



Final Scientific Progress Report: Recovery from catastrophic weather: mold exposure and health-related training

February 23, 2016

Project period: October 1, 2013- September 30, 2015

Funded under the Centers for Disease Control and Prevention's National Institute for Occupational Safety and Health (NIOSH) Research Cooperative Agreement to Aid Recovery from Hurricane Sandy, RFA OH13-002, Agreement 1U01OH010627-01. This report is solely the responsibility of the authors and does not necessarily represent the official views of NIOSH.

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1. List of Abbreviations.

American Academy of Allergy, Asthma and Immunology/AAAAI
American Academy of Pediatrics/AAP
American College of Occupational and Environmental Medicine/ACOEM
American College of Preventive Medicine/ACPM
American Society of Heating, Refrigeration and Air Conditioning Engineers/ASHRAE
Centers for Disease Control and Prevention/CDC
American Industrial Hygiene Association/AIHA
Council for Occupational Safety and Health/COSH
Connecticut/CT
Connecticut Council on Occupational Safety and Health Inc./ConnectiCOSH
Connecticut Department of Public Health/CT DPH
Continuing Medical Education/CME
Emergency medical technician/EMT
Federal Emergency Management Agency/FEMA
Office of the Assistant Secretary for Preparedness and Response within the United States
Department of Health and Human Services/ASPR
National Council for Occupational Safety and Health/National COSH
National Institute for Occupational Safety and Health/NIOSH
National Institute of Environmental Health Sciences/NIEHS
National Institute of Medicine/IOM
Non-governmental organization/NGOs
Personal electronic device/PED
Personal protective equipment/PPE
Principal Investigator/PI
Turner Building Science and Design, LLC/TBS
United States/US
United States Department of Health and Human Services/HHS
United States Environmental Protection Agency/EPA
University of Connecticut/UCONN
Volatile organic compounds/VOCs
World Health Organization/WHO

Sandy Science Group Contractors refers to the 31 contractors with individual awards from ASPR, CDC (including NIOSH) or NIEHS for research and training projects regarding recovery after Hurricane Sandy.

2. Abstract

The University of Connecticut/UCONN Health project- **Recovery from catastrophic weather: mold exposure and health-related training** is focused on research and training to increase knowledge and protective behavior related to mold mitigation and health effects within emergency and recovery responder groups, construction workers, and the public in states affected by Hurricane Sandy. The Connecticut Department of Public Health/CT DPH, Connecticut Council on Occupational Safety and Health Inc./ConnectiCOSH, and Turner Building Science and Design, LLC/TBS are partners in this work. Severe weather, typified by Superstorm Sandy and flooded buildings, brings attention to respiratory health and the threat from indoor mold/bioaerosols. The UCONN team worked to:

- better understand why some workers and the public haven't prepared well-enough to respond to the health risks associated with mold/bioaerosols, and haven't utilized protective gear and resilient building practices (Aim 1);
- make carefully-vetted technical materials and risk messaging accessible (Aim 2) through development of collaterals, a web resource and workshops (Aim 3);
- increase health provider awareness of how bioaerosol exposures during hurricane response and recovery activities may affect health (Aim 4);
- explore the feasibility of having information available on personal devices (Aim 5); and
- disseminate education through multiple channels (including using social media and building synergy with Sandy Science Group contractors) to sustain positive outcomes of the program (Aim 6).

The UCONN project completed tasks in three overall components in fulfillment of these aims: 1) focus group research, 2) risk communication strategy and messaging, and 3) training development and dissemination of educational material. UCONN held five focus groups representing emergency response, public health, construction, faith-based outreach workers, and home occupants. Most participants expressed concern over the burden on those most vulnerable, and were troubled about health effects from mold. Many expressed confusion about accessing and using hurricane preparedness information, including information about gear such as masks, gloves, and clothing. Almost all participants described anxiety over their uncertainty around mold exposure and health and their distrust of government support. With consideration of the themes learned through the focus group encounters, UCONN developed a risk communication strategy, a website *Hurricanes: What you need to know about mold/moisture/bioaerosols and human health* <http://hurricane-weather-health.doem.uconn.edu/>, and held 4 workshops: *Hurricanes and Mold: The health concerns; reducing personal risk; and re-building homes with resiliency*. Considering that the number of severe wet weather events with building flooding is expected to increase, health providers who recognize the risk and know where to access resources on personal protection are in a strong position to guide their patients to prevent respiratory illnesses fostered by exposures in the flooded environment. UCONN provided multiple continuing medical education/CME presentations in the Northeast to disseminate information directed at health providers, and is updating an on-line CME-eligible education program for physicians with guidance on environmental history-taking, treating patients with mold exposure, and determining medical clearance for participation in mold clean-up and for using respirators.

SECTION I

3.0 Significant (Key) Findings.

Whether a worker is a contractor cleaning up mold, a social service advocate providing service to a family in a moldy home, an emergency responder or public health professional committed to the community's wellbeing, or a resident faced with repairing destruction after severe wet weather, they may exhibit a lack of attention to protecting themselves from mold exposure. **Focus group research identified that worker and occupant groups were anxious over their uncertainty about relationships of mold with illness and distrust of government and others that acted as a barrier to taking actions that would foster protection from mold exposure** (Aim 1). It is likely important to address the causes for this wariness as a prerequisite to changing behavior that would increase the use of personal protective equipment/PPE (especially appropriate respirator) and proper mold remediation methods. There were some differences about why they felt anxiety from the uncertainty and distrust. Reasons included:

- skepticism about consequences and severity of illnesses from mold exposure in comparison to other hurricane-related impacts (all groups);
- frustration with timeliness and/or variability in meteorological predictions (all groups);
- lack of control over subpar contractor practices (construction workers and residents);
- difficulty and delays with insurance claims (residents);
- insecurity about overall safety from many things including theft in damaged homes and in shelters (residents, faith-based outreach workers, agency personnel); and
- cumbersome government applications and delayed payment for rebuilding costs (agency personnel, residents, faith-based outreach workers).

The representatives from coastal communities and worker groups shared concern about those who are most vulnerable to the added burden from mold exposure (Aim 1). Not unexpectedly our findings indicated that the barriers to protective behavior are most difficult to overcome for the poor residents and marginalized workers. This empathy towards others led to individuals helping others at their own physical risk and placed an emotional and psychological toll especially among the emergency response and public health agency responders, a well-recognized phenomenon (HHS 2005). Considering the effect of uncertainty and distrust (noted above), clear risk communication directed at vulnerable groups is likely a key to countering barriers to PPE use.

Knowledge about respirator selection and use was inadequate among all the targeted groups (Aim 1). Even though emergency responder participants had experience with PPE and respirator use, most representatives of the other targeted groups reflected uneven knowledge and had little or no training or fit-testing experience. Acknowledging that many faced with mold exposure won't have opportunities for formal training, the project team specifically included information on the accessibility of N95 respirators at local retail outlets and hands-on practice doing a seal check at workshops (Aim 3). The importance of a medical review and proper respirator fit test is incorporated into the risk message strategy (Aim 2), workshops and web materials (Aim 3), and clinicians' education (Aim 4).

In addition to identifying research and educational needs, the focus group effort provided rich input for the development of risk communication messages for those subject to mold and moisture exposures in flooded environments (Aim 2) **and for workshop curriculum** (Aim 3). Risk messaging that carefully explains why PPE is important should help change behavior in workers who had put themselves at risk for mold exposure and respiratory illness. Although limited to a project anecdote, one of the focus group participants from the small construction firm reported that she had sought fit testing and training in PPE use after having recognized her personal risk from mold exposure when taking part in the question and answer session held after the conclusion of the focus group. Moreover she

decided to use time from work to attend one of the project workshops as she was looking specifically to learn about improved construction methods.

Information from outreach activities consistently identified three overriding issues to consider in developing risk messaging (Aim 2): 1) Multiple variables -personal health, response activity, and damage/area affected -should be addressed. 2) Prior knowledge and training varies within and among each targeted group. 3) Messages need to be delivered through electronic (including desktop computer and personal electronic devices/PEDs) and through print distribution (flyers and posters).

Training opportunities should be offered to all the targeted groups regarding health effects of mold, preparation for catastrophic wet weather events, proper PPE use, and remediation and resilient construction (Aim 1). Trainings should be expanded vertically to include varying strata within organizations such as managers of public health programs as well as the sanitarian who is tasked to go on site, and housing officials as well as inspectors, and horizontally to a broader range of companies and workers who provide services in response to floods beyond clean-up companies and construction firms.

An evaluation of continuing medical education/CME eligible courses reflected a lack of programs for educating physicians related to disasters and mold/moisture (Aim 4). Considering that the number of severe wet weather events with building flooding is expected to increase, health providers who recognize the risk and know where to access resources on PPE are in a strong position to guide their patients to prevent respiratory illnesses fostered by exposures in the flooded environment.

Multiple channels are needed and were used to disseminate information to all the targeted groups (Aims 3, 4, 5, 6). Consistent with themes developed in focus group discussions workers and the public rely on many different ways to get information. The project held four specialized workshops (102 individuals) and gave presentations at meetings of housing officials (75 individuals), local public health healthy homes coalitions on the Connecticut/CT Coast (48 individuals), and union workers (40 individuals) (Aim 3). Other presentations targeted to health providers were made at regional and local physician continuing medical education/CME events, reaching hundreds of individuals (Aim 4). Materials were introduced at the National COSH forum on health and safety for workers and at the National Association of County and City Health Officials/NACCHO Preparedness summit. Over a thousand individuals were categorized and listed for outreach (Aim 6). A web site, *Hurricanes: What You Need to Know About Mold/Moisture/Bioaerosols & Human Health*, <http://hurricane-weather-health.doem.uconn.edu>, and holding workshop trainings, *Hurricanes and mold: The health concerns; reducing personal risk; and rebuilding with resiliency*, were offered to raise awareness of concern over mold exposure and to introduce available resources that would lead to improved practices (Aims 3, 6). Data on page hits and results from surveys at the conclusion of the workshop and six weeks after confirmed that the information is being used, and workshop trainings were well received. The website is fully accessible by PED (Aim 5).

