

# Water Intrusion and Microbial Response Plan



University of San Diego

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**Purpose:**

The University of San Diego Water Intrusion and Microbial Response Plan was developed to establish guidelines for handling water intrusion incidents. This plan will direct University of San Diego Facilities Maintenance personnel on how to prevent microbial amplification from water damage affecting the health, safety and comfort of area occupants. It will promote the minimization of property damage, remediation cost, and to enable prompt resumption of routine activities in affected areas.

**Responsibilities:****1. Environmental Health and Safety (EH&S) Manager**

- a. Develop, review and update the Water Intrusion and Microbial Response Plan annually, or as standards are updated or created.
- b. Have a working knowledge of microbial lifecycles and their potential risks.
- c. Provide guidance to personnel on multiple microbial issues.
- d. Provide personal protective equipment (PPE) recommendations and procedures to minimize health risks to occupants and workers.
- e. Provide training for handling procedures of microbial contaminated building materials and furniture.
- f. Perform indoor air quality investigations.

**2. Supervisors**

- a. Ensure that workers know and follow procedures defined in the WIMRP.
- b. Ensure protective equipment is available and in good working order.
- c. Ensure that personnel receive annual training on proper procedures and use of PPE and safety equipment. (See appendix 1 for training information).
- d. Provide regular inspections of work area annually.
- e. Notify EH&S should an incident develop beyond the scope of the plan.

**3. Employees**

- a. Minimize all potential work exposures to microbial organisms.
- b. Avoid unsafe work practices and report unsafe work conditions.
- c. Are familiar with all hazards in their work area.
- d. Learn what precautions and protective equipment are required for specific jobs.
- e. Practice good personal hygiene.
- f. Comply with all elements of this plan.

**4. Human Resources**

- a. Provide insurance support for incidents which qualify under the terms of the plans.
- b. Provide support to employees by workers compensation insurance for any exposures that could result in illness or injury.
- c. Manage the issues arising from the destruction of personal items owned by students, faculty and staff.
- d. Assist departments in relocating residents, faculty and staff to temporary locations during investigation and remediation.
- e. Risk Management will act as the team leader for the Complex Facility Issue Team (CFIT).

**5. Public Safety**

- a. Provide evacuation measures and secure the area for the public's safety.
- b. Provide emergency first aid measures to injured or exposed staff and students.
- c. Coordinate with emergency crews to manage incidents beyond the scope of USD staff.

## **Prevention:**

Water is the single most long-term destructive substance in the indoor environment. It dissolves or weakens many materials and supports the growth of microorganisms on others. The flowing nature of water can allow these microorganisms to travel through walls, ceilings and across multiple rooms in a building. When a water emergency occurs, a timely reaction is beneficial to the building, occupants and workers. This can greatly reduce 1) the amount of water able to flood a building, 2) the distance the water can travel 3) the damage to valuable property and 4) the destruction caused by microbial growth.

Two common types of microbial concerns during a water emergency are sewage and mold. Sewage poses a very significant threat to human health. The severity of the health threat depends on the content of the sewage, the extent of penetration, and time allowed in the indoor environment. Molds are part of the natural indoor and outdoor environment. Mold may begin growing indoors when mold spores land on surfaces that are wet. It is important to dry water-damaged areas and items within 24-48 hours to prevent mold growth.

The facilities maintenance staff is primarily responsible for limiting the potential for water intrusion and microbial growth. We can minimize water emergencies with: 1) preventative maintenance procedures, 2) considerations during new construction and remodeling plans, 3) response times to water intrusion work orders or microbial growth concerns, 4) awareness of campus surroundings and 5) creating new work orders for any leaks. Responsibilities by department:

### **1. Building Maintenance:**

- a. Upon entry into buildings, all staff should be alert for conditions that may indicate water intrusion such as musty odors, water damage on building surfaces, mold growth on materials, condensation on materials or furniture, overall humidity level in room.
- b. Maintain heating and air conditioning units for proper working condition and periodically check condensate pans, coils, filters, and insulation during regularly scheduled preventative maintenance. Ensure water is not pooling beneath fresh air intake. Only run blower motor during cooling or heating function.
- c. Ensure windows of buildings can close and seal to prevent rain water intrusion or the potential for condensation from outdoor humidity levels.
- d. Identify and quickly fix roof leaks, window leaks, or door leaks. Reseal roofs, flashing and ensure proper distance of fascia to reduce water penetration to the building façade.
- e. Keep rain gutters and floor drains clear of debris to prevent water backup and flooding.
- f. Immediately fix leaky plumbing fixtures and clogged toilets or drains.
- g. New projects should consider building ventilation and occupancy standards recommended by ANSI/ASHRAE.

