



Responding to Building Water Intrusion & Damage

This guidance document provides information to assist Campus Facilities' staff in responding to water damage due to flooding and water intrusion in University buildings. Water intrusion is a release of water (fresh water, storm water, sewage water, etc.) into the interior of a building. Large water intrusions in buildings may potentially involve multiple spaces, leak through to lower floors, and affect multiple building components including ceilings, walls, carpets, and furnishings. When water damage occurs in a building, an immediate response can save time and money, and protect human health. Delays or incomplete responses may increase both the scope and severity of the problem, and result in increased time and expense toward final restoration.

If building materials impacted by water intrusion must be removed and are suspect asbestos and/or PCB containing, the Physical Plant Environmental Shop must be consulted.

Types of Water Damage

Water causing damage in a building can be assigned to categories based on its source and on the level of chemical or biological contamination it contains.

- **Category 1 - Clean Water:** Clean water, such as from a sink overflow, broken water line, or rainwater infiltration, is referred to as Category 1. Category 1 water represents the lowest health risk to building occupants and clean-up crews. Building materials and furnishings damaged by Category 1 water have the best potential for being salvaged.

Damage from water in Category 1 should be responded to as soon as possible, within approximately 24 to 48 hours. After 24 to 48 hours, the amount of microbial growth begins to lower the water quality to that of Category 2.

- **Category 2 - "Gray Water":** Category 2 water is water that is not "clean", but is also not highly contaminated. Category 2 water might be contaminated with chemicals, debris, or microbial growth. Some sources of Category 2 water might be a storm drain backup, a leak of treated cooling water, surface water flooding, a leaking fire suppression system, or a broken steam line.

Water in Category 2 presents an increased potential for risk of disease or infection to building occupants and clean-up crews. Because of additional contaminants in the water, materials damaged by Category 2 water are more difficult to salvage and require additional decontamination efforts.

- **Category 3 - "Black Water":** Category 3 water is water that is highly contaminated. Sources of such water might be sanitary sewers, contaminated rivers, seawater, or contaminated surface water. This water might contain viruses, bacteria, or parasites that could pose a threat to human health. It might also contain toxic or allergenic materials. Category 3 water is likely to cause disease or infection from direct, or possibly even indirect, contact.

Potential microbial contaminants in Category 3 water:		
Viruses	Bacteria	Parasites
Rotavirus, Hepatitis A, and Norwalk	Salmonella, Campylobacter, and E. coli	Giardia, Cryptosporidium, Round worms, and tapeworms

Why is Water Damage Such a Concern?

Water infiltration in a building can damage building materials and furnishings in ways such as staining, swelling, rusting, or loss of structural integrity. Category 2 and 3 water carries contaminants that must be addressed as part of any restoration effort. For building occupants, water infiltration and damage could result in the disruption of work activities, and can cause the loss of irreplaceable data and materials. Even damage from water in Category 1 can potentially promote infectious or allergenic microbial growth, as well as the generation of noxious odors, when not addressed promptly and properly. Category 2 and 3 water damage can potentially present significant health risks.

Responding to Water Damage

A water damage response should consist of five fundamental steps:

1. Protect Occupant and Clean-up Crew Health

To protect the health of building occupants and crews responding to water damage, it is necessary to determine the category of water involved. The source of the water, the appearance, the odor, and suspected contaminants will help to determine which category of water is involved in an incident. (See Categories 1, 2, and 3, presented above.)

If the water is Category 2 or 3, the Environmental Health Office [phone: 315-443-4132] should be notified. Building occupants should be instructed to avoid contact with contaminated materials or contaminated water.

Cleanup crews should wear appropriate personal protective equipment when working with contaminated materials or contaminated water. Appropriate equipment may include:

- Air-purifying respirator with a P100 filter. (Organic vapor or other cartridges might be necessary as well. Consult the Environmental Health Office [phone: 315-443-4132] for guidance. To wear a respirator, employees must participate in the University's Respiratory Protection Program).
- Protective clothing, including boots and gloves.
- Eye protection.