Feedback from state agency personnel in a state impacted by recent flooding confirmed the utility of the risk message flyers that provide guidance on preparing to address moldy environments and on cleaning up these environments after a storm (Aim 6). In the fall 2015 the team sent project materials to states along the southeastern and gulf coasts where severe weather flooding was occurring. One of the agencies recently re- contacted the team and intends to incorporate the flyers into future training material.

SECTION II

4. Scientific Report.

4.1 Background for the project

The Northeast has been experiencing catastrophic weather events: excessive snow and ice (2011, 2015); storms and hurricanes-Tropical Storm Irene (2011); fall Storm Alfred (2011); and Hurricane Sandy (2012)- which caused extensive destruction. Occurrences for severe wet weather that bring water/moisture indoors are expected to continue, as just seen on January 23, 2016 when winter Storm Jonas brought substantial flooding to Connecticut/CT. The report from the “Second National Climate Assessment” suggests that the Northeastern and Midwestern United States/US should expect more severe storms and more intense short duration storms (Karl et al. 2009). Water damage is expected to occur at higher up locations in buildings, and in buildings farther from coastline and waterways. These events bring attention to threats to respiratory health associated with indoor exposures from moisture incursion. The National Institute of Medicine/IOM Committee on the “Effect of Climate Change on Indoor Air Quality and Public Health” identified mold and moisture associated illnesses as potential impacts from damage and degradation in buildings, and flooding and water damage associated with hurricanes. Their report specifically called for attention to intervention activities that serve to prevent illness (IOM 2011).

Moisture in the indoor environment is directly associated with adverse respiratory health effects (Mendell et al. 2011, Heseltine and Rosen 2009, IOM 2004). Some reports suggest that exposures in moldy workplaces increase the risk of developing asthma (Nevalainen and Seuri 2005, Karvala et al. 2011) and other respiratory illness (Park et al. 2008). Studies have shown that the higher the moisture content, the more severe these illnesses (Sahakian et al. 2008). Even after flood waters subside, water/moisture is left in materials and encourages biological growth. When mold is detected by sight, smell or measurements, it indicates a health risk to those exposed. Mold may be: 1) a direct factor influencing illness, 2) an indicator of other biological agents and bioaerosols that proliferate in conditions of excessive moisture, or 3) acting on building materials to release chemicals and dusts of concern (Nevalainen and Seuri 2005). Characteristics that contribute to determining what mold will grow indoors include: climate, geography, season, location, building construction, maintenance, use, ventilation, moisture control materials, and occupants (Nevalainen et al. 2015).

Those taking part in hurricane response and rebuilding activities could be exposed to moldy environments and dust. Exposures in buildings contaminated with mold/moisture are associated with predominantly allergic and irritant illnesses. Infectious etiologies for mold related diseases are of concern to immune compromised individuals. After Hurricane Katrina with widespread damage and extensive flood waters, concerns over cough and respiratory disease from prolonged exposure to post hurricane flooding conditions surfaced. A cross-sectional study of a Katrina worker group representing maintenance, construction trades and homeowners reported that transient fever and dry cough, and new onset sinusitis correlated with time in renovation activities. New asthma onset was also noted, but was not statistically significant (Rando et al. 2012). Laboratory studies with fungal species isolated from homes after Katrina flooding demonstrated the possibility that exposure to mold volatile organic compounds/VOCs may have contributed to health effects after exposure (Bennett 2015, Inamdar and Bennett 2013). It is not improbable given the descriptions of musty odors and airborne dust in homes after Hurricane Sandy that significant concentrations could be reached. The news reports of non-productive “Sandy Cough” among recovery workers and clouds of dust (9 news reports) lend strength to the argument that wearing a proper respirator is an appropriate worker health and safety action. There are many limitations to self-reports and symptom surveys with limited exposure measures; however the correlation of symptoms with floodwater contact and renovation activity supports public health actions that mitigate exposure to dusts and mold.

The University of Connecticut/UCONN Health project- **Recovery from catastrophic weather: mold exposure and health-related training** is focused on research and training to increase knowledge and protective behavior related to mold mitigation and health effects within emergency and recovery responders, construction workers, and the public in states affected by Hurricane Sandy. The CT Department of Public Health/CT DPH, CT Council on Occupational Safety and Health Inc./ConnectiCOSH, and Turner Building Science and Design, LLC/TBS are partners in this work. This project recognizes a significant respiratory health threat to workers and the public ensuing from catastrophic weather that brings water indoors. Hurricane Sandy serves as an example of a severe storm that left communities largely unprepared for meeting the threat, especially in light of the more obvious and significant task of responding to acute needs and overall community rebuilding. With the storm's devastation, areas on CT's coast were the recipient of a combination of factors that increased risk- 1) severe wet weather with associated flooding and accentuated wind-driven precipitation that brought moisture into buildings, 2) coastal communities' typical construction with building materials that held wetness, 3) the unevenness of training availability to the workforce, residents and volunteer communities; and 4) a paucity of educational programs that address the relationship of health with indoor moisture/mold exposures in flooded buildings and explain ways to limit individuals' exposures.

4.2 Specific aims

The overall goal of this work is to provide a program that would contribute to actions that prevent respiratory disease in hurricane disaster responders, rebuilding and clean-up workers, volunteers, and home occupants. The six project aims are to:

1. identify barriers, through structured focus groups and other qualitative approaches, to a) becoming knowledgeable about mold exposure health risks and b) acting appropriately on the knowledge pre-, during, and post-response and recovery activities;
2. create a risk communication strategy/messaging around mold health effects targeted to union and non-union construction, trade, and municipal workers; and faith-based and other community groups who would likely be involved in hurricane response and recovery;
3. implement a training program in CT that overcomes identified barriers for worker groups through web-based and seminar encounters;
4. develop a course segment on mold exposure/health effects for emergency medical/health care personnel for the UCONN Center for Indoor Environments and Health on-line clinicians course (www.video.uchc.edu/MoldMoisture) and renew the CME offering;
5. establish the feasibility of making technical guidance accessible via PEDs to increase overall use at the time and point of response and recovery action; and
6. disseminate technical resources that have been evaluated and piloted in CT to all Sandy States.

The project had three overall components in fulfillment of these aims: 1) focus group research, 2) risk communication strategy and messaging, and 3) training development and dissemination of educational material. A discussion of these components, outcomes and major accomplishments follows.

4.3 Focus group research (Aim 1)

Focus group meetings were conducted to identify educational needs regarding mold and health among the targeted groups. The UCONN Health Institutional Review Board reviewed the protocol and determined the effort to be exempt from further review under Category 2: Educational tests un-linkable to individuals and no risks from disclosure.

4.3.1. Focus group objectives

The objectives of the focus group effort were to:

- investigate attitudes about, and knowledge of, health risks associated with catastrophic wet weather and subsequent indoor mold exposure among: worker populations, emergency response and health district personnel, volunteers, and home occupants;

- identify barriers to protective behaviors as these groups both prepare for catastrophic weather events as well as deal with the aftermath;
- identify gaps in knowledge and/or practice relative to health effects from mold exposure, personal protective equipment/PPE use, and mold remediation;
- explore how the targeted groups get information so to plan health risk messages and educational programs; and
- identify topic areas, issues or attitudes deserving of research efforts.

4.3.2. Focus group methods

Community based participatory research: The project engaged community members in the design and implementation of qualitative research through partners and an advisory panel that represented different constituencies with interest in the subject. The panel included individuals with: public health perspective; emergency response orientation; worker health and safety focus, medicine (occupational, allergy, and primary care) expertise; outreach and risk communication knowledge; environmental and marine science interest; and/or with volunteer experience from the faith-based community.

Script development: The principal investigator/PI drafted the initial script with input from subject matter experts in emergency response, construction/mold remediation, public health, occupational medicine, and industrial hygiene. The draft script was refined after several reviews and approved by the advisory panel to ensure comprehensiveness, relevance, and understandability of questions. Script components included: an ice-breaker exercise; disclosures about participant rights, information confidentiality, research purpose and ground rules; and guidance to facilitate discussion. The script supported collection of information with open ended questions to explore participants' knowledge about topic areas and then probing follow-up questions to focus the discussion. The script addressed five primary areas of interest: 1) experience with hurricane response (what they did before, during and after Superstorm Sandy and/or other storm flooding events), and thoughts about community priorities; 2) attitudes about personal sense of safety during and after the storm; 3) knowledge about mold/moisture and health (understanding health effects from exposure in indoor environments and the principles and practice of mold remediation); 4) experience with PPE- (how they dressed, what PPE they wore during activities that could expose them to mold, what PPE was available, what training did they have in the use); and 5) means for risk messaging and outreach (how are they informed now, suggestions for strategies to disseminate educational information and risk messaging within their communities).

Participant recruitment: The team utilized the network of project staff and partners who either directly represented one of the targeted groups or had relationships with members of one or more of the targeted groups to recruit participants. The team distributed an informational flyer through established contact lists available from the regional office of the CT Office of Emergency Management and Homeland Security, the CT DPH, and the UCONN Sea Grant operation. The team used email correspondence and made phone calls drawing names from neighborhoods affected by Superstorm Sandy, local health department contact lists and other networking sources. The investigators and ConnectiCOSH met with regional labor councils and other advocacy groups to reach out to workers who had Sandy clean up experience. The brief flyer described the project, explained consent, confidentiality and the voluntary nature of participation, and solicited interest in attending a focus group session. The project offered a \$20 gift card from a home improvement store as an incentive for participating. Copies of the recruitment and informational flyers are available on the project website.