### **2. Grounds Maintenance:**

- a. During daily duties, watch for leaking pipes, broken sprinklers, puddling against building foundations, and overly wet ground.
- b. Maintain sprinklers to spray away from building structures. Do not allow overspray to occur on any exterior building surface.
- c. Keep root systems from penetrating into building structures.
- d. Keep leaves from deciduous trees free from drains, gutters and drainage ways.
- e. Maintain storm water drains.
- f. Create work orders for areas susceptible to flooding and indoor intrusion.
- g. Maintain watering cycles to prevent oversaturation of the ground.
- h. Look for potential building hazards from falling branches and trees.

### 3. Janitorial Maintenance:

- a. During the course of duties, identify any water intrusion or condensation issues and create a work order immediately.
- b. Identify leaky plumbing and plugged toilets. Post out of service signs on all defective plumbing fixtures. Create work order.
- c. Close windows and outside doors in work areas before or during rain events.
- d. Wipe down dust with a damp cloth to prevent spreading into the air. Use vacuums with high-efficiency filters and ensure that the filters are maintained as recommended by manufacturer.
- e. Create work order for any areas that have high levels of dust or dirt, and encourage the occupants of office space to create work orders to have ceiling fans, registers or other furniture and equipment dusted when needed.

#### Notification:

During regular business hours, Monday through Friday, 7:30 am to 4:30 pm, Facilities Customer Service must be notified of leaks or floods. Customer Service will create a work order and assign it to the proper department. Immediate notification by customer service to the appropriate department by radio or telephone is required to minimize flood damage. Public Safety should be contacted to help evacuate and secure a site when necessary. EHS is not a first responder to floods, but should be contacted if water intrusion is contaminated (sewage, flood or storm water), there is mold growth or it causes a potential for off-site contamination or hazardous material spills.

Facilities staff hours are as follows:

Monday – Friday	
Department	Hours
Building Maintenance	7:30 am to 12:00 am
Grounds	6:30 am to 3:00 pm
Custodial	5:30 am to 2:30 am
Saturday and Sunday	
Custodial	7:00 am to 11:00 am

After customer service hours, contact facilities staff directly or public safety for immediate response to the water intrusion area. Do not leave the site unless proper barriers have been placed to keep the public safe or to get safety for yourself and others.

During water emergencies, the lead department will ensure assisting departments are notified. The lead department will provide amendments to the work order to ensure all effected departments perform the full scope of work required. If at any time the water emergency becomes greater than what is outlined in this plan for USD personnel to provide support on, the lead department will contact a pre-approved contractor to do the remediation work. The lead department will manage the contractor and all other departments on the project. All microbial incidents shall have a clearance report after remediation provided to EHS to maintain for the university files.

Current campus approved restoration companies:

J&M Keystone, Inc. 2709 Via Orange Way, STE A Spring Valley, CA 91978 (619) 466-9876 office (619) 466-6701 fax	American Technologies, Inc (ATI) 8444 Miralani Drive San Diego, CA 92126 (858) 530-2400 office (858) 530-2401 Fax
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Notification to risk management shall occur when the scope of clean up requires an outside contractor, when a long term leak has been determined to have compromised the surrounding area, or when sudden break down of equipment/piping etc. causes damage to property of others including public land. The CFIT team should be notified if the water intrusion displaces students or staff from their residence or work place. Additionally, employees with health concerns or exposure and injury should make a report with public safety and be seen by an Occupational Healthcare provider under the guidance of the Workers Compensation program.

**1. Safety Evaluation:**

- a. Responding personnel shall immediately evaluate the physical location of the water leak/flood and attempt to identify the source. Immediately evacuate occupants in the area if the source contains grey or black water, or mold is found larger than a 10 square feet area.
- b. Carefully approach the apparent source of the water leak and attempt to determine if any imminent hazard may have been created by the presence of the water (e.g., electrical wiring or equipment exposed to water, water-saturated ceiling tiles, slip hazards, broken glass).
- c. Shut-off electrical power to leak/flooded area unless doing so will adversely affect equipment in the impacted area (e.g., critical computer servers).
- d. Immediately mitigate any identified safety hazards and then isolate the affected area before attempting to address the water leak/flood.

