Wolf Construction Services, Inc

Water Intrusion Management Plan

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Introduction

Risk for litigation arising from water damage and mold in buildings has dramatically affected the construction industry in recent years. For this reason, any firms involved in construction – but particularly general contractors, developers and subcontractors – must proactively work to prevent water intrusions, either during or subsequent to construction that could lead to microbial growth in a structure. Opportunities to prevent water intrusion occur at all phases of construction: design, pre-installation, installation, and maintenance or warranty. In addition to prevention, Wolf Construction Services must also respond immediately and appropriately, when a significant water intrusion event occurs in a building during critical phases of construction or during renovation.

Wolf Construction Services can ultimately minimize their risk of water intrusion and possible resulting mold damage claims by establishing a Water Intrusion Management Program. This Water Intrusion Management Plan is integral to the program and is intended to help personnel, particularly Foreman & Superintendents:

- Understand and employ the best prevention practices during the design, pre-installation, and installation phases of construction.
- Understand their responsibility to inform the building manager or construction manager of all maintenance requirements for systems equipment, weatherproofing, and other building components essential to ensuring a moisture-free environment for inhabitants of the structure. (Fulfilling this responsibility is part of an effective risk transfer program following construction).
- Establish response protocols for key personnel to follow when water intrusion or microbial contamination does occur during construction.
- Establish roles and responsibilities for key personnel who will implement the program.
- Properly document their response procedures, which will be critical should claims ever arise. Checklists and forms provided in appendices will help key personnel easily document these activities.
- Determine when to retain a third-party microbial consultant to assist with prevention efforts or response to incidents.

Mold

What is Mold?

More than 100,000 identified species of fungi exist naturally in our environment today. Species have existed for millions of years, are generally present throughout the world at ambient airborne levels, and have limited negative impact on mankind. In fact, very few types of mold have been shown to be harmful to human health. Upon germination, some fungi will produce a mold colony. Germination or reproduction of fungi occurs when fungal spores, which are naturally present in or on building materials (such as ceiling tile, drywall, wood, carpet, insulation, etc.), are exposed to moisture. As long as the moisture is present the fungi will reproduce (grow).

Is Mold a Concern?

We are constantly exposed to thousands of different types of fungi in our everyday lives, which are generally not harmful to our health. Inhalation of elevated levels of airborne fungi may result in

health problems, the majority of which are usually allergic reactions consisting of sniffling, runny noses, coughing, itchy skin, and congestion. In very rare circumstances, more serious health problems can arise from mold exposure. Individuals who are already immune-compromised and infants appear to be particularly vulnerable. There are no established safe exposure limits for fungi. Individual health and sensitivities will influence both the impact and duration of any potential health effects of exposure.

Public concern regarding indoor air quality and the potential of fungal growth in the indoor environment has increased due to a variety of factors including media attention, increased litigation action, and general "air tight" building design.

Microbial particulates (fungi, mold, bacteria, mycelia fragments, etc.) are ubiquitous to the environment in which we live. Fungal spores are one component of settled dust, which, as we know, is present in the indoor environment as well as the outdoor environment. It is impossible to eliminate all microbial particulates from the indoor environment. Current guidance dictates acceptable levels of mold and fungi at levels and types quantitatively and qualitatively similar to that of outdoor air and removal of visible colonies of fungal growth by an acceptable method.

When Will Mold Develop?

Generally, building materials must remain wet for more than 24-48 hours for mold to develop. If mold is visible prior to that time it is likely from a preexisting water problem and not from the immediate occurrence. It is, therefore, extremely important to respond quickly to issues of water intrusion by repairing the source of the leak, thoroughly drying all wet materials, and removing moisture from the air, as soon as a leak is discovered.

Importance of Visual Inspections

Once mold becomes visible it should be removed. A visual inspection is an important first step in any microbial investigation. Unfortunately, mold thrives in environments where there is a lack of ventilation such as in wall cavities, sub-floors, beneath wall/floor coverings, behind vapor barriers, and behind ceiling tiles. Therefore, when microbial growth is suspected it is critical to investigate all areas thoroughly for potential water impact.

Airborne Mold

Until the source of water intrusion is eliminated and all impacted materials dried, mold will continue to grow. Eventually, mold may become aerosolized (airborne). This occurs when fungus germinates and distributes millions of spores. Generally, the longer the mold has been germinating the higher the spore counts and the more likely mold will become aerosolized. Therefore, any drying in an area with existing mold should be performed only under controlled conditions.

Causes of Mold

Moisture problems have many causes including uncontrolled humidity. Many causes of fungal growth in the indoor environment include instantaneous or slow plumbing leaks, inadequate drainage, roof penetrations, uncontrolled humidity due to HVAC considerations, drain pan leaks, flooding events, uncontrolled exposure to the structure from inclement weather during construction, and other water accidents. It is important to avoid "simple" causes of water intrusion and leaks. Cautious practices and quality control during construction as well as prudent preventive maintenance are the first steps to preventing microbial contamination.

