



**HURRICANE SANDY
MOLD, WATER INTRUSION AND
FLOOD CONTROL**

August 25, 2014

TABLE OF CONTENTS

LETTER OF TRANSMITTAL..... i

1.0 Introduction to Environmental Advisory Council..... 1

2.0 Critical Issue 1

3.0 Lessons learned from Sandy 2

4.0 Insurance 2

5.0 Mold Abatement Best Practices..... 4

6.0 Environmental response and remediation capabilities 6

7.0 Mold Training and Credentials, Current licensing requirements 7

8.0 Prevention of Water Intrusion..... 8

9.0 Conclusion 10

10.0 Bibliography 12

1.0 Introduction to Environmental Advisory Council

The Environmental Advisory Council (EAC) is a group of environmental remediation professionals working toward advancing the remediation industry by creating an open dialogue for best practices and advanced methods. The council will address issues ranging from asbestos abatement to pathogen contamination and reducing risk for all facilities through effective, safe remediation/mitigation.

The EAC recognized that pathogen-borne contaminants are an increasingly alarming issue in the built environment and called on top remediation experts to form a group dedicated to promoting safety, effectiveness and efficiency in resolving pathogen-borne crises. The council's mission is to identify environmental issues and mitigation plans through best practices that promote environmental wellness.

2.0 Critical Issue

Hurricane Sandy resulted in widespread damage and economic hardship in the impacted region including flooding, water damage and mold. Mold was an environmental issue that was difficult to manage because it is not highly regulated. The purpose of this white paper is to provide stakeholders with guidance for managing water and mold related to catastrophic events.

Another critical issue is the absence of mold exposure limits. Health Canada stated "...in the absence of exposure limits, results from tests for the presence of fungi in air cannot be used to assess risks to the health of building occupants." (Health Canada, 2007) Mold will not be a public health issue until there are exposure limits. Interestingly, the state of Maine gives health officers the authority to investigate mold as a public issue.

NIOSH estimates that 29-33% of adult onset asthma is a direct result of exposure to mold in the workplace, and 23% of adult asthma cases are exacerbated by work. Mold is a problem in homes too, and approximately 4.6 million out of 21.8 million cases reported in the US are the result of exposure at home. According to the U.S. Environmental Protection Agency and Lawrence Berkeley National Laboratory, the national annual cost of mold related asthma is estimated at about \$3.5 billion.

3.0 Lessons learned from Sandy

The lesson learned is that mold was not anticipated as well as it could have been. The emergency response, environmental and construction industries did a great job at emergency response, cleanup of regulated hazards and then rebuilding. The environmental industry is highly trained to address the hazards that are required by law to be managed prior to any construction project. Since mold is not “regulated”, it was not addressed on every project.

Another lesson learned is that prevention is very important. The planning that was done to prevent water intrusion, emergency response and remediation reduced the damage that was done by the storm and reduced the cleanup cost. Prevention and planning should be continued on a city-wide basis so that there are certified contractors, engineers and consultants who are retained on a contract as-needed basis with pre-established rates for emergency response. This will enable government agencies access to emergency response and remediation services that have been well thought out prior to the storm. Emergency situations typically have multiple hazards including asbestos, lead, electricity, chemicals, mold and oil to name a few. Chemicals such as bleach, ammonia and acids are commonly found in buildings and are dangerous when mixed. Emergency response crews may also be working in confined space with unknown structural integrity. The emergency response crew should have awareness training and be able to assess the situation.

4.0 Insurance

Insurance was an important factor in the cleanup effort. Many building owners and businesses most likely do not understand their flood risk or what is covered and excluded in a flood insurance policy. FEMA manages the National Flood Insurance Program (NFIP) to provide flood insurance for direct physical loss by or from flood of buildings and property. The term “Flood”, as used in a flood insurance policy, means a general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties from overflow of inland or tidal waters, unusual and rapid accumulation or runoff of surface waters from any source or

mudflow. Property covered by insurance includes building property, personal property, debris removal and loss avoidance measures.

NFIP will pay up to \$1,000 for the costs to protect the insured building from a flood or imminent danger of flood for sandbags; fill for temporary levees; pumps; and plastic sheeting and lumber; and the value of work, at the Federal minimum wage.

NFIP will pay up to \$1,000 for the reasonable expenses to move insured property to a place other than the location that contains the property in order to protect it from flood or the imminent danger of flood.

NFIP will pay up to \$10,000 for damage caused by pollutants if the discharge, seepage, migration, release, or escape of the pollutants is caused by or results from flood.