**Grey or Black Water Intrusion Response:**

The assumption must be that potential pathogens are present in grey or black water contamination. Such microbial contamination includes bacteria, fungi, viruses, and parasites. Table 1 lists the microflora that may be found in raw, untreated sewage and the diseases that these organisms have the potential to cause. The routes of exposure of the building occupants to these pathogens are contact, ingestion, and inhalation. An incomplete or inadequate job of cleaning and disinfection may leave residue that can be a substrate for disease-causing microorganisms. Occupants may be infected by contacting contaminated surfaces, with inadvertent transmission from hands to mouth, or aerosolization of contamination may result in the inhalation of microorganisms or their products (e.g., endotoxins). Residue and microbial contaminants also can be tracked by occupants' feet to other parts of the building.

**Initial Response:**

Initial response may only be performed by trained personnel wearing the proper personal protective equipment. Untrained personnel identifying the intrusion should evacuate the area and notify facilities customer service. They may stay in an uncontaminated area and maintain an evacuation line, but they are not to come into contact with any grey or black water.

**Personnel Safety:**

Block off and isolate the spill area to prevent building occupants from accessing spill area with yellow tape, cones, or any physical barrier. Only personnel trained to handle sewage should be allowed to work in the spill area or with any contaminated furniture, items, equipment or trash. Don proper protective clothing before addressing the spill, 1) Safety glasses 2) Mouth and nose protection (at least an N-95 disposable dust mask) 3) Tyvek suit 4) Hand protection (latex or neoprene gloves) 5) Rubber boots or water proof shoe covers. If uniforms become soiled by grey or black water, shower off contaminants from the body using soap and place uniforms in a soiled bin for proper decontamination. Boots should be decontaminated if they become saturated with gray or black water. Technicians should report any wounds that occur during restoration and take care to avoid "cross-contamination" from affected to unaffected areas by foot traffic or material handling.

**Minimize Damage:**

Obtain the necessary equipment to contain the water intrusion like mops, buckets, wet vacuums, extractors, floor fans, dehumidifiers and absorbent materials. Early identification of the water intrusion source is very important to minimize damage. If the intrusion source is not apparent, use tools such as moisture meters, infrared camera, psychrometer (relative humidity). Engage other building maintenance staff to help locate the water intrusion from different potential sources: Plumbing, building structure, grounds, etc. Contact a remediation contractor to assist in locating water intrusion problems that cannot be found by USD personnel.

**Remediation:**

The factors to be considered in remediation include the types of materials affected, assessment of the degree of damage, the extent of contaminated absorbent material, the total contact time, the humidity, and the amount of ventilation available. Remediation should begin as soon as possible. The longer the contamination is allowed to persist, the greater the potential for microbial growth and resultant damage. The primary goal of remediation must be the complete removal and disposal of water and contamination using the sanitary sewer system if possible. The following guidelines are presented with a goal of restoring the contaminated area such that the health of occupants is protected from any risk of pathogen-caused disease.

**Scope of Work**

USD personnel should only remediate hard, non-porous surfaces or remove carpet tiles to clean off-site. Items such as draperies, mattresses, paper products, and furniture with fabric and padding which can soak up water in the materials should be discarded. Irreplaceable items, or work that requires demolition, carpet and upholstered furniture disinfection, or beyond the safe and healthy scope of trained personnel, a remediation contractor should be hired to immediately perform remediation practices. For small damage on non-porous surfaces, (i.e.: tiled bathrooms, kitchen floors) follow the procedures below:

**Remove Standing Water Immediately**

Excess water may be mopped or mechanically extracted by a pump or wet vacuum system. Black or grey water that is extracted from a building should be disposed of in a sanitary sewer system.

Heavy organic matter, especially raw sewage and silt, must be physically removed by any safe means available. This may include the use of shovels, squeegees, wet vacuums, and moisture-extraction machines. Water must also be extracted from floorcovering fabrics such as carpets and rugs. All tools and machines, especially recovery tanks, wands, and hoses, must be cleaned and disinfected after use.