Microbial Contamination

The term "microbial contamination" is used in this plan. "Microbial contamination" refers to the presence of mold or fungus at levels quantitatively higher and/or qualitatively different from the

ambient outdoor conditions. The term is also used to describe visible fungal growth on surfaces and inside wall, ceiling cavities or HVAC ductwork and systems.

References
New York City Department of Health, "Guidelines on Assessment and Remediation of Fungi in Indoor Environments," updated January 2002, http://www.nyc.gov/html/doh/html/epi/moldrpt1.shtml.
Macher, J. M., ed., Bioaerosols: Assessment and Control, American Conference of Governmental Industrial Hygienists, 1999.

Prevention – Design Phase

To properly manage or prevent microbial contamination within a building envelope, it is essential to understand individual building components and their potential impact on water intrusion and bioorganic growth. A thorough knowledge of building components related to sources of water intrusion will best serve in the design of construction systems and the management/control of microbial incidents.

As previously discussed, the source of fungi and mold growth is moisture. In addition, any source introducing continuous moisture to building components and materials can be problematic to building envelope, wall, floor, and roof/ceiling assemblies must allow building components and materials to dry out if they get wet. Such assemblies that do not allow drying are very problematic to the building envelope.

A "tight building" is the ultimate goal for any project, yet good design and construction will include contingencies to ensure the removal of any moisture that may occur within the building envelope. Examples of these design considerations include the control of climate, temperature, relative humidity and dew points as they relate to the type of building components to be constructed. These factors affect the outside air requirements, airflow and the potential for condensation within building components. Hot and humid climates create their own set of moisture-inducing phenomena, which must be planned for in the building design.

It is the responsibility of the owner/operator, design team, and GC to weigh the numerous trade-offs between the expense of suitable materials and products and compatibility of materials with each other, and installation practices against the risk of long-term water intrusion.

Among other factors impacting the introduction of moisture to construction systems are *temperature* and *air flow*. Water intrusion in the form of *condensation* must also be considered in the design of building systems. Under any conditions of moisture-laden air proximate to cold surfaces below the dew point of the ambient air temperature, condensation can occur.
In addition to the seasonal and arbitrary nature of exterior climate and weather conditions, the building designers must also address the interior environment of the building envelope and limit condensation in components not intended to control this phenomenon.

Two key considerations in controlling moisture are:

- Design for the climate where you are working. Practices that work in Miami do not necessarily work in Minnesota.
- Prevent infiltration of moisture, but also provide a means for the building materials to dry. Building materials will get wet; they must be allowed to dry.

Common Water Intrusion Sources

As related to building design and construction, the origin of potential water sources responsible for bioorganic growth can be separated into two groups: exterior and interior. Listed below are examples of considerations contractors must take into account during the design of a project to manage possible intrusion issues.

Some Examples of Exterior Building Water Intrusion Sources:

- Rain
- Ground water
- Irrigation systems
- Hardscape and softscape drainage
- Septic systems
- Pools and spas
- Exterior plumbing (city water supply, etc.)
- Penetrations and junctions of
- Adjacent properties – the path of exterior water sources
- Roofs and roof drains
- Decks and deck drains
- Windows and doors
- Cladding (wood siding/trim, stucco, brick, one-coat systems and panelized systems)
- Concrete foundations
- Basement walls

Some Examples of Interior Building Water Intrusion Sources:

Plumbing:

- Piping and drains
- Plumbing fixtures (faucets, toilets, sinks, shower valves)
- Equipment (water heaters, dishwashers, disposals, ice makers)
- Sump pumps and other miscellaneous equipment
- Ejectors

Mechanical Systems:

- Heaters
- Air handlers
- Evaporators
- Condensate drains
- Chillers
- Pumps
- Tanks
- Boilers
- Piping
- Refrigerant lines
- Reservoirs

Fire Sprinklers:

- Piping
- Sprinkler heads
- Control boxes
- Stand Pipes

"Wet" areas:

- Showers
- Baths
- Steam rooms
- Laundry
- Lavatory
- Water closet
- Natatoriu

Construction Systems Design Checklist

- Ensure the design team, including the architect, engineer(s), GC personnel and all others involved in the design, are knowledgeable of the moisture-sensitive systems required for the project.
- Verify all details related to the weatherproofing and waterproofing of the structure are properly designed and demonstrated on the construction drawings.
- Verify all specified materials provide for the adequate moisture control of the building envelope and are compatible with the design applications and other related materials to be used on the project. Wolf Construction Services recommends Glass-Mat products be used in lieu of sheetrock products.
- Ensure the availability and/or application of all specified materials will not negatively impact the anticipated construction schedule and installation of other moisture-control components.
- Confer with waterproofing consultants, manufacturer's representatives and approved applicators to ensure proper applications and installations of specialized systems.
- Verify the compliance of the construction plans, landscaping, and drainage plans, and/or site plans with the most current soils reports and/or civil drawings/reports with the responsible architects, engineers, and designers.
- Verify all design drainage systems adequately remove water away from the perimeter of the building to approved drainage receptacles.
-

Review Construction Documents and Contracts

Define accountabilities relative to the following:

- Moisture control
- Identification of mold cultivating conditions and mold growth
- Notification
- Documentation
- Remedial procedures
- Preventive maintenance
- Proper commissioning training to place the burden of maintenance responsibility on the building owner to maintain the building following construction.

