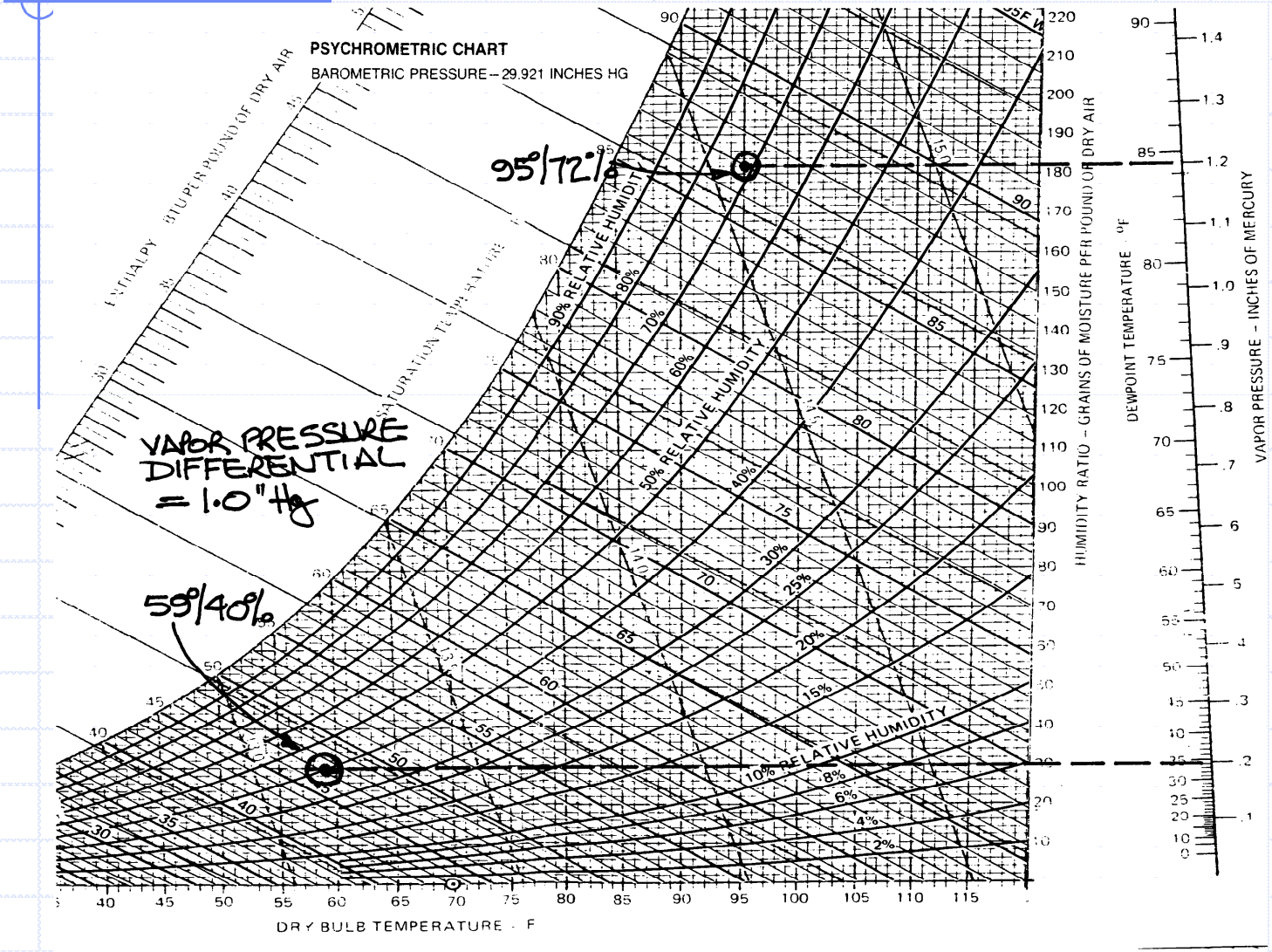
Methodology: Indoor relative humidity of 40% or less should be attained as quickly as possible, this is typical for drying of hygroscopic materials in structures. Rapid drying that stresses proper management of temperature, air flow, pressure differentials, and dehumidification is essential for success. Desiccant dehumidification could be employed to reduce the RH to as low a level as possible. Use of blowers to evaporate bound water not recommended thus desiccant dehumidifiers are more effective than refrigerants.

Porous material that have a value that exceeds the cost of restoration (high value rugs, etc.) should be removed and restored offsite.

Chemical disinfectants are appropriate for use in areas exposed to sewage. These chemicals are defined as being capable of inactivating potential pathogenic microorganisms on inert, nonporous substrates.

Psychrometrics




PSYCHROMETRIC CHART
BAROMETRIC PRESSURE – 29.921 INCHES HG
95/72%
VAPOR PRESSURE DIFFERENTIAL = 1.0" Hg
59/40%
ENTHALPY BTU PER POUND OF DRY AIR
SATURATION TEMPERATURE °F
90% RELATIVE HUMIDITY
80%
70%
60%
50% RELATIVE HUMIDITY
40%
30%
25%
20%
15%
10% RELATIVE HUMIDITY
8%
6%
4%
2%
HUMIDITY RATIO – GRAINS OF MOISTURE PER POUND OF DRY AIR
DEWPOINT TEMPERATURE °F
VAPOR PRESSURE – INCHES OF MERCURY
DRY BULB TEMPERATURE - F

50
70
81
DRY BULB TEMPERATURE - F
ENTHALPY - BTU PER POUND OF DRY AIR
SATURATION TEMPERATURE
90% RELATIVE HUMIDITY
80%
70%
60%
50% RELATIVE HUMIDITY
40%
30%
25%
20%
15%
10% RELATIVE HUMIDITY
8%
6%
4%
2%
48
63
22
44
HUMIDITY RATIO - GRAINS OF MOISTURE PER POUND OF DRY AIR
DEWPOINT TEMPERATURE °F
VAPOR PRESSURE - INCHES OF MERCURY

Solution

We have a dysfunctional construction family. Mold growth in buildings illustrates the disconnect between the technical wisdom of building science and the economic wisdom of the market for building construction and operation.