### **Dry Affected Areas as Soon as Possible**

In order to speed the drying process, both mechanical and natural dehumidification should be employed as the gross contamination is removed and during restoration. An indoor humidity target of 40% relative humidity (RH) or less should be attained as quickly as possible. If possible, depending on the design of the contaminated space and the outdoor weather conditions, there should be ventilation with fans and evaporation of indoor water by introducing outside air. The use of dehumidifiers for removal of moisture from inside building surfaces and air is recommended. Rapid drying that stresses proper management of temperature, airflow, and dehumidification is essential for success.

### **Remove affected materials**

All affected materials should be evaluated for porosity. From this inspection, materials should be rated as highly porous (saturated), semi porous, and nonporous. Some materials may exhibit varying degrees of porosity, depending on the exposed surfaces. For example, the surface of painted drywall has very low porosity, yet the base of the wall may be unpainted or have exposed gypsum paper that is highly porous.

1. **Highly porous materials** that have been exposed to sewage backflow and have a value that exceeds the cost of restoration such as high-value rugs and carpet, upholstery, and other textiles should be removed and restored off site. Highly porous materials with low cost or replacement value, such as carpet cushion, carpet, cardboard, tackless strip, wicker, and straw, should be removed and discarded as soon as possible. Other materials, such as saturated mattresses and cloth upholstery, regardless of value, cannot be restored and should be discarded. If disposal is necessary, these materials should be bagged in plastic for removal to a proper disposal site.
2. **Semi porous materials**, including items such as linoleum, vinyl wall covering and upholstery, and hardboard furniture, along with construction materials such as wood, painted drywall, and plaster, should be cleaned, disinfected, or replaced as part of the initial restoration process. If these materials are not removed or properly disinfected, they can become reservoirs for growth of microorganisms.
3. **Nonporous materials** such as Formica™, linoleum, vinyl, and tile finishing materials can be inspected for subsurface contamination with a non-penetrating moisture meter. Although these materials may be rated as nonporous, they must be evaluated carefully because contamination can migrate from the perimeter and become trapped below the surface. If migration of contamination below the surface has not occurred, these materials may be fully restored.

Residual organic matter in cracks and crevices can be removed by pressure washing with a disinfectant solution. The solution then must be recovered with an extraction unit, immediately after application, to prevent further migration or saturation of contaminants into other porous materials. After removing heavy organics, affected materials must be cleaned before a second application of disinfectant takes place. Use of many cleaning agents, such as soaps and detergents, will solubilize most organic matter. After thoroughly cleaning all contaminated materials, a second application of disinfectant may be applied.

### **Disinfectants**

Choice of disinfectants depends on the degree of microbial killing required, the nature of surfaces to be treated, application safety, and the cost and ease of use of available agents. Because the use of disinfectants such as glutaraldehydes, iodophors, and phenolics for disinfection produce irritating vapors, appropriate personal protective equipment to preclude chemical exposure is required. The type of safety equipment used will depend on the disinfectant used, the concentration, and the method of application. The material safety data sheet

(MSDS) and label instructions on the chosen disinfectant will provide more detailed information and must be reviewed before use. Classes of disinfectants and their common-use dilutions include alcohols (60 to 90% in water), quaternary ammonium compounds (0.4 to 1.6%), phenolics (0.5 to 5%), iodophors (75 ppm), glutaraldehydes (2%), household bleach (sodium hypochlorite, diluted 10%), and hydrogen peroxide (3 to 6%). The advantages and disadvantages of each of these disinfectants are given in Table 3.

Caution should be used in mixing some disinfectants. For example, mixing chlorine containing solutions with ammonia or amine solutions will produce extremely toxic vapors, and could have lethal effects on workers or building occupants. Of critical importance is "contact time". Contact time is the length of time that the disinfectant is permitted to work on the contaminated surface. The contact time must be at least 15 min before additional cleaning and removal of the disinfectant is undertaken. Some disinfectants, such as the phenolics and glutaraldehydes, leave a residue that continues to suppress microbial growth for some time after treatment. Chemicals classified as disinfectants are appropriate for use in areas exposed to sewage backflow. These chemicals are defined as being capable of inactivating potential pathogenic microorganisms on inert substrates.