Focus group implementation: Five focus groups were held in two coastal locations in CT from April 2014 to February 2015. Participants included staff from state emergency response and public health agencies, local health districts and housing departments; workers from a small independent construction company and a faith-based charitable organization; as well as volunteers and home occupants who had

experienced at least one storm with flooding event. All but one focus group was comprised primarily of representatives of one of these groups. However some participants were able to respond from the perspective of both affected resident as well as from his/her experiences during the discharge of professional responsibilities in response to storm-related needs. The composition of focus groups by role, gender and date can be found in Table 1. Groups were moderated by individuals with prior experience in conducting focus groups. A co-moderator with technical knowledge was present for each session. The moderators addressed subject matter questions at the conclusion of each session. The project’s PI served as moderator for three, and co-moderator for one other focus group encounter. A research assistant facilitated the other two groups. Each focus group was approximately 90 minutes long.

| Date | Who | Female | Male | Total |
|-------------|---|---------------|-------------|--------------|
| 7-Apr-14 | Public health and emergency response agencies' personnel | 9 | 7 | 16 |
| 6-Jun-14 | Home owners, volunteers, local health workers (overlapping roles) | 4 | 3 | 7 |
| 30-Jan-15 | Construction workers | 3 | 2 | 5 |
| 30-Jan-15 | Faith organization workers and volunteers | 5 | 1 | 6 |
| 24-Feb-15 | Residents | 5 | 6 | 11 |
| | | 26 | 19 | 45 |

Coding transcripts: All proceedings were recorded, transcribed and uploaded to ATLAS.Ti.7 (version 7.1.4, copyright 1993-2015 by ATLAS. Ti, GmbH, Berlin). Transcripts were coded by two independent coders, Joanne Burcher, MD MPH and Jennifer Cavallari, ScD who identified major themes within and across focus groups, by way of an iterative process. Coders did not confine themselves to theme “density”, denoted by themes mentioned by more than one participant or in more than one group. Rather, if a pertinent point was made by just one participant, that comment was considered.

Design limitations: 1. Generalizability: Some targeted groups were represented by participants from just one organization (one contracting company, one charitable organization), reducing generalizability. The incentive offered benefit to those who participated, while the amount, a \$20 gift card, was selected to minimize any incentive bias. 2. Moderator bias: The effect of this potential bias was minimized with a carefully designed script to foster conformity and by utilizing the same three project team members to moderate and/or co-moderate each encounter. However two moderators facilitated the 5 groups and the moderator style may have had an influence on responses or in directing the trajectory of a discussion. 3. Recall bias: Interviews were conducted 18 to over 27 months after the event which may have introduced recall bias. Some participants had roles which changed from the initial event to the time of interview (For example, a homeowner at the time of the hurricane later became a case manager; another who had been a volunteer at the time of the storm became a town employee involved in emergency response planning.) .

4.3.3 Results:

A. Experience with hurricane response

While almost all referred to experiences with Superstorm Sandy, some referred to other events- Hurricanes Isaac, Andrew, Katrina, Gloria and/or Tropical Storm Irene. Individuals across all groups recounted measures they or others they knew took to minimize damage to property and to ensure health and safety of families. Home occupants stockpiled supplies: food, water (for drinking and sanitation), lighting (flashlights and batteries), medications, PPE (gloves, masks). One individual with emergency response training described preparation for her family which included having “go kits” on standby. Kits contained several weeks’ worth of supplies for each family member and important documents. She periodically checked and upgraded her go kit as needed. Some residents obtained generators. Some

secured or removed outdoor items which could become projectiles. Several emptied their basements of furnishings and materials in anticipation of flooding, not just to prevent destruction of property but also to eliminate materials which, once wet, could promote mold growth. *“If there’s a hurricane, make sure you go into your basement before (resident).”* *“it.. isn’t like a tornado. . doesn’t sneak up on you...everyone knows a hurricane is coming...you need to make a plan (local agency staff).”* Others presented opposing views: *“But to be honest, there’s not too much you can prepare for (resident).”*

Members of the charitable organization, emergency response teams and health districts described activities which would enable them to 1) maintain operations, staffing and communication; 2) maintain critical services for residents; 3) provide for the longer-term needs of residents, including for displaced residents in shelters. Many health district employees reported preparing in advance (as much as 96 hours) of the storm. Construction professionals cleaned out residences and assessed reconstruction needs.

All groups noted widespread failure to prepare and/or evacuate among residents. They offered the following reasons why they thought this had happened:

- Meteorologists’ warnings were ignored because they are viewed as exaggerations or “hype”.
- Residents were afraid of theft or being forced to leave their homes (especially the elderly).
- Many relied on others for guidance that didn’t come (the building association’s management).
- Some exhibited a false sense of security (Residents who had elevated their houses, were not located in flood zones, or whose property survived previous hurricanes).
- Vulnerable populations---the mentally ill, the elderly, those with no family support--- had demands for those providing relief that they didn’t think would or could be met.
- Many were concerned over a place for pets.

Some residents felt that the National Guard and public works personnel should be deployed before a storm strikes. The theme of neighbors relying on others “neighbors helping neighbors” was mentioned often as an activity residents engaged in immediately post-storm.

All groups discussed priorities. Agency personnel noted that the uniqueness among CT towns could make it difficult **to identify critical resources**. Local health agency staff identified **the need to prepare** *“for the critical appointments...earlier on... before the storm actually hit...getting immunizations and..making sure..staff are well-equipped ..to stay at work...”* They also suggested **the need to address administrative requirements that prolonged recovery efforts**. The workers from the small contracting firm **called for local oversight of reconstruction efforts** to protect residents from fraud and **to ensure that re-building is conducted according to recognized guidelines**. *“They [other contractors]. . don’t give the people a proper fix up in their home. And .. I would suggest that someone .oversee those things and make sure the resident of the home gets a proper, well-done job.”* They noted the **responsibility of individuals to take** precautions to reduce damage”

B. Attitudes about personal health and safety

Most participants denied any personal sense of danger, but expressed concerns about hazards to others: downed electrical wires, carbon monoxide poisoning, contaminated waters, and blocked roadways preventing access to medical care and resources. Some felt prepared through current or former jobs and training (firefighter, military, and emergency medical technician/EMT). Emergency responder staff referred to their sense of situational awareness as the first step to ensure personal safety. Most of the agency staff who entered damaged buildings felt protected by their PPE and the “buddy system” they had been taught to use when assessing building damage. However others- from the small construction firm and some of the residents- described incidences where they lacked a sense of the need for PPE. As an example, a resident reported the following incident which at the time didn’t concern her but in light of the discussion she offered it as an example that put her at risk: *“They [pumping company] made me... go in*

my.. basement and open the backdoor.... the water was up to here. They said if you want me to clean your basement, go downstairs and open that door."

C. Interest and knowledge about mold and moisture

The participants displayed high variability in their interest and level of knowledge about mold. Some participants considered mold to be a "problem" both for health and for the sake of building integrity. Most understood that moisture promotes mold growth. A number of them cited a "lesson learned" from previous flooding, namely that possessions stored in basements could be destroyed not just by water but by mold. Some prepared for Hurricane Sandy by removing items from basements. However, as typified by a lively discussion in the resident group, many participants expressed confusion about mold. *"mold is a mystery to me," "there's not enough information about mold."* Several asked direct questions of the moderators regarding remediation procedures. Participants cited respiratory health effects most often. *"[What concerns me most is] breathing it in (resident)"*. Several asthmatics stated that they were aware of the potential health effects resulting from mold exposure because of their own illness. Others attributed health concerns that aren't as clearly affected by mold exposure- *"People that're in it for a length of time, there is definitely deterioration in the cognitive function when working with a client (worker, faith-based charitable organization)"*. Participants looked to their doctor, their work, the internet, their own medical background, cleanup contractors and networking for information on mold.

Mold exposures are not a priority: *"so much going on .. so overwhelmed, you're not gonna call the health district who's .. dealing with failing septic systems and ..you're in.. shock (health district employee and resident)"*. *"Where am I gonna live? What am I gonna do? When am I gonna get insurance money? You're not gonna say, well, gee, let me call up the health district or google it ..You're just gonna react to it (coastal resident)"*. Some residents occupied with the destruction did not consider that they may be putting their health at risk when they either a) rescued belongings or b) began remediation on their own. Some participants feel that they were in no danger because they are exposed *"only a short time."* Some reported that residents become inured to their living conditions (mold odor) and fail to recognize the risk, while others consider warnings about the hazards of mold to be untrue.

Most workers were aware that mold remediation requires a methodical approach. Several participants stated that they identified risky environments by moldy odors and were aware of the dangers of disturbing mold, especially when dried. Some expressed a sense that the size of the affected area helped them determine whether remediation needed professional attention. Their experiences included personally tackling the job within their own homes, observing untrained homeowners performing remediation, or performing initial assessments but turning to other professionals for the actual abatement. Participants offered opinions regarding obstacles to proper remediation, noting the following:

- difficulties with cost reimbursements- Federal Emergency Management Agency/FEMA requirements, and insurance company demands that act to delay action and/or encourage people to use less appropriate but less costly means;
- lack of knowledge regarding proper remediation that placed homeowners at risk of being taken advantage of by contractors and subpar construction; and
- having to meet building association and/or historical building commission specifications that require actions such as replacement materials that may not be compatible with resilient construction recommendations.