Examples of items that typically could be included as building owner responsibilities are changing filters, maintaining proper climate control & indoor air quality.

Prevention – Pre-Construction Phase

Reducing the risk of water intrusion and possible mold contamination should begin immediately during the pre-construction phase of a project. This practice applies not only to new construction, but also to remodels, renovations and repairs, where new building components are integrated with existing assemblies.

Suggested Preventive Activities:

1. Implement a Water Intrusion Management Program (WIMP) plan with consideration of the unique characteristics of each project.
2. Inspect all building components to ensure they are free of bioorganic growth prior to installation.

3. Check all items for proper working condition and damage prior to installation.
4. Consider the ramifications of climate and weather on the construction process.
5. Keep porous building materials dry at all times.
6. If building materials do come into contact with a moisture source, dry out the affected areas immediately.
7. If mold is suspected, document the condition and report it immediately. All cases of mold will be documented (location, type of mold, contributing factors), photographed and placed on Procore. The field report will be communicated to Superintendent/PM. These measures will help in dealing with potential future claims.
8. Document everything: any changes to the plans, agreements of installation procedures, pre-installation conditions, etc. Place documentation on Procore.
9. Sequencing of a project is important to try to ensure that materials arriving on site be properly stored in a safe, dry condition.
10. Begin documentation process: photograph/examine all materials for proper packaging, damage, and mold (including lumber) prior to installation.
11. Verify site drainage/topography is consistent with the design; if not, document and notify appropriate parties.
12. Identify any potential conflicting envelope or barrier products. Confirm any unique flashing details, or taping details that could potentially create a water intrusion issue. To include but not limited to the following: liquid membrane, deck flashing details, wall and roof penetrations, knife plate flashing, etc.

Prevention – Construction Phase

During construction, the GC implements their construction strategy through scheduling and coordination between design and the work product of the various trade subcontractors, including. As the entity most responsible for constructing a moisture-free building, the GC must have a broad knowledge of all trades and understand the consequences of how he chooses to schedule events. Material availability, the points of installation of these materials, and potential subsequent delays in material or labor can affect the entire project outcome and, whenever possible, must be identified before a realistic schedule can be established.

Failure to properly sequence the components of moisture-sensitive assemblies will undoubtedly create latent water intrusion incidences, some of which may not appear for months or years. For instance, in regions of little rainfall, such as in the southwestern United States, water intrusion at improperly installed windows may only appear (wet carpeting or drywall) during periods of abundant rainfall, which may only occur a few times each decade. Wall cavities adjacent to windows may become wet every time it rains, facilitating bioorganic growth, but without any manifestation in the living space of the building.

In addition to the GC, subcontractors & are also responsible for understanding the effects of the installation of their specific building components on the entire related moisture control systems. This will require a general knowledge of adjacent materials of other trades and the proper integration of the entire assembly.

Finally, regardless of the quality and accuracy of the building plans, unique and/or peculiar situations and conditions arise in the field not adequately addressed in any of the construction documents. Solutions to these problems should be approved by the project manager and agreed

upon by the customer. For conditions anticipated to reoccur throughout the project, the GC may require additional detailing from the design team. All directives and field modifications should be documented and included in the field file.

Personnel Supervision is CRITICAL. *The vast majority of water intrusion incidents are caused by improper installation of the moisture- control assemblies. Proper and adequate supervision of field personnel, therefore, is a critical element in the success or failure of these assemblies and, thus, the eventual performance of the building.*
Jobsite superintendents must develop and conduct a system of checks and inspections to ensure that all installations of building components in moisture-sensitive assemblies adhere to the building plans, manufacturers' specifications, industry standards, and all relevant building codes.

The customer and/or GC may want to consider engaging third-party water intrusion experts to assist with developing project-specific water intrusion management plans and prevention checklists and to conduct onsite inspections of work by various trade personnel, particularly at critical phases of construction, to reduce risk even further.

Managing Bio-organic Growth

This section details proactive activities to prevent and address instances of mold growth. Programs of instruction should be developed for all construction personnel working on jobsites. Also, jobsite personnel should conduct routine inspections that consider the following:

Identifying potential mold issues. As a matter of habit, all construction personnel should be aware of possible mold contamination in and around the jobsite.