NFIP will pay up to \$30,000 for policyholders to comply with a State or local floodplain management law or ordinance affecting repair or reconstruction of a structure suffering flood damage. Compliance activities eligible for payment include elevation, floodproofing, relocation, or demolition of a structure. Eligible floodproofing activities are limited to nonresidential structures and some residential structures with basements.

The FEMA Standard Flood Insurance Policy has many exclusions. Environmental professionals take note that there is exclusion for the cost of testing for or monitoring of pollutants unless it is required by law or ordinance. NFIP only provides coverage for direct physical loss by or from flood, and does not pay for:

1. Loss of revenue or profits;
2. Loss of access to the insured property;
3. Loss of use of the insured property;
4. Loss from interruption of business or production;
5. Any additional living expenses incurred while the insured building is being repaired or is unable to be occupied for any reason; and
6. Fungi and mold.

NFIP does not insure for direct physical loss caused directly or indirectly by:

1. Water, moisture, mildew, or mold damage that results primarily from any condition:
 - a. Substantially confined to the insured building; or
 - b. That is within your control including, but not limited to:

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- (1) Design, structural, or mechanical defects;
 - (2) Failure, stoppage, or breakage of water or sewer lines, drains, pumps, fixtures, or equipment; or
 - (3) Failure to inspect and maintain the property after a flood recedes;
2. Water or waterborne material that:
 - a. Backs up through sewers or drains;
 - b. Discharges or overflows from a sump, sump pump, or related equipment; or
 - c. Seeps or leaks on or through insured property;
 3. The pressure or weight of water unless there is a flood in the area and the flood is the proximate cause of the damage from the pressure or weight of water;
 4. Power, heating, or cooling failure unless the failure results from direct physical loss by or from flood to power, heating, or cooling equipment situated on the described location;

Rebuilding efforts should ensure that the new construction is flood resistant. A recommendation in the Hurricane Sandy Rebuilding Strategy report (U.S. Department of Housing and Urban Development, 2013) is to encourage and promote the Insurance Institute for Business and Home Safety Fortified home programs and Resilience STAR development standards. The standards provide practical guidelines, design and verification procedures for building based on the location of the building. The standards can be used for retrofitting or new construction. The Resilience STAR program was developed by the Department of Homeland Security as a voluntary program for construction of buildings that are resilient to natural disasters. The intent of these programs is to reduce property loss and recovery time by designing resiliency into the construction process in areas that are prone to natural disasters.

5.0 Mold Abatement Best Practices

There are typically three entities involved in any mold project including the owner, environmental consultant and the contractor. The environmental consultants' role is to perform the following

- Inspect for visible mold and identify areas of water intrusion by visual assessment, use of moisture meter and infrared camera,

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- Prepare a survey report that summarizes the areas of water intrusion and mold,
 - Develop design drawings and specifications for bid to contractors,
 - Manage contractor during abatement and take post-abatement clearance samples, and
 - Prepare a final report summarizing abatement and presenting clearance results for re-occupancy.

There are only a few federal, state or local regulations for the mold inspection or remediation of mold. Texas and Louisiana have mold laws to protect consumers. Texas requires state approved training and licensing. Louisiana relies on independent third party training and certification, however, does not address disaster recovery, which was a problem when the state needed licensed individuals after Katrina. Connecticut developed the “Connecticut Guidelines for Mold Remediation Contractors” which is not a regulation, but is similar to New York City’s concept to manage mold by developing guidelines.

The “Guidelines for Assessment and Remediation of Fungi in Indoor Environments”, known as the DOHMH Guidelines, (New York City Department of Health and Mental Hygiene, 2008) are the industry standard for inspection and remediation of mold. State agencies, building owners and property managers should provide guidance for remediation of mold based on the DOHMH Guidelines. According to the “Final Report to the Governor and Legislature” (New York State Toxic Mold Task Force, 2010) it would cost approximately \$150,000 to provide information about mold best practices and programs on the state level. It would cost approximately \$4.5 million to provide state agency staffing and overhead administrative staffing for regulation of the mold assessment and remediation industry. The proposed mold agency would be funded in the future by fees and fines. The “Mold in Maine Buildings Task Force Report” (Maine Department of Health & Human Services, 2007) found that the primary reason for consideration of regulation of the mold assessment and remediation industry is consumer protection. The Maine Report also concluded that regulatory programs that used third party accreditation of standards, guidelines and professionals were the best solution.