D. Personal protective equipment (PPE)

Participants discussed the types of PPE they used or observed others using during a variety of activities (emergency response, property assessment post-storm, general clean-up of residential and commercial interiors, mold-specific remediation). Some noted that PPE is "cumbersome", hard on the user when doing tasks, and can make the user feel claustrophobic. For respiratory protection, practices included using nothing at all, cloth tied across the face, or a mask or "respirator"- precisely which was not

clear. Gloves, eyewear, footgear and protective clothing were also mentioned but may have been used inconsistently. Housing officials reported using eye protection and gloves but not respirators when performing initial housing assessments. The faith organization workers expressed their reluctance to utilize PPE even if they felt they should, if the client was residing in the “moldy” home and not using PPE. EMTs used PPE appropriate for potential blood-borne disease if responding to medical emergencies. Some participants stated they used “common sense” and their senses to determine if PPE is needed; others used PPE if they expected to be in moldy environments for extended periods of time. Some decided on PPE use based on the extent of mold encountered. One participant noted that he/she would don PPE if others were observed using PPE on site. Those whose professional responsibilities (agency and EMT) required them to use PPE, had been supplied the equipment and trained by their current or former organizations. They reported having been fit tested for respirator use but did not offer specifics and most were unaware of a seal check.

E. Means for risk messaging and outreach

Participants were enthusiastic about education needs and made suggestions on content, format and target audiences. They suggested topics; mold (biology, detection, risk), preparation of property pre-storm, and how-to apply for funding for reconstruction. All groups like print notices (enclosures with energy bills, doorknob hangtags, wallet-sized cards, small notebook sized to fit in glove compartments). Self-described “visual learners” liked the idea of videos and TV public service announcements. The internet-including social media- and mobile phone applications were popular choices, although some participants noted that cell phones and the internet were not always available during storms. One commented, *“health departments have a Twitter and a Facebook presence . get information out . rapidly and .. shared.”* Many participants suggested “piggybacking” informational programs with community events such as town fairs. They considered schools to be good places to distribute information, because children bring messages home, one likening mold exposure health and safety to fire safety information. Workshops are well thought of if considerations (working hours, convenient location and parking, transportation needs, and cost) are addressed. They want the messages tailored to language (possibly Spanish) and pre-existing knowledge of each unique group. Some suggested training managers and administrators because they noted their lack of field experience to appreciate risks. All groups felt that poor populations would benefit from education about mold problems and noted that they have less access to information and are less likely or able to follow-through on advice. Respondents offered caveats to avoid information overload- *“You also get immune (to information) after a while”*.

4.3.4 Discussion

As a result of these focus group meetings, the following themes emerged:

- 1. Anxiety impeded all groups from taking actions that would foster protection from mold exposure.** They were uncertain about illness severity and distrusted meteorological predictions, contractor practices, insurance repayment, and government support- Participants across all groups were uneasy about not understanding mold exposure health risk and they looked to their doctors, contractors, neighbors, and the internet for information – a mixed variety of resources, not likely to provide complete, consistent and/or appropriate guidance. Their general distrust towards government systems limited their seeking information, even from government entities they appreciated such as local health departments. Difficult administrative hurdles at all levels contributed to this anxiety, from complaints over changing federal guidelines for reimbursement to the obstacles to rebuilding posed by local housing authorities or historical society guidelines. Delays in government loans (and reimbursements from insurance companies) compromised health in several ways:
 - Participants described instances of residents remaining in moldy, unsafe environments for long periods of time until they received funding to rebuild. Some of those living under these conditions are unaware of the threat to their health.
 - Some residents employed contractors unlikely to use correct methods in an effort to reduce cost and return to their homes as soon as possible.

- Homeowners put themselves at risk by undertaking remediation on their own, often with little or no knowledge of proper procedures or how to protect themselves.
2. **Participants expressed empathy for vulnerable populations.** Concern for those displaced by the storm placed an emotional and psychological toll on our participants, especially among responders, a well-recognized phenomenon (HHS, 2005). Volunteer organizations, first responders and health district personnel should be mindful of their own and their staff's emotional needs not only during immediate disaster response but also as issues for residents remain unresolved months and years later. All groups expressed empathy for vulnerable populations and emphasized the need for local municipalities to identify these populations and plan for their care prior to a crisis. Participants pointed out, that the physically or mentally disabled, the elderly or those with no family support are not able to prepare in enough time. In addition, empathy for neighbors in need prompted several respondents to reach out to them during the height of the storm, putting their own safety at risk.
 3. **Knowledge about mold, health effects from exposures, PPE, and mold remediation is uneven in all communities.**
Some participants from each group recognized that mold exposures had potential health effects, and most identified respiratory effects. But they knew little beyond that. Adding risk identification regarding mold exposures as a component in trainings for disaster response for health district and emergency response personnel would be a benefit. As one health district employee pointed out, first responders may be at greater, unrecognized risk for mold-related health problems because of cumulative exposures, since they are going in and out of many homes with their primary focus on the emergency response, not on potential mold exposure. Although some participants stated that they had been trained in PPE use, their descriptions of the types of PPE used and their criteria for wearing PPE were inconsistent and inadequate. Bolstering this part of trainings, adding an emphasis on seal checking, and expanding opportunities for hands-on programs would serve all the groups well. Home occupants in particular expressed interest in learning about the biology of molds, how mold spreads and how to address it. Knowledge regarding remediation principles seemed limited and inaccurate in some cases. Guidelines for identifying when individuals can attempt remediation on their own and when they need professional help are needed.
 4. **Reliance on many different ways to get information to understand risk.** Our participants were receptive and enthusiastic about opportunities to learn, especially with respect to the health effects of mold. They embraced the workshop model but also provided numerous suggestions for other media (web-based, print, video, telephone applications) and community events. Participants believe that current risk messaging regarding preparation and evacuation should be re-evaluated. Despite participants' contention that there is much storm-related and mold-related information available, their awareness of reliable sources (state and local health department web sites, for example) seemed incomplete. Likewise seeking advice from their physicians prior to participating in clean-up activities did not seem to be a consideration.

4.3.5. Conclusions

Research is needed to explore how overall distrust may be affecting the mental and emotional health of the groups targeted in this program, and how this serves to reduce the ability of these groups to adequately protect themselves from exposures and prepare for hurricane response. A corollary effort should explore interventions that would address the subjects of the uncertainty, especially administrative concerns.

All of the representative groups need training regarding the preparation for catastrophic water-related weather events and health effects of mold, proper PPE use, remediation and resilient construction. In addition education programs should be expanded both vertically to varying strata within organizations such as managers of public health programs as well as the sanitarian who is tasked to go on site, and housing officials as well as inspectors, and horizontally to a broader range of companies and workers who provide services in response to floods such as clean-up companies and construction firms.

Accomplishments and outcomes-focus group research (Aim 1): The make-up of the advisory panel brought diverse perspectives to the qualitative research design and access to targeted groups. Five focus groups (comprising 45 individuals) were held with representatives of all the targeted groups. The focus group effort: **identified research and educational needs, and provided rich input for the development of the risk communication strategy and workshop curriculum.** In the context of this grant aim, the investigators implemented modest qualitative research that sought encounters with a limited representation of each targeted group- agency personnel, workers, volunteers and home occupants. A segment of workers- day laborers, a group particularly at risk, was not represented. Although the workers from the small independent construction firm that participated have overlapping experience with day laborers, the unique perspective of day-laborers was not represented in the discussion. Qualitative research such as this is limited to identifying themes and trends. All of the areas explored could be further described through surveys utilizing larger samples of the representative groups.

4.4. Risk communication strategy and messaging (Aim 2)

Risk messaging is an important part of safety training that requires presentation of information and consequences in understandable and relatable language. For health and safety to be practiced by those at risk for exposure to mold associated with wet weather events, it is critically important to clearly communicate the reasons why safe work practices should be followed. Mold and moisture health risks are especially challenging to explain because: 1) the relationships of exposures with health outcomes require exploration of complex topics (air pathways, exposure dose, health effects); 2) there is some controversy (Bush et al. 2006, Craner 2008) and differences among the guidelines available from many sources- medical societies [American Academy of Pediatrics (Mazur and Kim 2006), American College of Preventive Medicine, American College of Occupational and Environmental Medicine (Hardin et al. 2003), American Academy of Allergy, Asthma and Immunology], -public health agencies [IOM (IOM 2004 and 2011), World Health Organization/WHO (Heseltine and Rosen 2009), Centers for Disease Control and Prevention/CDC (Brandt et al. 2006)], -environmental agencies [US Environmental Protection Agency/EPA]; and -trade and professional organizations [American Industrial Hygiene Association (Prezant et al. 2008) and American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE 2009)]; 3) intervention costs can be substantial, and 4) this topic elicits emotional responses for many. Risk messages need to consider the potential for both exaggerating and underestimating the health risk, and provide an accurate and understandable estimation of risk.

This project's risk messages are grounded in consensus reviews from the IOM and WHO (IOM 2004, Heseltine and Rosen 2009,) and peer-reviewed literature. Technical information about environment, health and safety, and mold remediation methods draw from resources the team evaluated on two criteria: 1) usefulness to stakeholders tasks; and 2) relevancy and completeness on health & safety topics (general mold information, health effects, PPE and remediation) and/or on rebuilding with resiliency (mold growth, mold resistant materials, and resilient construction methods). A list of resources that met these criteria are included in section 8 with the report citations.

An iterative process aligned the communication strategy with information as it became available from outreach activities throughout the grant period - focus group recruitment, advisory board deliberations, early workshop encounters. Information from other Hurricane Sandy Science Group contractors and federal agency personnel (NIOSH, EPA, CDC, NIEHS, ASPR) was gathered at conferences and meetings. These efforts consistently identified three considerations: 1) There are multiple variables -personal health, response activity, and damage/area effected – that need to be addressed. 2) Prior knowledge and training varies within and among each targeted group. 3) Messages need to be delivered through internet (computer and PED) and print (flyers and posters) distribution. Subject matter experts and members of the advisory panel reviewed draft materials for appropriateness for each targeted group. The PI vetted draft material at the NACCHO Preparedness Summit training session-

Tools and Methods from Hurricane Sandy Recovery Research where she presented jointly with Columbia University and University of Pittsburgh in April 2015. With ConnectiCOSH she solicited feedback on risk message flyers from a diverse worker groups at the June 2015 National COSH conference round table session- Building Capacity in Disasters: Flooding and Mold: Workers' health and reducing the risk.