1. The most basic method is to rely on the senses:
    - Visual (growth, water damage)
    - Smell (odor)
    - Feel (dampness, humidity)
    - Listen (to complaints by occupants)

2. If contamination is suspected, inspect water-related systems for possible problems. Find building components with visible signs of moisture and check adjacent assemblies.
    - HVAC System
    - Plumbing fittings
    - Shower/tub assemblies
    - Waterproofing assemblies
    - Retaining walls and foundations
    - Fire sprinkler heads & valves
    - Drain lines
    - Roof and deck assemblies
    - Exterior building envelope penetrations
    - Window and door assemblies
    - Site drainage

3. Required Activities
    - Immediately identify and document all mold-related issues.
    - Report all mold-related issues immediately to supervisor (Super/PM).
    - Determine significance of event.

- Determine remedial activities (collaborate with project designers, supervisors, risk management and WIM representatives, as required).
- Use checklists/inspection forms for formal documentation
- For projects which include finish carpentry, Wolf will administer a humidity reading before work begins. If humidity levels are below 25% or above 55%, the GC will be notified, and work WILL NOT proceed until levels are within the industry standards for installation.

General Building Activities

- Discuss mold awareness and water intrusion in weekly site meetings such as safety toolbox talks or morning huddles.
- Cover open construction/repair areas to prevent water infiltration. Specify means to protect building components from moisture during adverse weather conditions.
- Ensure that schedule of work for trades are done to eliminate the exposure of building materials that will absorb moisture.
- Document the construction process in sufficient detail, including photos, to allow reconstruction of events during key project phases.
    - Schedule and document periodic inspections by the design professionals (i.e., architect, waterproofing experts, mechanical engineer, manufacturers' representatives) to inspect building components for potential sources of water intrusion. Consider hiring an independent, third party water intrusion/microbial expert to conduct oversight and assist with conducting and documenting periodic inspections (see discussion in earlier chapter on Builder Risk of Water Intrusion).

Specific Systems Criteria

The primary barrier for the prevention of water intrusion to a building is the continuous building envelope. This barrier may consist of a variety of similar and dissimilar materials installed by different subcontractors, under supervision of the GC, at various times during the construction schedule. The greatest risks of intrusion through the continuous building envelope occur at the transition and integration points of these materials. It is essential that all participants in the design and construction pay the utmost attention to these areas.

The following lists are basic principles for typical construction assemblies; should be aware of and responsible for seeing that hired subcontractor personnel are adhering to these principles. Taking into account the wide variety of designs, engineering, and construction within the building industry, this list should be used as a guideline and not considered exhaustive:

Exterior Walls

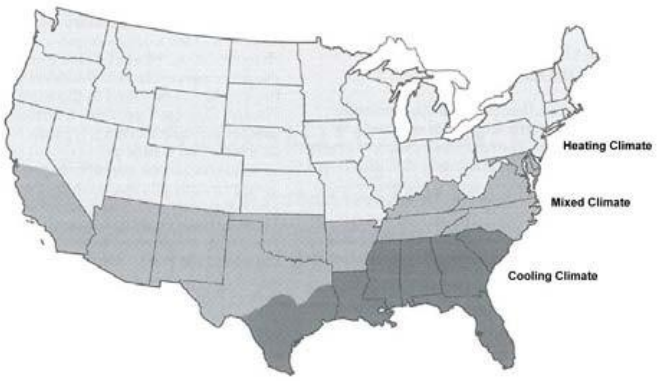
Water will invariably enter the most exterior skin of a building envelope, usually at transition points such as at windows/siding transitions, plumbing (i.e. hose bibs) and other penetrations. It is essential to design and install moisture and air infiltration barriers or retarders, which will allow water to exit the exterior wall systems.

- Review exterior wall designs and the wall section details for material selections and installation instructions. Suggest substitutions of technologically improved materials where applicable.

- Verify the location and application of specified moisture, vapor, and air barriers and retarders (if required) conforms to manufacturer's requirements for the wall components and are appropriate for the geographic region of the project.
- Verify external walls (especially on brick-faced buildings – which act like a sponge with respect to moisture) have appropriate drainage planes behind them with appropriate vapor barriers (if required).
- Review the terminations of the specified moisture, vapor, and air barriers and retarders (if required). The performance of these components will depend upon the adequacy of their sealed terminations. Verify avenues of exit for moisture outside the drainage plains are provided as designed and remain clear.
- Ensure subsequent building components do not block weep locations (such as by caulking, concrete, mortar, etc.).
- Verify exterior wall components are properly installed and integrated with adjacent building components. Make certain all flashing is installed as required and exterior wall penetrations are properly weatherproofed.
- Pay particular attention that the flashing, waterproofing components, and the moisture, vapor, and air barriers and retarders are installed properly at complex penetrations and integrations.
- Make certain all flashing, waterproofing components, and moisture, vapor, and air barriers and retarders are free from unsealed holes, tears and gaps except those made by attachment devices.
- Verify the placement of moisture, vapor, and air barriers and retarders are located properly in the exterior wall assemblies allowing building material in the wall to dry if wetted. Use the following general guidelines for the proper placement of vapor barriers in different climates:

    - Heating Climates (low winter temperatures, low relative humidity) – Generally, these climates are in areas above the 37th parallel. Locate vapor barriers in exterior walls to the warm side of the wall cavity, toward the interior of the building. *Note that the use and location of vapor barriers in exterior walls should be used only after careful examination of the prevailing regional climate conditions and the conditioning and pressurizing of the interior air environment, as it is important for walls to breathe, permitting drying of wall construction materials from moisture that will enter the wall cavity.*

    - Cooling Climates (mild winter temperatures, high relative humidity) – Generally these climates are in areas on the gulf coast and lower east coast areas. Locate vapor barriers in exterior walls to the warm side of the wall cavity, toward the exterior of the building or eliminate the vapor barrier completely. *Note that the use and location of vapor barriers in exterior walls should be used only after careful examination*



United States climatic zones used for moisture recommendations

of the prevailing regional climate conditions and the conditioning and pressurizing of the interior air environment, as it is important for walls to breathe, permitting drying of wall construction materials from moisture that will enter the wall cavity.

- Heating & Cooling Climates (varied temperatures, moderate humidity) – Generally, these climates are below the 37th parallel, and are not a cooling climate. Roof design becomes more important. The use and location of vapor barriers in these climates is a complicated issue that should be determined in consultation with a moisture intrusion professional and built as specified by the manufacturer.

- Damp proof all surface and subsurface building components as required by the climate and site conditions, such as basement walls, planters adjacent and/or above to building systems, adjacent retaining walls, etc.

Window/Door Selection and Installation

Window and door systems and installation are one of the major, and most common, sources of water intrusion locations inside of buildings. Water intrusion at windows is often not noticed until it is too late. The proper selection and installation of windows should be a primary concern of the GC.

The quality of windows and doors selected for a project is very important. Poor quality will save a few dollars initially but, subsequently, could result in water intrusion and expensive repair costs. Use better quality double- glazed windows.

On a typical wood-framed structure, the framer usually installs the windows. The cost of installing windows is minimal compared to actual framing; however, the framer's greatest exposure to water intrusion and defect litigation is the window installation. Wolf Construction Services requires a 'Mock-Up' be conducted before window/door installation begins. The purpose of the 'mock-up' is to verify all parties agree regarding the installation procedures of windows and doors. The following are required to be in attendance: window supplier, door supplier, window installer, building envelope specialist (Tyvek or Zip rep.), and GC field representative. In the instance that a window supplier will not send a representative, Wolf Construction Services requires a signature, and or, email correspondence from the GC's Project Manager confirming Wolf Construction Services was instructed to proceed with field installation procedures.

Wolf Construction Services will complete the following to ensure the correct installation process has been maintained throughout the project:

1. The project foreman and superintendent will attend and document the 'mock-up' on Procore. Documentation will include product information and pictures of each phase of the installation process. Caulking, nailing, taping, and flashing pictures need be included.
2. The project foreman will duplicate the 'mock-up' with the installation crew. Documentation will be included on Procore.
3. The project foreman will inspect two windows per day for each day of installation using the Procore Window inspection to ensure the installation process is being followed correctly.

- Review window installation methods and sequencing with all affected subcontractors and agree on proper duties for each.
- Verify the installation adheres to the latest code requirements and industry standards.
- Properly lap all flashing, which should be free of tears, holes and folds.
- As a practice, do not nail aluminum window fins within 3" of the corners.
- Make certain there are no open gaps between window fins, stucco molds or flashings. This is especially critical at the stacking bars in field stacked windows. **Flash a lot!**
- Caulk junctions of window fins and flashing on appropriate sides. The sill side should not be caulked.
- Emphasize the detrimental effects of reverse lapping, cuts, tears and inadequate attachments of window flashing and building paper when applicable.
- Pay close attention to installation and integration of flashing, waterproofing components, and the moisture, vapor and air barriers and retarders at inset windows. Verify ledges slope away from the structure.
- Wood-framed windows are not generally recommended, as they are a good food source for mold.
- Window stacking is generally not recommended due to the potential problems of water intrusion.
- Ensure windows are properly sloped and drain properly.
- Do not drop windows. If they are dropped during construction, replace them.

Roofs and Balconies

Roofs and balconies are also a major source of water intrusion locations; however, unlike windows, water intrusion through roofing and balcony flooring is often noticed very quickly so the opportunity for fungal growth from leaks at these areas is reduced. Due to the wide variety of roofing systems and balcony flooring finishes and waterproofing materials, only a general discussion follows. Consult manufacturer and industry standards as required. Information is available from APA: The Engineered Wood Association, *Build a Better Home Series*, www.apawood.org.

The majority of roof leaks occur in locations where the plane of the roof is interrupted by a ridge, or another roof intersecting at an angle, a wall or a penetration. Proper flashing at all these locations, including chimneys, is critical to proper performance. Roof design is a major cause of roof issues especially in cold climates where ice dams may develop.