When working in, or remediating, damage from Category 2 or 3 water, employees should protect from contamination any cuts, abrasions, or other wounds that penetrate the skin. Contamination of these wounds could potentially expose an individual to infectious organisms.

It is important to advise building occupants of any risks caused by the incident, and to give them guidance on entering their areas. If air handling units might contaminate other areas, they should be isolated or shut down. Access to the contaminated area should be limited, to prevent the spread of contamination.

2. Prevent Additional Damage

Once occupant safety has been addressed, take steps to prevent additional property damage. Preventing additional damage requires stopping the flow of water, as well as protecting building materials and furnishings. If the water flow cannot be stopped, it should be directed to drains, or otherwise out of the building, if possible. If the water flow cannot be stopped, it should be directed to drains, or otherwise out of the building, if possible. (It may be necessary to collect Category 2 or 3 water for disposal as "hazardous waste". Call the Environmental Health Office [phone: 315-443-4132] for assistance in determining whether drain-disposal is appropriate.)

Building occupants and restoration crews should take steps to prevent or minimize damage to additional furnishings in and near the flood area. Some actions that might be appropriate include:

- Remove and secure small furnishings, breakables, moisture sensitive items, and high value items.
- Place items onto tables or counters and cover them with plastic.
- Protect chair and desk legs with a wrap of foil, or place each leg in a plastic cup or bowl, where the legs contact the floor,
- Pin or tie up drapes and furniture skirts.
- Remove undamaged files from file cabinets that are still at risk of coming in contact with water.

3. Remove Contamination

Once the flow of water is stopped and undamaged materials have been protected, remove the excess water and any contamination carried with the water. Pumping is recommended in order to remove large volumes of water. Where water is too shallow for the use of pumps, wet/dry vacuums are recommended, unless the water is contaminated with flammable materials. (For water contaminated with flammable materials, contact the Environmental Health Office [phone: 315-443-4132] for assistance with clean-up.) Mopping is a less effective method that is limited to relatively smooth, hard surfaces. With Category 2 or 3 water, it may be necessary to repeatedly flush the area with clean water to assist in the removal of contamination. Depending on the source of the water (research lab, mechanical system, etc.) and the contaminants in the water, disposal of the contaminated water into a floor drain or sewer system might not be allowed. Before disposal of Category 2 or 3 water, consult with the Environmental Health Office [phone: 315-443-4132] for proper disposal methods. (If a disposal method has not yet been determined, collect the category 2 or 3 water in 55-gallon drums, and label the drums with the suspected contents.)

Once the contaminated water is removed, a decision can be made regarding the use of biocides as part of the clean-up and restoration process. The use of biocides may or may not be warranted. Biocides can slow microbial growth and aid in sanitizing contaminated materials, but they can also cause eye and respiratory irritation to occupants or clean-up crews, as well as odor complaints from building occupants. Also, determining the proper application rate can be difficult. Refer to the product label for instructions on product use and associated personal protection required. (Contact the Environmental Health Office [phone: 315-443-4132] for help in determining whether or not to use disinfectants, which disinfectants to use, and what disposal method may be used to discard the resulting waste.)

Properties of Environmental Disinfectant Classes			
<i>Suggested Guidelines for Remediation of Damage from Sewage Backflow into Buildings. Journal of Environmental Health, 9-15 (October 1994).</i>			
Disinfectant Class	Action	Advantages	Disadvantages
Alcohols	Bactericide, Viricide, Fungicide	No staining, non-irritating	Inactivated by organic matter, highly flammable
Quaternary ammonium compounds	Bactericide*, Viricide*, Fungicide	Inexpensive	Inactivated by organic matter, limited efficacy
Phenolics	Bactericide, Viricide, Fungicide	Inexpensive	Toxic, irritant, corrosive, might remain on contacted items
Iodophors	Bactericide, Viricide, Fungicide, Sporicidal**	Stable, residual action	Inactivated by organic matter, expensive
Glutaraldehydes	Bactericide, Viricide, Fungicide, Sporicidal**	Unaffected by organics, non-corrosive	Irritating vapors, expensive
Bleach	Bactericide, Viricide, Fungicide, Sporicidal**	Inexpensive	Toxic, corrosive, inactivated by organic matter; removes color
Hydrogen Peroxide	Bactericide, Viricide, Fungicide, Sporicidal**	Relatively stable	Corrosive, expensive, degrades in heat or ultraviolet light