Accomplishments and outcomes- risk communication strategy and messaging (Aim 2): The project team **developed a risk communication strategy, produced collaterals with health risk messaging, and planned for a web resource and workshops.** A comprehensive flow chart - **After the Storm-Mold and Moisture Cleanup; A Guide to your Safety** provides a step by step process for individuals to: 1) determine their health suitability for mold clean up; 2) explore what moldy environments they can safely work in; and 3) decide on PPE and safe work practices. This **Guide** and these listed flyers are available for download.

- **Before the storm - What do I Need to Know? (for workers)**
- **After The Storm - How Can Mold Affect My Health? (for residents, volunteers and workers)**
- **After The Storm - What Steps Do I Need To Take to Clean-Up Safely? (for residents, volunteers and workers)**
- **After The Storm - What Can I Do to Prevent Becoming Ill From Mold Exposure? (for volunteers and workers)**
- **After The Storm - How Can I Safely Clean/Remove Mold? (for residents and volunteers)**
- **After The Storm - What Can I Do to Prevent Mold Growth After the Flood Waters are Gone? (for residents, volunteers & workers)**
- **Why Does Mold Grow? (for Residents)**

4.5 Training and dissemination of educational material. (Aims 3, 4, 5, 6)

Our educational strategy engaged the target groups in information gathering activities initially through focus group participation and then re-engaged interested individuals and others through multi thrust outreach activities, web resources and workshop seminar trainings. The overall goal is to change long-term behavior to reflect better adherence to risk reduction actions including PPE use and adherence to resilient building practices.

4.5.1 Workshops (Aim 3)

Workshop trainings had three major subject components on how: 1) exposures in flooded buildings affect respiratory illness; 2) individuals can protect themselves from exposures when working in flooded buildings, and 3) to rebuild buildings to be more resilient to future storms. These components drew on the risk communication strategy and focused on practical matters. For example with consideration of the variability in fit testing (Campbell et al. 2001, Coffey et al. 2004) and limited opportunities for respirator fit testing, Paul Bureau, MS CIH, an industrial hygienist on the team, gave a hands-on segment on respirator availability with practice doing a seal check. William A. Turner, MS PE, a building scientist from TBS, provided practical advice on mold remediation and resilient building practices. The workshop plan, presentations and small group exercises are available at <http://hurricane-weather-health.doem.uconn.edu/2015/06/26/1059/>.

The PI and a project team member with evaluation expertise, Sara Wakai, PhD designed a workshop evaluation program consisting of a satisfaction survey, a pre-and post-workshop knowledge assessment, and a follow-up survey. Respondents reported high levels of satisfaction on the training objectives, the training segments and the instructors. The PI and other trainers used feedback from the satisfaction survey provided in the earlier trainings to make improvements in subsequent trainings. There were 10 demographic/background questions and 39 satisfaction questions with response options on a scale of one (strongly disagree) to five (strongly agree) that addressed program objectives, segments of

the workshop, instructors, and general feedback. Three open-ended questions allowed respondents to provide additional feedback on instructors, ways they may apply what they learned in the workshop, and suggestions to improve future workshops. The survey also asked respondents if they would be willing to complete a follow-up survey and, if so, to provide their contact information. Of the 102 individuals who attended the trainings, 91 participants completed the satisfaction survey, a response rate of 89.2. Survey takers come from all four workshops with the largest number from the July workshop (Table 2).

Table 2. Workshop Attendees and Survey Respondents

| Trainings | Number attended | Percent attended | Number who completed surveys | Percent of those present who completed surveys |
|------------------------------|-----------------|------------------|------------------------------|--|
| 14-Nov-14 Bridgeport | 28 | 27.4 | 26 | 92.9 |
| 2-Mar-15 Farmington | 20 | 19.6 | 18 | 90.0 |
| 27-Apr-15 Avery Point/Groton | 18 | 17.6 | 17 | 94.4 |
| 23-Jul-15 West Haven | 36 | 35.3 | 30 | 83.3 |
| Total | 102 | 100.0 | 91 | 89.2 |

As Table 3 shows, 54 % of the respondents live in an area affected by Superstorm Sandy. Over one-third worked or cleaned up after the storm, with 75 % of them doing this as part of their job.

Table 3. Demographics and Background Characteristics

| | Number | Percent |
|---|--------|---------|
| Currently live in area affected by Superstorm Sandy | 49 | 54 |
| Worked or cleaned up after Superstorm Sandy | 35 | 39 |
| Currently employed | 82 | 90 |
| Worked or cleaned after Superstorm Sandy as part of job | 27 | 30 |
| Currently work primary in public health field | 47 | 52 |
| Years worked in field (11 to over 15 years) | 51 | 56 |
| Age range (51 years and older) | 44 | 48 |
| Female | 53 | 58 |
| Primary language: English | 89 | 99 |

The mean scores of the questions on learning objectives indicate that the respondents agreed or strongly agreed that all the learning objectives were met (Table 4). The highest rated objective was “identifying health symptoms”. Even the lowest rated item, “relevant to my work” under the “types of adaptive building design” signified agreement (a mean score of 4.08). The somewhat lower score may reflect that the respondents were primarily from the public health field rather than in construction or other related fields.

Table 4. Learning Objectives

| Participants will be able to: identify health symptoms of concern for individuals who are involved in hurricane/storm recovery activities that include work in flooded buildings | Mean | SD |
|---|------|------|
| The objective was clearly defined at the beginning of the workshop | 4.52 | .643 |
| The objective was relevant to my work | 4.34 | .744 |
| The objective was met | 4.42 | .661 |
| Participants will be able to: select personal protective equipment/PPE and work practices that reduce health risks from exposure to bioaerosols | | |
| The objective was clearly defined at the beginning of the workshop | 4.40 | .674 |
| The objective was relevant to my work | 4.28 | .730 |
| The objective was met | 4.43 | .709 |
| Participants will be able to: become acquainted with types of adaptive building design in response to storm damage and flooding | | |
| The objective was clearly defined at the beginning of the workshop | 4.27 | .717 |
| The objective was relevant to my work | 4.08 | .795 |
| The objective was met | 4.20 | .818 |

Participants' knowledge gained was examined using a pre/post learning survey. The test was piloted during the November training and a modified version of the test was administered at the trainings in March, April and July. The test consisted of 15 true/false questions which were identical on the pre and the post test. Almost half the questions were answered correctly by a majority of workshop attendees on the pre-test, indicating that some had knowledge before taking part. There were sizeable increases on questions answered correctly on the post-test related to N95 respirator, reducing future costs and material use in basements.

A follow-up survey was designed to examine if participants retained knowledge learned from the workshop approximately six weeks later. The test consisted of five true/false questions which were identical to questions asked in the pre- and post-tests. Twenty-one completed a follow-up survey (of the 66 participants who indicated willingness at the time of the workshop). A comparison of the post-test and follow-up findings indicates that respondents maintained high scores on the questions related to requirements for fungi to thrive, moldy odors and visible mold indicating risk, and properly wearing respirator. However, there was a sizeable decrease in the percent of respondents answering correctly to the mold growth and health risk, and to the level of protection afforded by a N95 respirator. The feedback questions (I have shared information that I have learned with others; and I have recommended this workshop to my friends and colleagues) were similar to those posed on the initial satisfaction survey. The findings on the follow-up indicate that the respondents continued to view the workshop positively several weeks/months after the workshop and that they had shared information with others.

4.5.2. Website (Aim 3) and access through personal electronic devices/PED (Aim 5)

A comprehensive project website *Hurricanes: What you need to know about mold/moisture/bioaerosols and human health*, <http://hurricane-weather-health.doem.uconn.edu> provides access to materials developed in this project. The site is designed to provide information to help users understand the scope of the health risk based on scientifically sound reviews of health effects and reasoned understanding of environmental assessment when they clean up mold contaminated materials. In January 2016, 173 users accessed the site in 227 sessions, viewing an average of 4 pages for an average 3:55 minutes. Of those known to be from the US, the person viewed an average 7-8 pages in 8:21 minutes each session. Seventy-five % of the known US sessions and 57% of the new users were from CT,

California and Georgia. In addition to the website, the team established a presence on Facebook and Twitter. However, these sites have had limited success at engaging interest.



To make information available on PEDs (Aim 5), the team used a software template for the website that allows ready accessibility with PEDs. Four percent of the January 2016 web site sessions were accessed through mobile devices. Efforts continue to explore development of a specific PED application. Under Paula Schenck’s direction, a group of seniors from UCONN’s computer engineering program are working to develop “Mr. APP”, a PED application prototype for Android cell phones that will deliver “just-in-time” training to those faced with responding to flooded damage in buildings. Materials from the project website and the UCONN mold and moisture guidance for physicians are being utilized in developing the application. Mr. APP will be demonstrated at the end of the spring 2016 term.

4.5.3 Guidance for health providers (Aim 4)

Seven years ago, the UCONN Center for Indoor Environments and Health and the UCONN Office of Continuing Education developed an online course, CME-eligible, for clinicians in specialties where consideration of mold and moisture environmental factors would contribute to the quality of care. Since the course was first offered in 2009, the need for educating health providers about mold and moisture has expanded to include the temporality of symptoms with wet weather events such as Hurricane Sandy. Recent publications have underscored that exposures to mold and their metabolites after flood events can be substantial (Bennett 2015). This further raises the need for physicians to be aware of possible wet weather exposures, mold growth and effects on health. As part of this project, a new course committee consisting of Joanne Burcher, MD MPH, Marc Croteau, MD MPH, Dewei Li, PhD and Paula Schenck, MPH (course director) began work on an update. The updated course is being developed to:

- include the benefit of current clinical experience from the UCONN Division of Occupational and Environmental Medicine;
- reflect 2009 WHO and 2011 IOM consensus reviews, and other peer-reviewed research on health effects and mold that became available after the initial publication of the course;
- increase health provider awareness of the relationship of these illnesses to exposures associated with wet weather response; and
- educate physicians about requirements around PPE and resources available to them and their patients so individuals are better prepared for mold exposure.