1. Glutaraldehydes: These agents display a broad spectrum of activity and rapid rate of kill against the majority of microorganisms. Glutaraldehydes are capable of destroying all forms of microbial life including bacterial and fungal spores, tubercle bacilli, and viruses. They are excellent sporicides and will not corrode most materials. Disadvantages include increased peroral, percutaneous, and inhalation toxicity, along with elevated eye and skin irritation. –
2. Iodine and Iodine Compounds (Iodophors): These agents are highly effective, have broad-spectrum antimicrobial capabilities and exhibit some residual properties. Disadvantages include inactivation by organic matter, and vapors may pose a hazard to respiratory organs. Some formulations may stain porous materials an orange-yellow color. –
3. Phenolic Compounds: These agents are stable (less inactivated by organic matter), broad spectrum (generally include antiviral properties), and readily available, and leave a residue. Disadvantages include substantially increased peroral, percutaneous, and inhalation toxicity, along with eye and skin irritation. –
4. Quaternary Ammonium Chloride Compounds (Quats): These agents have a limited spectrum of activity but are capable of killing gram-positive bacteria and fungi, and of inactivating gram-negative bacteria and some viruses. Quats have a naturally pleasant odor, counteract offensive odors, and are excellent cleaners. Ammonium chloride compounds are safer to use than most other disinfectants, because they are less toxic and cause less irritation to the mucus membranes. Quats, when diluted for use, are low in toxicity and irritation. Disadvantages of this class of agents include the facts that they are neither sporicidal nor tuberculocidal and that many formulations exhibit poor results against gram-negative bacteria and some viruses. Also, these compounds are incompatible with anionic cleaners (i.e., mutual neutralization of disinfectant and cleaner) and with the dye blockers in stain-resistant carpet.

#### **Indoor Mold Growth Response:**

Another aspect of health impact caused by moisture intrusion from clean, grey or black water are the growth of non-sewage microorganisms. The conditions for their growth must include wetness, humidity, and organic matter.

Microorganisms, which exist in various life stages in both indoor and outdoor environments, have the opportunity for exponential population growth. These species can produce bioaerosols, which are potential sources for disease. For example, mold allergy is a common source of indoor air symptoms and complaints. In regard to the susceptibility of building occupants, those individuals whose immune systems are in some way compromised (i.e.,

immunocompromised), or who are otherwise susceptible due to age, medication, or underlying illness, are considered to be at greater risk of contracting potentially fatal infections than those individuals who are healthy.

### **Initial Response:**

Initial response may only be performed by trained personnel wearing the proper personal protective equipment. If possible, locate the water intrusion source to identify any safety concerns like a sewage spill or grey water intrusion. Untrained personnel identifying the mold should notify facilities customer service and do not disturb the contamination.

### **Personnel Safety:**

Only personnel trained to handle mold should be allowed to work in the area or with any contaminated furniture, items, equipment or trash. Don proper protective equipment before addressing the mold removal: 1) Safety glasses 2) Mouth and nose protection (at least an N-95 disposable dust mask) 3) Hand protection (latex or neoprene gloves).

### **Minimize Damage:**

Early identification of the moisture source is very important to minimize damage.

Check for:

1. indoor relative humidity levels greater than 60 %
2. look for condensation on surfaces
3. Check HVAC condensate pans for overflow, mold growth and water pools near air intakes for the whole zone
4. check for use of moisture generating appliances and ensure they are ventilating to the outside where possible
5. check drainage patterns and slope of the ground to keep foundations dry
6. Look at sprinkler heads outside to ensure they are not spraying the buildings.

If the intrusion source is not apparent, use tools such as moisture meters, infrared camera, and psychrometer (relative humidity). Engage other building maintenance staff to help locate the water intrusion from different potential sources: Plumbing, building structure, grounds, etc. Remove mold contamination immediately since it has the ability to grow exponentially.

### **Remediation:**

The factors to be considered in remediation include the types of materials affected, assessment of the degree of damage, the extent of contaminated material, the total time of mold growth and whether its active or historical, the relative humidity, and consider all other rooms shared within the zone of the involved HVAC system.