Verify balconies have appropriate drainage systems. Balconies should be sloped away from the structure. Promptly correct ponding issues observed on balconies and ensure thresholds are appropriately drained and above balcony grade.

- Review the installation methods and sequencing of all affected subcontractors and agree on proper duties for each. Typically this should include roofing, sheet metal, framing and siding, stucco and may include mechanical, electrical, plumbing and/or masonry.
- Make certain all manufacturers' installation guidelines are followed. In lieu of contradicting architectural and structural details, Wolf Construction Services will always follow the manufacturer's specifications.

- Verify all roof penetrations are properly bibbed and sheet metal is properly installed. In lieu of contradicting details, Wolf Construction Services will always follow the manufacturer's specifications.
- Pay close attention to roof junctions such as rake and headwalls, chimneys, plumbing penetrations, vents, skylights, parapet walls, ladders, HVAC and electrical penetrations, etc.
- Verify all drainage systems are in place where applicable (i.e., roof drains, crickets, scuppers, gutters, etc.)
- Direct roof drainage and gutter systems away from foundations and make certain the grade at foundation edge drains away from the building.
- Chimneys should be side fastened only – not top fastened. They should also be appropriately insulated.

Sealants

Sealants play an important role in maintaining a moisture-free building and are a critical finish element for most systems. Care must be taken to ensure sealants are placed only where required, do not block other designed weeping or evaporation systems installed on the building envelope, and are appropriate for the materials being sealed. The project manager has the responsibility to ensure sealants are compatible with surface materials and installed properly, for example use of primers when manufacturer required.

Sealant manufacturers generally provide detailed installation instructions, including descriptions of sealant mixing, bond breaker materials, primers, and size, shape, and thickness of the sealant bead.

- Make certain the proper type of sealant is used for each placement.
- Seal all appropriate penetrations in the building envelope.
- Seal all perimeters of the building envelope assemblies such as siding/wood trim, wood trim/windows, and doors, etc.

Responsibilities

Field Foreman Role

Subcontractors may likely be the first personnel to notice a water intrusion event. They should report any events to the site superintendent or foreman, who generally will be the first supervisor to observe and respond to any water intrusion event. The foreman will, in turn, report any incident of water intrusion and/or mold to the superintendent. The foreman may decide that some events, which are very limited in size and impact can be remediated immediately and documented only with a verbal report to the superintendent. In instances involving water intrusion issues of greater impact and magnitude, it will be necessary for the superintendent to visit the jobsite, observe the event, and begin to create a documentation file.

Foreman Responsibilities

Incident Response

- Evaluate severity of any and all water intrusion events on the jobsite and make determination if the event is significant and needs to be reviewed by the superintendent.
- Report ALL water intrusion events at least verbally to the GC's field superintendent, Wolf superintendent, and Wolf project manager.
- Carefully document all water intrusion issues. Provide pictures and dates of each issue on Procore.
- May remediate insignificant water intrusion issues according to a response plan developed in conjunction with the GC. Supplies will be provided by GC, and labor to be billed per hour as a Change Order.
- Responsible for ensuring, above all else, the safety of jobsite personnel and immediately reporting any safety concerns to the GC's field superintendent and Wolf superintendent.

Prevention Responsibilities:

- Responsible for inspecting materials upon arrival at jobsite/prior to installation to ensure they are in good condition and free from visible fungal growth.

General Note. *At any time during a water intrusion/mold event, if litigation is threatened, all documentation will be presented to the Wolf Superintendent for further negotiations.*

Superintendent Role

Once the foreman has advised that a potentially significant water intrusion issue has occurred, the superintendent should promptly respond, visit the jobsite, and observe the issue. The superintendent is also responsible for gathering all documentation pertaining to mold and water intrusion and must conduct a follow-up visit with the GC's field superintendent. The superintendent will pass along all the water intrusion documentation to the PM.

Superintendent's Responsibilities

Incident Response

- Visit the jobsite where the foreman has identified significant water intrusion issues.
- Evaluate severity and significance of event and communicate issue circumstances to GC's field superintendent and Wolf Construction Services PM. Determination of event significance will be made according to specific guidelines presented in the chapter on Initial Response Actions.
- Report ALL water intrusion events (significant or insignificant) at least verbally to the Project Manger.
- Carefully document all significant water intrusion issues and all incidents of suspected mold.
- Assist foreman in developing response plans to remediate insignificant water intrusion issues.
- Obtain and maintain any and all Safety Data Sheets (SDS) for any products used by any GC employees during remediation.

Prevention Responsibilities:

- Wolf superintendent will attend all window and door mock-ups.
- Responsible for inspecting the project environment prior to installation of any building systems to verify that the environment is appropriate for installation of materials and has not sustained prior water intrusion issues. Any pre-existing conditions found (such as stained ceiling tiles, roof leaks, floor tile buckling, etc.) should be addressed per applicable incident response procedures, documented through notes and photographs and the documentation forwarded to the risk management department.
- Responsible for ensuring that all general and subcontractor personnel are informed of their responsibilities under the water intrusion management plan during job meetings.