The committee reviewed the original course content and completed a needs assessment to identify the benefits to the medical community from reissuing the course and adding information on severe wet weather. The UCONN Health Office of Continuing Education accepted the committee’s application for course development with enduring materials. The committee developed new technical content and

engaged production staff. The material based on Dr. Marc Croteau's occupational medicine practice will significantly extend the discussion about health effects and mold. The new course will include: an updated health effects section, a discussion on the nature of wet-weather disasters and mold exposure health risk, and a resource segment for the health provider to utilize with patients preparing for wet-weather disaster response. This includes pragmatic guidance on the physicians' role in: 1) evaluating individuals for suitability for disaster response work with possible mold exposures; 2) advising patients about utilizing PPE; and 3) counseling patients as to the availability of helpful educational resources. The course is planned to be completed and available later in 2016.

4.5.4 Dissemination (Aim 6)

The program looked to disseminate education through multiple channels (including social media) and outreach opportunities (especially to Sandy Group contractors). Efforts are guided by a detailed plan, following the CDC "Dissemination Planning Guidance and Worksheet-Prevention Public Health Preparedness & Response Research to Aid Recovery from Hurricane Sandy". Beginning with focus group recruitment, the project team began developing means to support dissemination of outputs from this work. All contacts were categorized and added to an overall list that could then be utilized throughout the project. At the time of this report the list includes over 1050 contacts. The master list has subcomponents from CT worker populations (subdivided by union-affiliated, independent companies, temporary workers); health agencies (local and state); emergency response (service companies, utilities, agency); faith-based groups and other non-governmental organization/NGOs with volunteer functions; environmental advocacy groups; and a small number of uncategorized people or entities.

The team discussed findings and/or provided educational programs at events sponsored by others with a complimentary focus: CT Children's Hospital Healthy Homes Program partner meetings in November 2014 and July 2015 (~ 35 individuals); Bridgeport Healthy Homes Coalition in January 2015 (13 members); CT Association of Housing Code Officials in March 2015 (~75 attendees); and Connecticut COSH Annual Meeting in November 2015 (~40 people). Materials were discussed with experts from the NIOSH Education and Research Centers in New Jersey and New York City Health Department at the Northeast Occupational Health Surveillance Conference in May 2015. Paula Schenck's talk at the May 2015 UCONN Health Division of Occupational and Environmental Medicine colloquium, and CME eligible presentations at the 2014 and 2015 Annual Meetings of the New England College of Occupational and Environmental Medicine served to disseminate information to health providers. Outreach efforts through channels available through the CT DPH are underway and include an application to present a poster at the 2016 Council of State and Territorial Epidemiologists Annual Meeting. In keeping with an objective to specifically target other Sandy Science Group contractors, project team members attended all three Sandy Science group meetings contributing formal presentations at two of the meetings and provided descriptive information that was published in the ASPR March 2015 Hurricane Sandy Newsletter.

Accomplishments and outcomes-Training Development and Dissemination (Aims 3, 4, 5, 6): Through 1) **formal training encounters- 4 workshop programs to 102 individuals among the targeted groups (Aim 3); 2) specialized educational segments at meetings with other interested parties (168 persons), and 3) formal presentations at national meetings (Aim 6)**- the project offered opportunities for multiple audiences to learn about the health risks, how to utilize PPE and work practices to minimize exposure, and about recovery after a hurricane with an eye to long term community recovery and building resiliency. Participants came from: state and local agencies (health, housing, environment, emergency response); labor groups (especially construction workers); NGOs involved in disaster response and organizing volunteers; members of healthy homes coalitions; residents in Superstorm Sandy impacted areas; and the general public. **A project web site (Aims 3, 6) fully accessible by PEDs (Aim 5) continues to provide access to the workshop curriculum for future face-to-face trainings and to the**

collaterals (Aim 6) developed as part of the risk messaging task that fosters more understanding of the health risks and actions to reduce exposures.

Efforts were made to increase health provider awareness of health threats from bioaerosol exposures during hurricane response and recovery activities through **initiating development of an update to the UCONN's Guidance for Clinicians on Mold and Moisture on-line course (Aim 4) and teaching CME eligible segments at regional and local physician education events. A coterie of engineering students was engaged and they are developing a prototype application (Aim 5) to provide a just-in-time PED accessible tool. Through formal quarterly advisory panel meetings and numerous other working meetings with advisory panel members, the project reached constituencies beyond the stated outreach program. Importantly this project reinforced UCONN's working relationships with the CT DPH and ConnectiCOSH that will foster continued dissemination of the findings and materials to their constituencies (Aim 6). Of note, this past fall the materials were given to state health departments in South Carolina, Texas and Louisiana after severe storms and flooding threatened communities (Aim 6).**

Long-term utility of the web resource is limited by resources available to maintain the currency of the content. Considering that flooding events are increasing, there would be added benefit to offering additional hands-on workshops in other coastal locations. Similarly, the utility of the educational materials, currently available in English language versions, would increase if these materials could be customized for non-English learners and offered in multiple languages.

5. Translation of Research

Many responded to the devastation of Hurricane Sandy: union and non-union construction, trade and maintenance/public works employees; public health and environmental professionals; emergency response including medical personnel; volunteers - student, faith-based and/or community organizations; and resident family members and friends. Although technical guidance and training materials on mold exposure and mitigation are readily available, workers and residents of coastal areas are at risk for respiratory illness as recovery from Sandy ensues. Further complexity arises because knowledge about health effects from mold exposure (and appropriate protection) is incomplete, and misinformation and controversy in public media lead to confusion. The UCONN Health project- **Recovery from catastrophic weather: mold exposure and health-related training** sought to understand why some workers and the public do not utilize existing information about how to protect personal health during response and recovery activities. Is protective equipment accessible? Do people have access and/or comfort with procedures such as medical evaluation and fit testing? Are there language and/or cultural impediments to comprehending the guidance in training materials? Or does conflicting information that ranges from alarmist, non-scientific warnings to well-vetted, but not readily translatable by the non-scientific reader, technical communications build confusion around mold exposure and health making it difficult for individuals to decide how to respond to a hurricane event? With forecasts for severe wet weather expected to increase in the Northeastern and Midwestern US, increasing numbers of individuals would benefit from clearer risk communication with guidance on respiratory protection.

The project team gathered and assessed information from focus group research and multiple outreach encounters. With this work informing a risk communication strategy, the team developed a training program and specific risk messages designed to promote improved practice in the field. The materials are designed to increase the utilization of protective equipment and improve resilient recovery practices among workers and the public faced with responding to severe wet weather and rebuilding after flooding. Three examples of how themes elucidated in the focus group research are translated into flyers are presented here. Seven informational flyers, materials developed for the *Hurricanes and mold: The health concerns; reducing personal risk; and rebuilding with resiliency* workshop, and the detailed flow diagram *After the Storm- Mold and Moisture Cleanup-A Guide to your Safety* are available for download from the project website -<http://hurricane-weather-health.doem.uconn.edu/>.

Research to practice

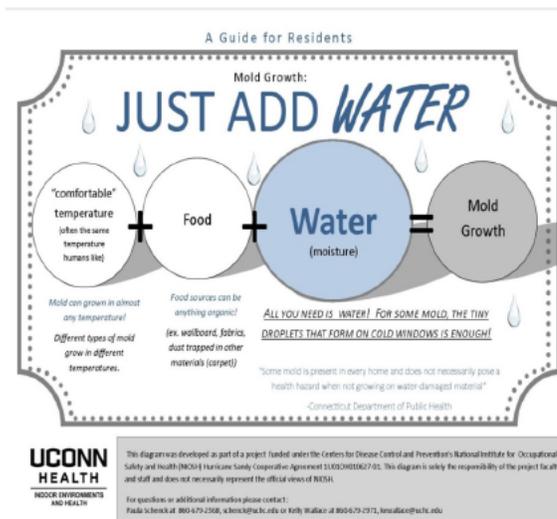
A guide for residents

Themes addressed:

- 1) Concern over the burden on those most vulnerable, and
- 2) Information quality –much is available, but target groups' access and ability to evaluate is variable.

Objective:

Bring attention to the importance of moisture and establish why mold is a concern after flooding



A guide for workers

Themes addressed:

- 1) Concern over the burden on those most vulnerable,
- 2) Information quality –much is available, but target groups' access and ability to evaluate is variable, and
- 3) Uncertainty about illness severity, meteorological predictions; distrust over contractor practices, insurance, and government help.

Objective: Introduce three key elements to consider as workers prepare before the storm to reduce exposure

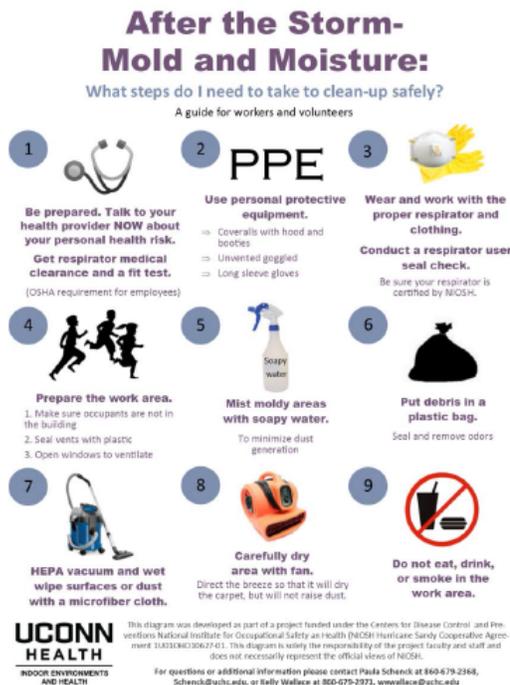


A guide for workers and volunteers

Themes addressed:

- 1) Information quality –much is available, but target groups' access and ability to evaluate is variable, and
- 2) Uncertainty about illness severity, meteorological predictions; distrust over contractor practices, insurance, and government help.