*=Limited effectiveness

**=Requires prolonged contact time

4. Dry the Site

Prompt drying of affected areas is essential for effective clean-up after a flood or other water intrusion inside a building. Drying should begin immediately after the removal of water and contaminants from the affected area. Prompt drying will reduce the effects of water damage, especially microbial growth and contamination.

The process of drying is managed through air movement, humidity level, and temperature. Fans, blowers, and carpet dryers are used to create air movement that increases the rate of evaporation of water from wet materials. It will be necessary to move chair pads and furnishings, to allow air movement to reach all areas. In some cases it may be necessary to create venting holes in walls and cabinets, to facilitate air movement.

Relative humidity level is important to the drying process, and is a good way to determine drying effectiveness. For optimal drying, the relative humidity in an affected space should be maintained below 40%. For small water intrusion incidents, the building's ventilation system may have adequate capacity to maintain optimal relative humidity levels. Energy saving modes (non-occupied settings) should be temporarily disabled, allowing the ventilation system to run in the occupied mode (or at a greater ventilation rate) for 48 hours, following the completion of cleanup activities, or longer, as required to dry all affected materials. For larger floods, it may be necessary to bring in industrial dehumidification or desiccation equipment to manage humidity levels in the building. (Contact the Environmental Health Office [phone: 315-443-4132] for help determining whether proper humidity levels are being maintained.) Temperature in the affected space can help indicate which type of equipment is appropriate. Below 68°F, refrigerant dehumidifiers can ice up, and desiccant dehumidifiers may be a better choice. Home dehumidifiers are not up to the task.

Indoor RH targets for drying	
Excellent	<40%
Good	40% - 50%
Fair	50% - 60%
Poor	>60%

Temperature influences evaporation rate, relative humidity, microbial growth rates, and occupant comfort. Higher temperatures increase the amount of water the air can hold, and thus speed up evaporation. However, higher temperatures can also encourage the growth of bacteria and molds, increasing concerns of potentially adverse health effects and odors. Cooler temperatures reduce the microbial growth rate, but can also cause condensation of moisture in the air. With very low temperatures, occupant comfort becomes a concern.

Opening windows is not necessarily a good way to speed drying. Mechanically ventilated buildings may rely on building pressurization to regulate the flow of air through the building. Opening windows will change the balance of the building pressurization, and upset the airflow. Further, in the warm months, an open window can allow humid air into the building. In cold months, the open window can rapidly cool the building, resulting in condensation of water onto interior surfaces. Open windows also present security concerns.

5. Salvage or Replace Materials

The costs in expense and time to salvage water-damaged materials may often outweigh the costs of replacement. In some cases, materials with limited damage and high value may be effectively salvaged. The less absorbent the material, the cleaner the water, and the shorter the time until drying begins, all increase the likelihood of a successful salvage.

Materials damaged by Category 2 or 3 water will require cleaning and sanitizing, in addition to drying. Similarly, materials damaged by Category 1 water, which have not been dried within 24-48 hours, will also require cleaning and sanitizing, in addition to drying.

- **Base Molding** : Base molding on walls might need to be removed in order to inspect the base of the walls for water damage. More expensive wood moldings can be carefully removed, cleaned as necessary, and then dried for re-use. It might be more cost-effective to replace moldings made of cheaper materials.
- **Carpet**: In many cases, replacement, rather than salvage of a carpet, might be the most appropriate course of action. Consideration should be given to replacing a carpet, if the water intrusion is of Category 2 water. Carpet contaminated by Category 3 water should be replaced, to avoid future adverse health effects for occupants, from residual contaminants. Carpet applied over a wood floor or sub-floor must be removed, to allow adequate drying of the wood floor, regardless of water category.