Designing and constructing the building enclosure to be able to dry when it gets wet is essential.

We tend to focus on preventing things from getting wet but we must also provide a plan for letting things dry after they get wet. In many instances the techniques used to prevent wetting also prevent drying.

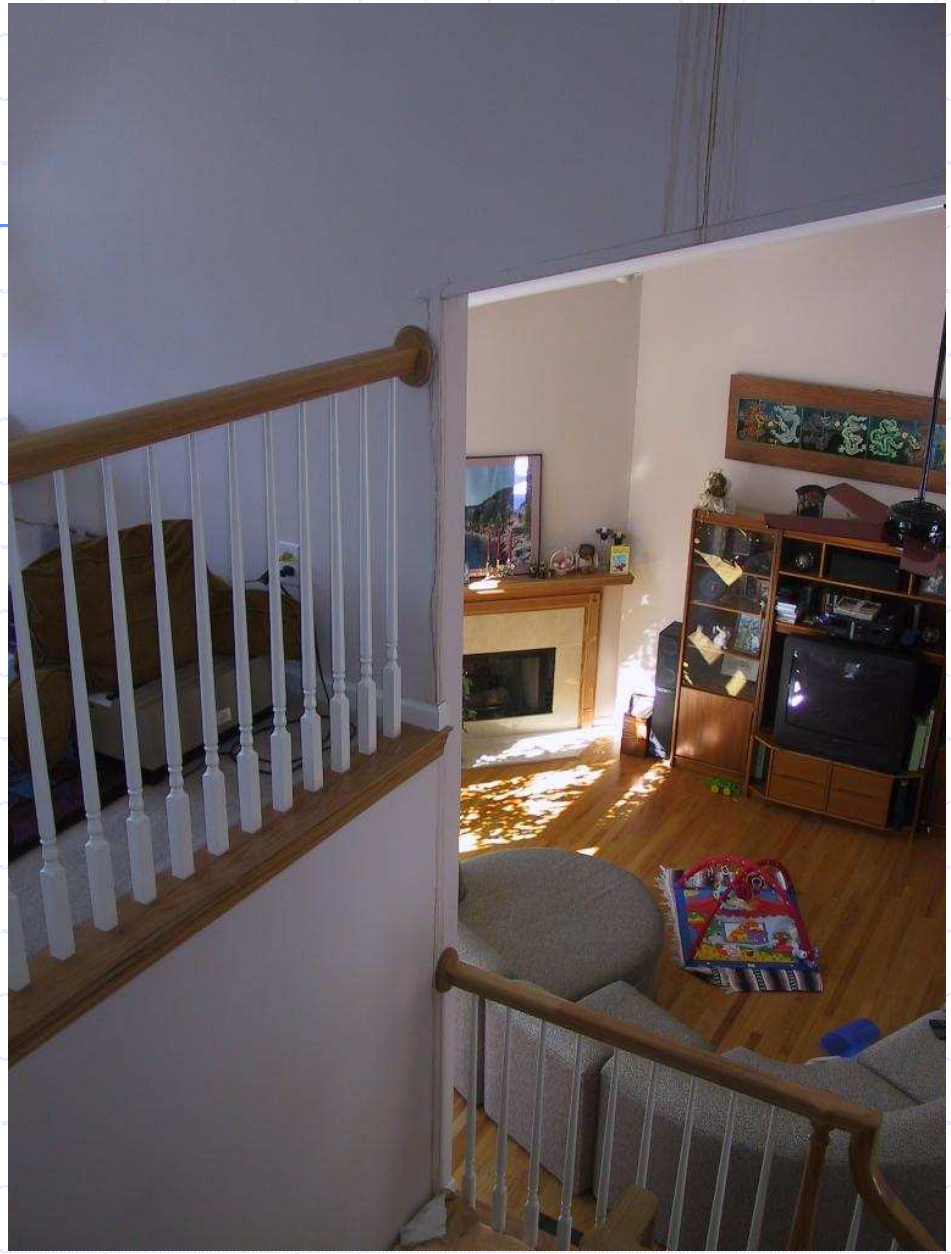
The fundamental principle of rain (and ground water) control is to shed water by layering materials in such a way that water is directed downward and out of the building.

Drainage, drainage, drainage.

Drainage applies to assemblies such as walls, roofs, and foundations, as well as to the components that can be found in walls, roofs, and foundations, such as windows doors, and skylights. It also applies to the openings for the windows, doors, and skylights and to the assemblies that connect to walls, roofs, and foundations, such as balconies, decks, railings, and dormers.

Finally, it also applies to the building as a whole. Overhangs can be used to drain water away from walls. Canopies can used to drain water away from windows, and site grading can be used to drain water away from foundation perimeters.

If we designed and built in compliance with building codes then much of the remediation activity would be eliminated.




COLEMAN CABLE 13 AWG RG 6/U

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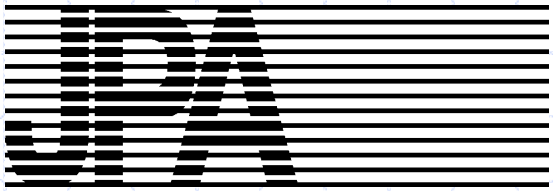

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