Some mold produces microbial volatile organic compounds (MVOC). According to the Standard and Reference Guide for Professional Water Damage Restoration (Institute of Inspection, Cleaning and Restoration, 1999), the musty odors in water damaged buildings are caused by alcohol compounds produced by bacteria and fungi. Workers should use organic cartridges in addition to particulate filters. In the haste of emergency response to a flood remediation, respirator selection may be incorrect. Workers should be educated on personal protective equipment including respiratory protection and be aware that medical exams are required prior to getting a fit test. A half face air purifying respirator with proper fit testing is the minimum respiratory protection for mold abatement. Full face respiratory protection is a better option as it provides respiratory protection and eye protection. Workers should be aware of other respiratory hazards such as silica dust and nuisance dust, both of which are regulated by OSHA.

6.0 Environmental response and remediation capabilities

Environmental remediation experts in NYC have the resources of local firms to mitigate the environmental impact of natural disasters and emergencies. Public and private organizations such as the Local Initiatives Support Corporation (LISC), American Red Cross, the Robin Hood Foundation, the Mayor's Fund, Neighborhood Revitalization NYC (NRNYC) and Environmental Contractors Association (ECA) have the ability to organize the financial resources, manpower and equipment in the community to coordinate post-disaster assessment and clean up. These organizations and many others worked together to assist families displaced by severe weather, and ensure that experienced professionals are available to respond quickly and effectively. LISC is administering the Build It Back Multi-Family Loan Program, Home Repair Program and a Capacity Building Program. LISC is also managing the Mold Treatment Program and the NRNYC program which funded over \$15 million dollars of mold remediation in over 2,000 homes that were damaged. The American Red Cross mobilized over 17,000 workers and provided more than \$300 million dollars for Hurricane Sandy response. The Robin Hood Relief Fund raised funds of \$75 million dollars that was distributed in grants to organizations in New York, New Jersey and Connecticut.

The environmental industry is committed to developing and educating communities regarding best practices for clean-up and recovery of the urban and green environment. The contractors specialize in hazardous materials removal, emergency response, asbestos removal, infectious clean up, oil, sewage and chemical spills, brownfields, and contaminated water.

7.0 Mold Training and Credentials, Current licensing requirements

The environmental industry in New York City and the tri-state area has access to a large pool of workers that are trained, certified and experienced in remediation of asbestos and lead hazards. These trained workers can use the same remediation principles to perform mold remediation. What is lacking is a New York City or New York State license program to close the loop and make mold remediation a more regulated segment of the industry.

As recommended in “Unhealthy Exposure: Mold in New York City Homes” (Public Advocate for the City of New York, 2006), New York City and State should develop licensing requirements for individuals and companies to assess and remediate mold. The report also emphasizes the importance of building codes, in terms of construction and inspection documents and recommends incorporating the DOHMH Guidelines into the Housing Maintenance Code. Code Enforcement Officials (CEOs) can have an influence on preventing mold damage. The report suggests that mold should be classified as an independent violation with civil penalties for landlords. NYC and NYS should consider strengthening building codes for new buildings as well as try to minimize the potential damage in existing buildings. The EAC agrees with the recommendations presented by the Public Advocate of the City of New York.

Consistent with the Public Advocate recommendations, Local Law No. 13 of 2014 (New York City Council, 2014) was passed on May 19, 2014 amending the administrative code of the city of New York and the New York City building code and requiring the use of mold-resistant gypsum board and cement board in moisture-prone locations. Local Law No. 13 requires that gypsum board or cement board has a mold resistance rating of 10 as defined by ASTM D3273. This applied to walls and ceilings in areas subject to moisture or water damage including interior faces of exterior below-

grade rooms, water pump rooms, laundry rooms, kitchens, bathrooms and service sink closets. The law will take effect on October 1, 2014.

Training duration and content should depend on the task of the worker as recommended by Guidelines for the Protection and Training of Workers Engaged in Maintenance and Remediation Work Associated with Mold (The National Institute of Environmental Health Sciences WETP, 2005). At a minimum, all training should include hazard communication, respiratory protection and mold safety and health plan. Maintenance worker training should be up to 2 hours in duration and include PPE. Mold remediation worker training should be presented in an 8 hour interactive class with hands-on practice for installation of critical barriers and engineering controls. Mold inspection workers should receive training be up to 2 hours in duration and include personal protective equipment. The Guidelines also recommend that fixing the leak should be emphasized, which in the context of this report would be prevention of water intrusion.