If the carpet is to be salvaged, it should be lifted, so that air can be circulated above and below the carpet. Disengaging and lifting a wet carpet requires special care, to prevent damage to the carpet, especially at seams and attachment points. If carpet is to be salvaged, the best procedure is to remove the carpet to a remote location where it can be dried, sanitized, and professionally cleaned. The cleaned carpet can then be brought back for re-installation when the area is fully dried.

- **Carpet Padding**: Consideration should be given to replacing padding if the water intrusion is of Category 2 water. Padding contaminated by Category 3 water should be replaced, to avoid future adverse health effects for occupants, from residual contaminants. Replace padding, if it has been more than 48 hours since the water damage occurred, regardless of category. Always replace padding made of natural fibers, foam rubber, or skinned pads. Carpet padding applied over a wood floor or sub-floor must be removed to allow adequate drying of the wood floor.
- **Ceiling Tiles**: Replace sagging tiles, tiles damaged by Category 2 or 3 water, or tiles wet for more than 24-48 hours.
- **Drywall**: With prompt response (within 24-48 hours of the flood or water intrusion incident), some drywall can be salvaged. Early in the assessment of a water intrusion incident, areas behind moldings can be opened for inspection without damaging much of the surrounding materials. An instrument for detecting moisture should be used to determine the condition of drywall near, or in contact with, water. If drywall is wet, but appears structurally sound, open weep holes to release any trapped water and allow ventilation into the inner wall or ceiling. Replace sagging or de-laminating sections of walls or ceilings with new materials.
- **Insulation**: Check for insulation inside of walls or above ceilings. If wet insulation is present, it might be necessary to remove sections of drywall to facilitate drying or replacement of the wet insulation. Replace wet insulation that has been contaminated with Category 2 or 3 water. Also replace insulation that has been wet with any category of water for more than 24-48 hours.
- **Plaster**: Heavily painted plaster can be difficult to dry. Open holes, as necessary, to provide for inspection and ventilation. An instrument for detecting moisture should be used to determine the condition of plaster near, or in contact with, water.
- **Wall coverings**: After removing base molding, vinyl wall coverings must be pulled back, in order to dry a wet wall. With more permeable paper or cloth coverings, it might be possible to adequately dry the wall with the coverings left in place. Staining may be a problem in trying to salvage wall coverings.

Responsibilities

In most situations, building occupants will be the first to become aware of flooding or water damage in their area. It is the occupants' responsibility to promptly notify their Physical Plant Zone of flooding or water damage, so that steps can be taken (if possible) to eliminate or contain the source of the water, in order to prevent damage to building materials and furnishings. Building occupants should avoid contact with Category 2 or 3 water. If contact is absolutely necessary, protective clothing must be worn, and individuals' hands should be washed after contact. (Contact the Environmental Health Office [phone: 315-443-9131] for help in determining what protective clothing is necessary.)

Physical Plant is usually responsible for providing the manpower and equipment necessary to control flooding and restore water damaged spaces. Supervisors of employees doing this work need to be able to determine the category of the water involved and assess the risks presented. They need to be knowledgeable in the use of disinfectants, in electrical safety, and in the tools and procedures required for removing carpet, wet sections of walls and ceilings, and other contaminated building materials and furnishings. Supervisors must also make personal protective equipment (protective clothing, gloves, boots, etc.) available to their employees, when necessary.

The Environmental Health Office is available as a consultative resource, and for potential indoor air quality related issues. The Environmental Health Office has instrumentation available for measuring temperature, humidity, and moisture content in building materials and furnishings.

Summary

Effectively responding to water damage requires that a plan of action and the necessary resources be available for quick implementation. Prompt and proper response can reduce the impact of water damage on building occupants, and reduce risks to occupants' health. Quick response to water damage can decrease the severity of the problem, as well as the time and costs required for final restoration. By having this policy in place, the University is better prepared to respond to water damage events properly, and in a timely manner.