Remediation should begin as soon as possible. The longer the contamination is allowed to persist, the greater the potential for microbial growth and resultant damage. The primary goal of remediation must be the complete removal and disposal of contamination using the least disturbing means possible. The following guidelines are presented with a goal of restoring the contaminated area such that the health of occupants is protected from any risk of pathogen causing diseases.

### **Scope of Work**

USD personnel should only remediate mold growth areas less than 10 square feet. For irreplaceable items, areas greater than 10 square feet, or beyond the safe and healthy scope of trained personnel, a remediation

contractor should be hired to immediately perform remediation practices. Items that are contaminated should be cleaned using methods listed in table 3.

### **Air Sampling:**

Air sampling will be conducted if occupants of the space have a request from a doctor or the EHS investigator recommends it. If the suspect area has relative humidity levels greater than 60%, if a water intrusion has gone on for more than 24-48 hours or an unknown amount of time, or if there is a strong musty smell in the room, it is recommended to perform air sampling to identify if an indoor mold source exists. All remediation work for mold areas larger than 10 square feet will require a post remediation air sample to clear the room for mold levels expected to be found after a remediation project. A third party representative should be hired to perform the sampling.

### **Dry Affected Areas as Soon as Possible**

In order to speed the drying process, both mechanical and natural dehumidification should be employed as the gross contamination is removed and during restoration. An indoor humidity target of 40% relative humidity (RH) or less should be attained as quickly as possible. If possible, depending on the design of the contaminated space and the outdoor weather conditions, there should be ventilation with fans and evaporation of indoor water by introducing outside air. The use of dehumidifiers for removal of moisture from inside building surfaces and air is recommended. Rapid drying that stresses proper management of temperature, airflow, and dehumidification is essential for success. See table 4 for guidelines to specific materials.

1. Method 1, Wet Vacuum: Wet vacuums are vacuum cleaners designed to collect water. They can be used to remove water from floors, carpets, and hard surfaces where water has accumulated. They should not be used to vacuum porous materials, such as gypsum board. They should be used only when materials are still wet—wet vacuums may spread spores if sufficient liquid is not present. The tanks, hoses, and attachments of these vacuums should be thoroughly cleaned and dried after use since mold and mold spores may stick to the surfaces.
2. Method 2, Damp Wipe: Whether dead or alive, mold is allergenic, and some molds may be toxic. Mold can generally be removed from non-porous (hard) surfaces by wiping or scrubbing with water, or water and detergent. It is important to dry these surfaces quickly and thoroughly to discourage further mold growth. Instructions for cleaning surfaces, as listed on product labels, should always be read and followed. Porous materials that are wet and have mold growing on them may have to be discarded. Since molds will infiltrate porous substances and grow on or fill in empty spaces or crevices, the mold can be difficult or impossible to remove completely.
3. Method 3, HEPA Vacuum: HEPA (High-Efficiency Particulate Air) vacuums are recommended for final cleanup of remediation areas after materials have been thoroughly dried and contaminated materials removed. HEPA vacuums are also recommended for cleanup of dust that may have settled on surfaces outside the remediation area. Care must be taken to ensure that the filter is properly seated in the vacuum so that all the air must pass through the filter. When changing the vacuum filter, remediators should wear PPE to prevent exposure to the mold that has been captured. The filter and contents of the HEPA vacuum must be disposed of in well-sealed plastic bags.
4. Method 4, Discard – Remove Damaged Materials and Seal in Plastic Bags: Building materials and furnishings that are contaminated with mold growth and are not salvageable should be double-bagged using 6-mil polyethylene sheeting. These materials can then usually be discarded as ordinary construction waste. It is important to package mold-contaminated materials in sealed bags before

removal from the containment area to minimize the dispersion of mold spores throughout the building.  
Large items that have heavy mold growth

**Documentation**

Indoor air quality investigation reports, remediation project steps and sampling results should be maintained and stored in TMA. Additionally, these documents are stored at U:\EHS\Indoor Air Quality (IAQ) & Mold investigations.