General Note. *At any time during a water intrusion/mold event, if a claim is possible, the Superintendent should promptly contact the Project Manager. It is the Wolf PM's responsibility to notify the Risk Management Committee of any potential mold instances.*

Microbial Response Plan

This section will outline how personnel should initially respond to all cases of water intrusion or mold.

Basic Protocol

- All reports of water intrusion must be treated as an *emergency*. A water problem handled in 24 – 48 hours usually carries little cost.
- All reports of water intrusion or mold must be investigated by the superintendent and reported at least verbally to the Risk Management Committee. The investigative and reporting process will NOT vary even though the responses to the problems may vary.

- All water intrusion events determined to be significant must be completely documented and the documentation retained. The Project Manager will pass the documentation onto the Risk Management Committee to determine if further action needs to be taken.

Initial Response Procedures
Immediately upon notification or observation that a water intrusion issue may have occurred or is occurring, the responding personnel should immediately:

1. Shut off the HVAC System,
2. Shut off all water, and
3. Contact the Foreman/Superintendent.

The responding employee (possibly with assistance from a third-party consultant) must immediately inspect the incident, define the extent of damage, and cause of loss, if possible.

When should a contractor suspect mold even if none is visible?
It is important to be aware that mold may be present and not visible. When determining event significance, personnel should be aware of the following conditions, which may indicate the presence of hidden mold:

- Relative humidity in the building greater than 65% for 3 – 5 days
- Building materials/HVAC components wet for more than 24 – 48 hours
- Musty/Damp odors
- Building conditions conducive to mold growth are present – such as roof leaks, wet/stained carpet or other building materials
- Evidence of previous moisture problems — staining, cracking
- Wet HVAC filters
- Lack of maintenance
- Wet building materials that are porous or semi porous
- Occupant complaints
- Prior history of problems with the building or system
- Wet flex duct

Response Actions - Insignificant Water Intrusion Events

Following initial response, **for water intrusion events determined to be insignificant**, personnel with help from a qualified third party, as necessary, will apply the following to resolve and properly document the water intrusion event and response actions taken. This protocol may also apply in cases such as emergency flooding or weather disasters when event response is expedited. Qualified personnel can perform any necessary cleanup work provided that no gray/black water and mold are involved.

Summary of Clean-Up Actions

- Identify all sources of water intrusion or leaks prior to remediation.
- Contain impacted areas with 6-mil polyethylene sheeting and dehumidify, if necessary.
- Insulation – Remove from opened cavities (where drywall is removed).

- Window Trim – Remove if water damaged, otherwise wet wipe clean using tow towel system. Remove all trim that is attached to drywall to dry.
- Metal studs and materials – Wipe clean with two towel system.
- Remove and replace any damaged building materials per Table 1 guidelines.

Post-Remediation Sampling
As a precaution (if directed by the WIM), an independent microbial consultant may perform post-remediation microbial sampling. (See chapter on Microbial Sampling for details.) This may be prudent if the project involves a high-risk environment, such as a day-care, or where there have been prior or current occupant health complaints or Indoor Air Quality issues related to the scope of work performed by the GC or if the issue is covered by warranty. Only a qualified microbial consultant should perform sampling**.**

Response Actions – Significant Water Intrusion Issues

Following initial response actions and once it is determined an event is significant, the following additional initial response actions should be employed as necessary, either by qualified contractor personnel or a qualified third party:

- Identify and shut off or repair all sources of water leaks or intrusion (if not already done).
- Shut down the HVAC system (if not already done).
- Contain visually impacted areas with 6-mil polyethylene sheeting to reduce chance of mold spores spreading to other areas of the building. Negative air machines inside the contained area may also be employed to further reduce spread of contamination.
- Dehumidify impacted areas.

Once it is determined there is a significant water intrusion event, the Wolf Superintendent should consider the following:

Contact Risk Management Committee for:

- Further investigation and determining potential future action steps.
- Work conditions. Can work be continued in a safe manner for all employees.

Pre-Remediation Microbial Investigations: When to Perform
If any significant risk factors are present, it is recommended that the GC immediately contact the services of a microbial consultant to perform an investigation including sampling.
A microbial investigation may be necessary if the cause of loss is not known and the extent of loss is not known. If there are multiple causes of loss contributing to a problem, a microbial investigation may be able to identify these causes. This is especially important because if another contractor or entity contributed to the cause of loss or was wholly responsible for the contamination found in the building, liability to the general contractor or will be reduced or eliminated. If the extent of the contamination is not known, it may be important to perform sampling to delineate the parameters of the problem ensuring that the entire problem has been addressed. Microbial sampling also can help determine if any visible mold is also the source of any airborne mold.

