RESOURCE ARTICLE

A comprehensive plan to reduce losses from water damage at a university

Water damage to buildings at research institutions is disruptive and costly. Research Universities have a unique variety of building stock varying from high hazard research laboratories to traditional offices, dorms, multifamily student housing, libraries, residences and rental properties. Each of these represents different challenges. Institutions can benefit from an integrated response to water events that includes prevention and mitigation strategies to reduce the cost and improve the durability of buildings.

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INTRODUCTION

The University of Minnesota (U of MN) had gross losses due to water damage averaging over $1.5 million dollars per year, for the past five years. Recent changes increasing the minimum deductible on these losses make it prudent to attempt to minimize the costs of water damage. Climate change models suggest that water events due to storm events may put further pressure on the system.[1] In 2007, the U of MN produced a document[2] that identified causes of water damage. Due to a change in the structure of Facilities Management only a few of the recommendations were implemented. In 2010, this document[3] was revised with additional deadlines for compliance and roles and responsibilities clearly described. Research Universities have a unique and varied building stock, from high hazard research laboratories to more traditional spaces such as offices, dorms, multifamily student housing, libraries, residences and rental properties. Each of these structures and types of occupancy offer different challenges.

In order to face these challenges, the response at a large institution needs to be integrated. Water damage is a major problem in many public and private buildings such as schools[4] and high-rise apartments.[5] Many factors contribute to an increased risk of water damage and it is hasty to assume that there is a simple one step solution which will resolve the problem. The following article discusses the challenge of water damage by reviewing the main contributing factors and possible ways to not only mitigate the impacts of water damage, but to also prevent them from occurring in the first place.

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COMMON CHALLENGES

Construction

During construction, water damage can result from factors such as design flaws, weak reinforcement and a general lack of building and material protection on worksites. Many of these incidents are preventable. It is estimated that globally at least 25% of all construction claims are due to water damage.[6]

Roofs

Although, water damage can occur during any type of construction, special attention must be paid to the roof. Rain events during roofing projects invariably occur. In order to prevent any water damage the area below the roof needs surveillance during and after a rain event.

Green roofs can present unique challenges. Properly designed green roofs with plants will work on a building and have been shown to prevent water damage.[7] Inadequately designed or poorly maintained green roofs can lead to water damage, including structural damage if the roof cannot handle the additional load. Plant roots cannot be allowed cause leaks by penetrating and degrading the roof membrane.

Construction Site Security

Inadequate site security leaves a construction site open to vandalism leading to water damage. In November 2014, three middle school children caused 5.6 million dollars of damage to the nearly completed Swenson Laboratory Building at the University of Minnesota Duluth Campus. They turned on the laboratory faucets and diverted the water away from the drain. Increased security for controversial structures including research animal housing and genetic research is particularly important. In order to prevent intentional water damage, shut off the water supply when unoccupied or monitor water flow remotely. Immediately investigate if unusually high water flow occurs at night or on the weekends.

Building Design and Geography

Some buildings have designs that are more susceptible to water intrusion.

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At the University of Minnesota, the extensive use of tunnel systems and entrances that start on grade and go down a level, provide challenges. The drains for the below grade entrances require extensive maintenance with water infiltration likely during high rainfall events when the drains have been seasonally plugged with debris like tree leaves. Occupied spaces below outdoor plazas with plants and vehicle traffic are prone to water leaks. Properly maintaining these unique roofs is very difficult and expensive.

Building envelope systems can be an area of concern. Buildings with aging, poorly designed or poorly installed windows can be sources of water leaks. Drains onto building balconies can funnel water into a building. Vinyl wallpaper on the interior side of an exterior wall can often act as an unintended vapor barrier and promote moisture accumulation in the wall.[8]

Although building design recommendations are outside of the scope of this article, it is important for facility managers and others, to be aware of the different types of buildings, and the spectrum of age and architectural design that is often present on large university campuses. It is important to know which buildings are more susceptible and if there are any particular points of weakness. For example, interior rain leaders in large buildings can fail. The vulnerable points include angled transitions using clamp connections.

Understanding the geology can predict locations susceptible to water infiltration. Some below grade structures going several stories down can penetrate several aquifers and present multiple water intrusion sites. The design of storm water holding ponds should also be considered. The storm water discharge areas may elevate the local levels of water and resulting in elevated water tables in areas without previous water problems. New buildings often displace ground water and may impact surrounding buildings.

Slab issues

Sub slab ventilation ductwork used in the basement of homes and on grade in childcare centers and single story office buildings will often have water infiltration issues. Water and vapor infiltration is a concern for slab on grade construction. For example, water can migrate up through the floor and be trapped by chair mats creating microenvironments for microbial growth.[9] The surface temperature of the slab may be low enough to raise the relative humidity at the surface enough to promote fungal growth. For these reasons carpet on grade can be problematic. Consider bare concrete or other flooring resistant to moisture to prevent microbial growth. Install a capillary break below the grade to reduce problems with water damage.

Communication

Communication about water intrusion events at a large institution is critical. Failure to report a water leak in time allows fungal growth to occur due to a delay in water extraction and removal of wet porous material. The failure to remove all furniture, file cabinets, bookshelves, etc. from the carpet yields pockets of fungal growth. Because water damage in walls cannot be seen, occupants and owners often incorrectly assume that the walls are unaffected. Exclusive use of moisture meters may also miss water damage to wall systems during a flood covering multiple floors as the meter will often fail to detect vertical leaks. For a large institution, an overall second or third shift supervisor can be given the responsibility for reporting after hours events that need additional attention in the morning. Water event situations can be highlighted on a facilities email list serve to allow for a quick scan of events requiring attention.

Incident command

Set up an incident command structure for large water events affecting the occupancy of a building or multiple buildings. More information on incident management is available at Federal Emergency Management Agency.[10] Coordination between facilities, the affected departments, Emergency Management, custodial and the water restoration company reduces the time to return the space to full occupancy. The U of MN developed a poster[11] and videos to list the tasks to be completed during a water event for offices.[12]

Schedule a meeting of stakeholders about 2–3 h into a large water event. A classroom with a white board provides a good environment to exchange information. Priorities can be set and the tasks laid out for work in the next day. Affected individuals are also contacted about water damaged materials in their space and planning can occur for relocation during the remediation and build back. Keeping a running secure or unlisted blog post of events[13] or using emergency management software for complex events also facilitates the sharing of information.

In addition to accurately characterizing the areas of water damage, provide security to prevent loss of valuables in the area. Doors are left open for access to extract carpet, dry the floor and remove walls so some sort of alternative security measure should be introduced. Consider providing a single check in location.

Learning from events

Keeping track of water events is essential to better understand patterns and locations of interest. Every event should be used as a learning opportunity. Establish a system for recording events and make sure that someone is responsible. Periodically review and try to find any patterns of water damage causes and implement preventive actions.

Types of Occupancy

Since large research institutions, such that University of Minnesota, have such a diversity of building uses various challenges are often faced. A few of the important areas are highlighted.

Laboratories

Laboratory environments often contain heavy and very expensive pieces of equipment located against the walls. In a water event, the back side of the wall cavity can be removed promptly along with the insulation. If possible the vinyl base cove on the wall behind the equipment should be removed to facilitate drying out the wall. As in traditional spaces, if fungal growth is noticed on the back side of the wall it can be physically cleaned off and dried under a controlled fungal abatement. Antimicrobial paint is often applied as