8.0 Prevention of Water Intrusion

According to the “Mold in Maine Buildings Task Force Report”, prevention and management of conditions that can lead to mold are the best methods to protect public health. With respect to flood protection and prevention of water intrusion during a hurricane, we have researched several systems. See Table I below for a comparison of these technologies.

According to Everett “Buzz” Waid of Sentinel Barriers, the TrapBag® system is easy to use in any flood situation. The TrapBag® system is warehoused to be delivered quickly for easy setup. There is a supply in the NYC area that can be delivered to a site in four hours, with additional supplies that can be delivered the next day. To install, TrapBag® barrier bag segments are placed on a Man Portable Deployment Unit, or MPDU. Then, using an excavator or a front-end loader, each bag is filled with sand, dirt or another recommended material. The MPDUs are removed immediately after a cell is filled and “leap-frogged” ahead to the next set of cells. The process is repeated to create for whatever continuous length of barrier protection is required. A four-person team with one skid steer can set up 1,000-foot barriers in 10-hours. The TrapBag may be an effective solution for unpaved sites due its inherent ability to form around contours and

collapse into sink holes. This property allows it to be self-correct during wash-out of subgrade soils that might otherwise compromise a flood wall.

Flood Control America has a product to protect buildings from flooding. According to Bryan Fryklund as presented at the Environmental Contractor Association conference *Superstorm Sandy: A Look Back and a Look Ahead at Disaster Recovery*, the Invisible Flood Control Wall (IFCW™) is a removable structure made up of aluminum planks that is erected before a flood event occurs. After the flood, the wall is removed and can be stored in the building for future use. The only component of the wall that remains when flood waters recede is the concrete foundation with embeds. This system has been used by Structure Tone on a commercial building in New York City to successfully protect it from flood waters during Hurricane Sandy. The IFCW™ may be effective for new construction or when existing foundation can be utilized. The IFCW™ may not be economical for retrofits where a foundation for the wall must be installed.

“Aqua Barriers” are water inflated dams are primarily used in construction projects because they allow access to underwater areas. They are comprised of a single tube that fills with water and contains an inner restraint baffle stabilizing system. They can also be used as a protective measure to prevent flooding along rivers, as they are used along the Red River in North Dakota that is prone to flooding. Water-Inflated Property Protectors (WIPP) manufactured by Hydrological Solutions, Inc. apply a similar concept as on-grade temporary dams for residential and commercial applications.

The Tiger Dams™ system is made up of long tubes that are stacked and inflated with water. They are generally stacked in a pyramid structure for maximum stability but can be stacked up to 32 feet high and extend for any distance. They can be filled by a fire hydrant, a 2 inch pump or a water hose, and when emptied each tube can be rolled up into a small package (10 inches high and 19 inches wide).

Table I
Summary of Deployable Flood Mitigation Technologies

	TrapBag®	Invisible Flood Control Wall	Water-Inflated Property Protectors	Tiger Dams™
Concrete Foundation Required	No	Yes	No	No
Effective Height Range (feet)	2 – 6	1.5 – 18	0.75 – 6	1.6 – 5
Required Horizontal Clearance (feet)	4 – 8	2 – 10	2.25 – 18	1.6 – 5
Primary Construction Materials	Polypropylene, Aluminum, Fill (Sand, Gravel, etc.)	Aluminum, Concrete	PVC reinforced with polyester	Polyester, Polyethylene, Fabric
Required Deployment Equipment	Excavator, Front-end loader	Light crane, Boom truck	Fire hydrant, garden hose, pump	Fire hydrant, garden hose, pump
Recommended Deployment Crew Size (# of Workers)	3-4	3-4	2-3	1-2

For any flood control project, it is important to ensure compliance with the environmental review requirements of the National Environmental Policy Act (NEPA). Environmental review is triggered by the use of discretionary approvals, including funding. Many projects would be the recipient of funding, as would be individual property owners in the municipalities that have requested assistance. The release of funding would likely be federal-level initiative, with state-level oversight, and generally localized effects.

9.0 Conclusion

Hurricane Sandy resulted in widespread damage and economic hardship in the impacted region including flooding, water damage and mold. Mold was an environmental issue that was difficult to manage because it is not highly regulated. The first step to improve on the solid foundation of the DOHMH Guidelines as the industry standard for mold regulation would be to consider mold a public health issue. Second,

the environmental industry and regulatory agencies should develop mold exposure limits. Third, the regulatory agencies should consider publishing guidelines and standards for mold assessment, remediation, professional education/certification and worker protection.

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