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Flood Risk Mitigation Measures - Architecture

Introduction

Flooding is an expensive and disruptive event in any building, especially in high-value, mission-critical buildings like laboratory and healthcare facilities. Engineers, architects, contractors, commissioning agents, and others on the design and delivery teams are responsible for recognizing the criticality of these facilities and proactively mitigating flood risks. Experience, best practice, and risk analysis should drive design decisions, including the locations of mechanical and plumbing systems and equipment, the routing and types of piping, and safety and redundancy features, that will reduce the risk of flooding.

This article focuses on architectural requirements to minimize damage from a flood caused by the failure of a building's mechanical or plumbing system.

Protection from Floods

The first line of defense against flooding is mechanical and plumbing systems that are properly designed, detailed, located, and maintained to minimize the chance of a flood and reduce the impact of a flood on critical program areas. This was the subject of two recent Technical Bulletins, "Heating and Cooling Coil Freeze Protection Design for 100% Outside Air AHUs" and "Flood Risk Management Measures for Plumbing Systems." Archived Technical Bulletins can be accessed at Technical Bulletins (nih.gov). Of particular concern are systems containing large volumes of water and/or water under pressure. These systems are typically located in service areas, including interstitial levels, mechanical rooms, and penthouses, but should not be located above laboratories, clinical areas, animal facilities, or other critical, high-value functions. Architects must review designs with plumbing and mechanical engineers to plan for the access, inspection, and service of critical shut-off valves for these systems.

Service areas are the second line of defense. They must be designed and detailed to contain and drain water to protect other areas of the building. Service area floors must be made of concrete or another material that is solid, stable, and appropriate for the application of a slip-resistant, high-traffic, waterproof system. Designs should provide adequate containment and drainage and appropriate detailing at expansion joints and other points of potential stress and failure.

The waterproofing system must extend up the wall at least 6in. (152 mm) at all edge conditions, including walls, penetrations, and shafts, to contain water. Stairs, elevators, and other through-floor connections must be protected. Large floor areas should be subdivided by berms, sloped thresholds, and other design features that prevent the spread of water while maintaining accessibility and functionality. All areas must have leak detection systems with alarms and notifications, as well as floor drains with sufficient capacity.

Waterproofing systems must be regularly inspected, maintained, expanded, and repaired as the building is modified to ensure continued integrity.

Protection From Flood Damage

If flood water reaches a program space, the area must be detailed to minimize incurred damage and required repair. One material vulnerable to damage is standard gypsum board, which will absorb moisture and is susceptible to mold growth. To minimize this risk, a mold-resistant gypsum board should be considered. Regardless of type, all gypsum board walls in flood-prone areas must be detailed following the requirements from DRM Section 4.3.1.1.C Flood Resistant Detailing, which requires that the gypsum board is installed above a 3½ in. (90 mm) tall base of cement board or other non-absorbent material to reduce the chance of flood damage. Areas prone to flooding or water damage include:

- Areas adjacent to or under service areas, large-piped utilities, or other flood risks
- ARFs and other facilities requiring wash-down
- Areas containing glasswashers, autoclaves, chillers, kitchens, and other water-intensive equipment
- Areas with exposure to the exterior

Conclusion

Floods are risks in facilities with large, complex mechanical and plumbing systems. Thoughtful design can substantially reduce the risk of flooding and limit the resulting damage if flooding does occur.