Objective: Provide guidance on work practice to reduce personal exposure when cleaning-up after a storm



6. Public Health Relevance and Impact

Recovery from catastrophic weather brings threats and opportunities to public health. Mold exposure and related respiratory illness are unintended consequences to unprepared response and recovery personnel and residents. With greater knowledge about mold's relationship to health and with better skills in addressing flood-damaged properties, the well-prepared public health workforce will have increased capacity to protect worker and volunteer populations against illness and to rebuild environments for healthier, more resilient communities able to withstand the next hurricane. Knowledgeable residents, especially those more vulnerable because of health, age or economic status would have better awareness of how to protect themselves and would be less likely to use inappropriate methods and/or accept unsuitable remediation assistance.

This work identified factors that manifest as barriers to workers and home occupants protecting themselves from exposure to mold and the bioaerosols associated with biological growth in indoor environments after flooding. The findings support incorporating clear risk messages into education that is accessible to different groups and delivered through multiple means. The project produced and posted collaterals to convey risk messages on the project website. The materials include flyers crafted to enable the user to better understand the risk to health from mold exposure in flooded buildings and then select appropriate actions to reduce this exposure. The step by step flow diagram shown at the end of this section instructs workers to first determine their own suitability for mold clean-up work and then to choose PPE and clean-up work practices appropriate for the situation. A workshop curriculum addresses many of the identified impediments and was used successfully in 4 workshops. The project team evaluated information available on the web, wrote specific text, and organized guidance on health and safety practices, and rebuilding with resiliency to provide an informational resource for workers, volunteers and the public. In particular a page is directed at health providers to help them evaluate their patients' suitability to clean-up mold and to wear PPE. An update to the UCONN on line clinicians' course initiated with this project will provide a CME-eligible opportunity for physicians to learn about respiratory illness risks associated with mold clean-up. Considering that the number of severe wet weather events with building flooding is expected to increase, health providers who recognize the risk and know where to access resources on personal protection are in a strong position to guide their patients to prevent respiratory illnesses fostered by exposures in the flooded environment. Any or all of these materials are available on the project website to be incorporated into specific public health intervention initiatives for communities faced with flooding after severe wet weather.

While utilizing the UCONN materials may clarify explanations why mold exposure is a hazard and reduce individuals uncertainty about the need for protective actions, other public health initiatives that act to reduce overall anxiety among those experiencing the aftermath of a storm with flooding are needed. Other investigators (Neria and Shultz 2012) have identified the threat of mental illness in facing the aftermath of Hurricane Sandy especially for high risk, vulnerable groups, and called for supportive measures to reduce anxiety. Considering that individuals' intention to protect their health has been shown to be affected by attitudes towards government programs (van der Weerd et al. 2011), public health interventions that build confidence in government are important. While overall safety and guidance on preparation for storm events are critical elements to public health outreach in these communities, local public health agencies could consider how they might help families who are recovering from storms with the less obvious need, but clearly articulated in this work, help with burdensome administrative requirements for cost reimbursement. This would act to reduce some anxiety especially if it accelerated payments, and would be supportive of other actions and education that encourages people to possibly change behavior to use PPE and proper clean-up and rebuilding methods. Adding incentives for local housing bureaus and public health agencies to work together in communities to establish agreed building criteria for rebuilding after flood damage that adheres to resilient criteria including attention to approaches that reduce future mold growth, would also be helpful. The criteria could also be given to building owners in areas subject to flooding and to the contractor industry that serves them.

Mold and moisture clean-up after the storm A Guide for Your Safety

<http://hurricane-weather-health.doem.uconn.edu/1268-2/>

This chart guides individuals to select the proper level of protection. The person's health status, the amount of mold present, potential dust generation, and work practice will determine the need for respiratory protection.

**After the Storm- Mold and Moisture Cleanup
A Guide for Your Safety**

Step 1
Is it safe for me to engage in cleanup?

| Assess your health risk * U.S. HEALTH CARE | | |
|--|--|--|
| None Known | Some Risk | High Risk |
| Okay to work all sizes of cleanup and dust generation | Okay to work small and medium size mold contamination with minimal dust generation | STOP Do not engage in cleanup Do not occupy structure during cleanup |
| Health Risk Color ● | Health Risk Color ● | Health Risk Color ● |

Once you assess your health risk color, follow the color through down the page to determine safe work practices for you

Step 2
What types of environments can I safely work in?

| Assess size of mold contamination * U.S. HEALTH CARE | | |
|---|---|---|
| ● or ● Small Less than 10 square feet About the size of a dining table for 6 | ● or ● Medium 10-100 square feet About the size of one side of a panel truck | ● Large Greater than 100 square feet Child's bedroom or small office floor |

| Assess dust generation | | | |
|--|--|--|--|
| ● or ● None Ex. observing from outside damaged area No Controls | ● or ● Minimal Ex. Inspecting, wet wiping, recovering moldy personal items Level 1 work practices | ● Moderate Ex. Sweeping, removing moldy building materials Level 2 work practices | ● Severe Ex. Demolishing building materials; using power tools Level 3 work practices |

Step 3
What safe work practices should I use?

| | Use appropriate work practices | | |
|-------------------------------------|--|---|---|
| | Level 1 | Level 2 | Level 3 |
| Work Area Preparation | Remove occupants from work areas AND adjacent areas | Remove sensitive occupants | Seal vent ducts/ grills with plastic sheeting |
| Personal Protective Equipment (PPE) | N, R or P-95 Respirator (minimum) | Long Sleeve Rubber Gloves Unvented Goggles Disposable Coveralls with hood and booties | Full-face elastomeric air purifying or powered air-purifying respirator (PAPR) with P100 cartridges with hood and booties |
| Work Practices | Respirator medical clearance and fit test (OSHA requirement for employees) Respirator user seal check Mist area with soapy water Minimize dust generation Put debris in plastic bag Seal bag and remove outdoors | HEPA vacuum dust Wet wipe surfaces or wipe with microfiber cloth Dry area with fan Do not eat, drink or smoke in work area | Exhaust air from work area to outside through HEPA filter. Construct windlock and decontamination chamber. |
| PPE Handling | Order of Removal 1st: coveralls, 2nd: gloves, 3rd: goggles, 4th: respirator Location of Removal At the worksite, preferably outdoors Reuse and Disposal Disposable coveralls and disposable respirators are to be discarded after use Goggles and gloves may be washed with mild detergent and warm water, dried and reused Full-face elastomeric and PAPR respirator cartridges can be reused Elastomeric and PAPR face pieces are to be washed in mild detergent and warm water, dried and reused When not in use, respirators are to be placed in a sealed plastic bag | | |
| Personal Hygiene | Wash entire body thoroughly (including hair, scalp and nails) | | |

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INDOOR ENVIRONMENTS AND HEALTH

7. Publications, Presentations, and Media Coverage.

Presentations:

- Schenck, P.; Bureau, P.; Burcher, J.; Croteau, M.; Preventing respiratory disease associated with severe weather response; 2014 New England College of Occupational and Environmental Medicine Conference- Innovations and Challenges in Occupational and Environmental Health December 4, 2014.
- Schenck, P.; Bureau, P.; Croteau, M. Mullin, C.; Wallace, K.; Hurricanes and mold: The health concerns, reducing personal risk; and rebuilding with resiliency; poster presentation CDC/NIOSH Hurricane Sandy Grantee Meeting Atlanta, Georgia; March 25-27, 2015.
- Schenck, P.; Climate Change, Severe Weather and Health Hurricanes and Mold: the health concerns, reducing personal risk; and re-building with resiliency; CDC/NIOSH Hurricane Sandy Grantee Meeting Atlanta, Georgia; March 25, 2015.
- Schenck, P.; Preventing Mold Exposure in the Flood Environment; National Association of County and City Health Officials/NACCHO Preparedness Summit Learning Session Tools and Methods from Hurricane Sandy Recovery Research Atlanta, Georgia April 16, 2015.
- Schenck, P.; Indoor exposures to mold/moisture and human health; UCONN Health Division of Occupational and Environmental Medicine Colloquium Series; May 6, 2015.
- Schenck, P.; Fitts, M. 2015 National COSH Health and Safety Conference; Round table Building Capacity in Disasters: Flooding and Mold: Workers' health and reducing the risk Maritime Institute Baltimore, MD June 2, 2015.
- Schenck, P.; Burcher, J.; Bureau, P.; Croteau, M.; Mullin, C.; Wallace, K.; Hurricanes and mold: The health concerns, reducing personal risk; and rebuilding with resiliency; poster presentation and panel; Office of the Assistant Secretary for Preparedness and Response (ASPR) - United States Department of Health and Human Services, Hurricane Sandy Conference: Translating Research into Practice; New York City August 10-11, 2015.
- Mullin, C.; Climate Change: Resilience and Adaptation in Connecticut; Connecticut Institute for Resilience and Climate Adaptation; UCONN Storrs, CT November 5, 2015.
- Schenck, P.; Mullin, C. 2014; Indoor air quality and health: Addressing mold after wet weather and floods. ConnectiCOSH Annual Convention November 13, 2015.
- Schenck, P.; Mold: Why has it become more of a concern? What does exposure mean to health? What is the role of environmental change in patient management?; New England College of Occupational and Environmental Medicine/NECOEM and Massachusetts Association of Occupational Health Nurses/MaAOHN 2015 Annual Conference –Tips, Tools & Pearls for the Occupational and Environmental Health Professional December 4, 2015.