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Table 1. Disease-Causing Organisms in Sewage

Organisms	Disease
<b>ENTERIC VIRUSES:</b>	
Enteroviruses (67 types)	Gastroenteritis, heart anomalies, meningitis, others
Rotaviruses	Gastroenteritis
Parvovirus-like agents (at least 2 types)	Gastroenteritis
Hepatitis A virus	Infectious hepatitis
Adenoviruses (31 types)	Respiratory disease, conjunctivitis, others
<b>BACTERIA:</b>	
<i>Escherichia coli</i> (enteropathic types)	Gastroenteritis
	Typhoid fever
<i>Salmonella</i> (approx. 1,700 types)	Salmonellosis
<i>Shigella</i> (4 spp.)	Shigellosis (bacillary dysentery)
	Gastroenteritis
<b>PROTOZOA:</b>	
<i>Balantidium coli</i>	Balantidiasis
<i>Entamoeba histolytica</i>	Amoebiasis
<i>Giardia lamblia</i>	Giardiasis
<b>HELMINTHS:</b>	
<b>Nematodes (roundworms)</b>	
<i>Ascaris lumbricoides</i>	Ascariasis
<i>Ancylostoma duodenale</i>	Ancylostomiasis
<i>Necator americanus</i>	Necatoriasis
<i>Ancylostoma braziliense</i> (cat hookworm)	Cutaneous larva migrans
<i>Ancylostoma caninum</i> (dog hookworm)	Cutaneous larva migrans
<i>Enterobius vermicularis</i> (pinworm)	Enterobiasis
<i>Strongyloides stercoralis</i> (threadworm)	Strongyloidiasis
<i>Toxocara cati</i> (cat roundworm)	Visceral larva migrans
<i>Toxocara canis</i> (dog roundworm)	Visceral larva migrans
<i>Trichuris trichiura</i> (whip worm)	Trichuriasis
<b>Cestodes (tapeworms)</b>	
<i>Taenia saginata</i> (beef tapeworm)	Taeniasis
<i>Taenia solium</i> (pork tapeworm)	Taeniasis
<i>Hymenolepis nana</i> (dwarf tapeworm)	Taeniasis
<i>Echinococcus granulosus</i> (dog tapeworm)	Unilocular echinococcosis
<i>Echinococcus multilocularis</i>	Alveolar hytid disease

Table 2. Properties of Classes of Environmental Disinfectants

Disinfectant/Class	Use Dilution Concentration	Action	Advantages	Disadvantages
Alcohols (ethanol, isopropanol)	60 to 90%	B, V, F	Nonstaining, nonirritating	Inactivated by organic matter, highly flammable
Quarternary ammonium compounds	0.4 to 1.6%	B*, V*, F	Inexpensive	Inactivated by organic matter, limited efficacy
Phenolics	0.4 to 0.5%	B, F, V, (T)	Inexpensive, residual	Toxic, irritant, corrosive
Iodophors	75 ppm	B, V, F, S**, T**	Stable, residual action	Inactivated by organic matter, expensive
Glutaraldehydes	2%	B, V, F, S**, T	Unaffected by organics, noncorrosive	Irritating vapors, expensive
Hypochlorites	≥5,000 ppm free chlorine (1:10)	B, V, F, S**, T	Inexpensive	Bleaching agent, toxic, corrosive, inactivated by organic matter; removes color from many interior decor fabrics; dissolves protein fibers (e.g., wool, silk)
Hydrogen peroxide	>3%	B, V, F, S**, T	Relatively stable	Corrosive, expensive; degrades in heat or ultraviolet light

Abbreviations:  
 B = Bactericidal  
 V = Virucidal  
 F = Fungicidal  
 \* = Limited effectiveness  
 ( ) = Not all formulations  
 T = Tuberculocidal  
 S = Sporicidal  
 \*\* = Requires prolonged contact time

Table 3. Guidelines for Response to Clean Water Damage within 24 - 48 Hours to Prevent Mold Growth