Remediation Planning

Just as there are no formally mandated guidelines or regulations for mold testing, neither are there any formal regulations for mold remediation. The following protocol, however, can be employed to mitigate mold without making an existing situation worse:

A. GC and sub-contractors should work together or with a microbial environmental consultant to develop a scope of work or mold remediation plan.
B. Notify and discuss the plan with any impacted parties, particularly building occupants. Consider relocating occupants during remediation, especially if high-risk individuals or pets are present, or if the impacted area cannot be sufficiently isolated from the rest of the building.
C. Proper remediation and Personal Protective Equipment (PPE) must be utilized at all times. At a minimum, PPE will include gloves, eye protection, and an N-95 respirator. Based on the amount of contamination, respiratory protection may be increased.
D. In all cases involving the presence of visible mold, the risk management department must develop a written plan for mold remediation. It is strongly suggested that this plan be developed in conjunction with an environmental consultant if other than clean water was involved or if more than 10 square feet of visible mold is present. Plans should include:
    a. Summary of the issue: including building age and location, identification of any occupants and all occupant comments (including health complaints), visual observations, cause of problem, immediate response actions, and photographs.
    b. Remediation plan, which will include remediation methods, what items are to be removed/cleaned, and all protocols, including detailed remediation/cleaning procedures.
    c. Types of PPE to be utilized.
    d. Whether occupants will be relocated.
    e. Plan for post-remediation sampling.
    f. Signoffs and releases by Agency or impacted party when work are complete.
    g. Plan to recoup any damages (if applicable).

The following guidelines for mold remediation may be used.

<u>Visible mold growth <10 square feet (s/f) caused by clean water:</u>

1. Trained personnel can remediate these problems.
2. Contain area of visible contamination with 6-mil polyethylene.
3. PPE to include gloves, eye protection, and an N-95 respirator.
4. Engage a qualified microbial consultant to run post-remediation samples.
5. Remove and carefully wrap all impacted building materials.
6. Consider replacing HVAC filters.

Visible mold growth between 10 and 25 s/f caused by clean water:

1. Trained personnel can remediate these conditions, but the services of a qualified microbial consultant and remediation contractor should be strongly considered due to additional remediation equipment and PPE that should be used.
2. Containment must be constructed and put under negative pressure. All HVAC system air vents, supplies, ducts, chases, and risers within the impacted area must be sealed to prevent migration of contaminants.
3. PPE may include half-face respirator and full-body protection, in addition to gloves and eye protection.
4. Surfaces of all objects removed from the containment area should be vacuum cleaned with a High-Efficiency Particulate Air vacuum prior to removal from contaminated area.
5. A qualified microbial consultant is needed to run post-remediation samples.
6. Replace HVAC filters.

Visible mold growth > 25 s/f and/or dirty water conditions:
These situations require initial involvement of environmental industrial hygiene consultant and environmental remediation contractor. They will always require post-remediation sampling.

Remediation Procedures

Once it is determined remediation can begin, qualified personnel or a qualified third party should remove and replace damaged building materials per the Table 2 remediation guidelines.

The following practices are also important with respect to solving water intrusion issues with suspected or visible mold present:

- Do not use biocides and/or anti-microbial chemicals as a substitute for microbial removal.
- Do not remove contaminated materials through the building without wrapping in plastic.
- Do not remove any materials that may contain lead or asbestos prior to testing.
- Do not run "post-remediation" sampling immediately following remediation. Utilize negative air machines equipped with HEPA filtration for 24 to 48 hours to "scrub" the air.
- Do not begin reconstruction prior to post-remediation sampling and receipt of successful sampling/visual inspection results.
- Do not delay instituting any mitigation procedures listed in this guide.
- Cut (do not tear) out wallboard.

- Ensure negative air machines and other equipment used on a site is decontaminated/cleaned prior to use in another site.
- Wet-wipe clean and/or HEPA vacuum surfaces in the remediation area to remove excessive settled spores. These areas should be free of dust and debris upon post-remediation monitoring.
- If removing visible contamination, remove and contain at least one- foot beyond visible water damage and/or visible contamination.
- Decontaminate all equipment prior to use in the work areas.
- All waste is currently non-regulated and may be disposed of in a regular landfill unless asbestos or lead-containing materials are also present. Microbial waste should be wrapped in plastic prior to disposal to protect from further exposure.

Post Remediation Sampling

If a building has been impacted by fungal growth and remediation has been performed, post-remediation sampling should always be performed by only a qualified microbial consultant (see Chapter on Microbial Sampling). Post-remediation sampling:

- Generates a level of comfort for the Agency and occupants;
- Provides documentation of successful project completion should there be an issue of future liability;
- Provides scientific evidence that the remediation process has been successful; and
- Provides an independent, third-party evaluation of the project.

Post-Incident Follow-up

Once the cause of the problem has been identified, it is important to determine why the problem occurred and make any necessary changes (such as system improvements or increased inspections) to prevent reoccurrence of the problem. The Wolf Superintendent and GC field representative will be responsible for any post-incident follow-up.