Guidelines for Response to Clean Water Damage within 24 – 48 Hours to Prevent Mold Growth*	
Water-Damaged Material†	Actions
Books and papers	<ul style="list-style-type: none"> <li>* For non-valuable items, discard books and papers.</li> <li>* Photocopy valuable/important items, discard originals.</li> <li>* Freeze (in frost-free freezer or meat locker) or freeze-dry.</li> </ul>
Carpet and backing – dry within 24 – 48 hours‡	<ul style="list-style-type: none"> <li>* Remove water with water extraction vacuum.</li> <li>* Reduce ambient humidity levels with dehumidifier.</li> <li>* Accelerate drying process with fans.</li> </ul>
Ceiling tiles	<ul style="list-style-type: none"> <li>* Discard and replace.</li> </ul>
Cellulose insulation	<ul style="list-style-type: none"> <li>* Discard and replace.</li> </ul>
Concrete or cinder block surfaces	<ul style="list-style-type: none"> <li>* Remove water with water extraction vacuum.</li> <li>* Accelerate drying process with dehumidifiers, fans, and/or heaters.</li> </ul>
Fiberglass insulation	<ul style="list-style-type: none"> <li>* Discard and replace.</li> </ul>
Hard surface, porous flooring‡ (Linoleum, ceramic tile, vinyl)	<ul style="list-style-type: none"> <li>* Vacuum or damp wipe with water and mild detergent and allow to dry; scrub if necessary.</li> <li>* Check to make sure underflooring is dry; dry underflooring if necessary.</li> </ul>
Non-porous, hard surfaces (Plastics, metals)	<ul style="list-style-type: none"> <li>* Vacuum or damp wipe with water and mild detergent and allow to dry; scrub if necessary.</li> </ul>
Upholstered furniture	<ul style="list-style-type: none"> <li>* Remove water with water extraction vacuum.</li> <li>* Accelerate drying process with dehumidifiers, fans, and/or heaters.</li> <li>* May be difficult to completely dry within 48 hours. If the piece is valuable, you may wish to consult a restoration/water damage professional who specializes in furniture.</li> </ul>
Wallboard (Drywall and gypsum board)	<ul style="list-style-type: none"> <li>* May be dried in place if there is no obvious swelling and the seams are intact. If not, remove, discard, and replace.</li> <li>* Ventilate the wall cavity, if possible.</li> </ul>
Window drapes	<ul style="list-style-type: none"> <li>* Follow laundering or cleaning instructions recommended by the manufacturer.</li> </ul>
Wood surfaces	<ul style="list-style-type: none"> <li>* Remove moisture immediately and use dehumidifiers, gentle heat, and fans for drying. (Use caution when applying heat to hardwood floors.)</li> <li>* Treated or finished wood surfaces may be cleaned with mild detergent and clean water and allowed to dry.</li> <li>* Wet paneling should be pried away from wall for drying.</li> </ul>
<p>*If mold growth has occurred or materials have been wet for more than 48 hours, consult Table 2 guidelines. Even if materials are dried within 48 hours, mold growth may have occurred. Items may be tested by professionals if there is doubt. Note that mold growth will not always occur after 48 hours; this is only a guideline.</p> <p>These guidelines are for damage caused by clean water. If you know or suspect that the water source is contaminated with sewage, or chemical or biological pollutants, then Personal Protective Equipment and containment are required by the Occupational Safety and Health Administration (OSHA). An experienced professional should be consulted if you and/or your remediators do not have expertise remediating in contaminated water situations. Do not use fans before determining that the water is clean or sanitary.</p> <p>† If a particular item(s) has high monetary or sentimental value, you may wish to consult a restoration/water damage specialist.</p> <p>‡ The subfloor under the carpet or other flooring material must also be cleaned and dried. See the appropriate section of this table for recommended actions depending on the composition of the subfloor.</p>	

Table 4. Clean-up Methods for Materials and Furnishings

Material or Furnishing Affected	Cleanup Method
Books and papers	3
Carpet and backing	1, 3
Concrete or cinder block	1, 3
Hard surface, porous flooring (linoleum, ceramic tile, vinyl)	1, 2, 3
Non-porous, hard surfaces (Plastics, metals)	1, 2, 3
Upholstered furniture and drapes	1, 3
Wallboard (Drywall and gypsum board)	3
Wood surfaces	1, 2, 3
<b>Method Description</b>	
Method 1: <u>Wet Vacuum</u> (in the case of porous materials, some mold spores/fragments will remain in the material but will not grow if the material is completely dried). Steam cleaning may be an alternative for carpets and some upholstered furniture.	
Method 2: <u>Damp-wipe</u> surfaces with plain water or with water and detergent solution (except wood – use wood floor cleaner); scrub as necessary.	
Method 3: <u>High-efficiency particulate air (HEPA) vacuum</u> after the material has been thoroughly dried. Dispose of the contents of the HEPA vacuum in well-sealed plastic bags.	