Media:

- ASPR “The Importance of Mold Mitigation for Hurricane Sandy Recovery” Hurricane Sandy Recovery Science Newsletter Volume 1, Issue 6 March 6, 2015

8. Citations

8.1 References

American College of Preventive Medicine INDOOR MOLD From Recognition to Remediation
http://c.ymcdn.com/sites/www.acpm.org/resource/resmgr/iaq-files/timetool_indoormold.pdf

American Academy of Allergy, Asthma and Immunology Mold Allergy <http://www.aaaai.org/conditions-and-treatments/allergies/mold-allergy.aspx>

ASHRAE. Indoor Air Quality Guide: Best Practices for Design, Construction and Commissioning 2009.
<https://www.ashrae.org/resources--publications/bookstore/indoor-air-quality-guide>

ATLAS.ti, <http://www.atlasti.com/index.html> (accessed June 24, 2013)

Bennett JW. Silver linings: a personal memoir about Hurricane Katrina and fungal volatiles. *Front Microbiol.* 2015 Mar 18. <http://dx.doi.org/10.3389/fmicb.2015.00206>

Brandt M et al. Mold prevention strategies and possible health effects in the aftermath of hurricanes and major floods. *MMWR Recomm Rep*, 2006. 55(RR-8): p. 1-27.

Bush, RK et al. The medical effects of mold exposure. *J Allergy Clin Immunol*, 2006. 117(2): p. 326-33.

Campbell DL, Coffey CC, Lenhart SW. Respiratory Protection as a Function of Respirator Fitting Characteristics and Fit-Test Accuracy. *Journal of the American Industrial Hygiene Association.* 2001. 62:1, 36-44, DOI:10.1080/15298660108984607

Coffey CC, Lawrence RB, Campbell DL, Zhuang Z, Calvert CA, Jensen PA. Fitting Characteristics of Eighteen N95 Filtering-Facepiece Respirators. *Journal of Occupational and Environmental Hygiene*, 2004.1:4, 262-271, DOI: 10.1080/15459620490433799

Craner J. A critique of the ACOEM statement on mold: undisclosed conflicts of interest in the creation of an "evidence-based" statement. *Int J Occup Environ Health*, 2008. 14(4): p. 283-98.

Hardin BD, Kelman BJ, Saxon A. Adverse human health effects associated with molds in the indoor environment. *J Occup Environ Med.* 2003 May;45(5):470-8

Heseltine E, Rosen J (eds.). WHO guidelines for indoor air quality: Dampness and mould 2009. World Health Organization: Copenhagen.
http://www.euro.who.int/__data/assets/pdf_file/0017/43325/E92645.pdf?ua=1

Inamdar AA, Bennett JW. Volatile organic compounds from fungi isolated after Hurricane Katrina induce developmental defects and apoptosis in a *Drosophila melanogaster* model. *Environ Toxicol.* 2015 May;30(5):614-20. doi: 10.1002/tox.21933. Epub 2013 Dec 5
<http://onlinelibrary.wiley.com/doi/10.1002/tox.21933/epdf>

IOM. Climate Change, the Indoor Environment, and Health. 2011 Institute of Medicine of the National Academies: Washington, DC. 320 pages.

IOM. Damp Indoor Spaces and Health. 2004 Institute of Medicine of the National Academies: Washington, DC. 356 pages.

Karl TR, Melillo JM, and Peterson TC (eds.). Global Climate Change Impacts in the United States, Cambridge University Press 2009. <http://www.globalchange.gov/browse/reports/global-climate-change-impacts-united-states>

Karvala K, Toskala E, Luukkonen R, Uitti J, Lappalainen S, Nordman H. Prolonged exposure to damp and moldy workplaces and new-onset asthma. *Int Arch Occup Environ Health*. 2011 Oct;84(7):713-21. doi: 10.1007/s00420-011-0677-9. Epub 2011 Jul 19.

Mazur LJ, Kim J. Spectrum of noninfectious health effects from molds. *Pediatrics*, 2006. 118(6): p. e1909-26.

Mendell MJ et al. Respiratory and allergic health effects of dampness, mold, and dampness-related agents: a review of the epidemiologic evidence. *Environ Health Perspect*, 2011. 119(6): p. 748-56.

Neria Y, Shultz JM. Mental health effects of Hurricane Sandy: characteristics, potential aftermath, and response. *JAMA*. 2012 Dec 26;308(24):2571-2.

Nevalainen A, Seuri M. Of microbes and men. *Indoor Air*. 2005;15 Suppl 9:58-64.

Nevalainen A, Täubel M, and Hyvärinen A. "Indoor Fungi: Companions and Contaminants." *Indoor Air* 2015. 25.2: 125-56.

Park JH. et al. Hydrophilic fungi and ergosterol associated with respiratory illness in a water-damaged building. *Environ Health Perspect*, 2008. 116(1): p. 45-50.

Prezant B, Weekes D, Miller JD (eds.). *Recognition, Evaluation, and Control of Indoor Mold*. 2008.

Rando RJ, Lefante JJ, Freyder LM, Jones RN. Respiratory health effects associated with restoration work in post-Hurricane Katrina New Orleans. *Environ Public Health*. 2012;2012:462478. doi: 10.1155/2012/462478. Epub 2012 Dec 9.

Sahakian NM et al., Identification of mold and dampness-associated respiratory morbidity in 2 schools: comparison of questionnaire survey responses to national data. *J Sch Health*, 2008. 78(1): p. 32-7.

US Department of Health and Human Services. *A Guide to Managing Stress in Crisis Response Professions*. DHHS Pub. No. SMA 4113. Rockville, MD: Center for Mental Health Services, Substance Abuse and Mental Health Services Administration. 2005. <https://store.samhsa.gov/shin/content/SMA05-4113/SMA05-4113.pdf>

Van der Weerd W, Timmermans DR, Beaujean DJ, Oudhoff J, van Steenbergen JE. Monitoring the level of government trust, risk perception and intention of the general public to adopt protective measures during the influenza A (H1N1) pandemic in the Netherlands. *BMC Public Health*. 2011;11:575. doi:10.1186/1471-2458-11-575.

8.2 List of reviewed resources that met criteria

| Health and Safety Links | |
|--|---|
| Title | Website |
| Residents and Volunteers | |
| Mold Basics | http://www.epa.gov/mold/moldbasics.html |
| Mold Cleanup Guidelines | http://www.epa.gov/mold/cleanupguidelines.html |
| What to Wear When Cleaning Moldy Areas | http://www.epa.gov/mold/whattowear.html |
| Brief Guide to Mold, Moisture, and Your Home: Moisture and Mold Prevention and Control Tips | http://www.epa.gov/mold/preventionandcontrol.html |
| Booklet: Flood Cleanup and the Air in Your Home | http://www.epa.gov/iaq/flood/flood_booklet_en.pdf |
| Center for Disease Control and Prevention (CDC): Mold | http://www.cdc.gov/mold/stachy.htm |
| Mold After a Disaster | http://emergency.cdc.gov/disasters/mold/ |
| Clean Up Your Home | http://emergency.cdc.gov/disasters/hurricanes/cleanup-home.asp |
| Flood Cleanup and the Air in Your Home | http://www.epa.gov/sandy/pdf/floodcleanupandairinyourhome.pdf |
| Five steps to prevent mold growth after a catastrophic flood | http://www.iicrc.org/wp-content/uploads/2013/07/Steps-to-Preventing-Mold-Growth-after-a-Flood.pdf |
| Respiratory Concerns and Mold Cleanup After Hurricane Sandy | http://www.health.ny.gov/environmental/emergency/weather/hurricane/docs/respiratory_health_flyer.pdf |
| Creating A Healthy Home: A Field Guide for Clean-Up of Flooded Homes | http://www.nchh.org/Portals/0/Contents/FloodCleanupGuide_screen_.pdf |
| Act Quickly to Beat Mold After a Flood | http://www.webmd.com/news/20121030/beat-mold-after-flood |
| Workers | |
| U.S. Dept. of Housing and Consolidated Safety Services: 57 Page manual on rebuilding healthy homes, safe rehabilitation or hurricane-damaged homes student guide | http://www.hud.gov/offices/lead/library/misc/HUD_CSS_Booklet.pdf |
| EMERGENCY RESPONSE RESOURCES: Storm, Flood, and Hurricane Response (HVAC) | http://www.cdc.gov/niosh/topics/emres/Cleaning-Flood-HVAC.html |
| Building Assessment, Restoration, and Demolition for Mold Remediation from their Hazard Exposure and Risk Assessment Matrix for Hurricane Response and Recovery Work | https://www.osha.gov/SLTC/etools/hurricane/mold.html |
| Fungi Hazards and Flood Cleanup | https://www.osha.gov/OshDoc/data_Hurricane_Facts/Bulletin3.pdf |
| Mold Hazards during Hurricane Sandy Cleanup | https://www.osha.gov/Publications/OSHA-FS-3619.pdf |
| Cleaning Flooded Buildings Hurricane Sandy Recovery Fact Sheet | http://www.fema.gov/media-library-data/1381405548275-ec9f9b9de186f1874b92ecda6c33182b/SandyFactsheet1CleaningFloodedBldgs_508_FINAL2.pdf |
| Medical Providers | |
| Mold Prevention Strategies and Possible Health Effects in the Aftermath of | http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5508a1.htm |
| World Health Organization Guidelines for Indoor Air Quality – Dampness | http://www.euro.who.int/document/E92645.pdf |
| DAMP AND MOULD – Health risks, prevention and remedial actions | http://www.euro.who.int/_data/assets/pdf_file/0003/78636/Damp_Mould_Brochure.pdf |
| Mold and Moisture-Related Illness Recognition and Management – A Key for the Clinician’s Office | http://doem.uchc.edu/consultation_outreach/indoor_environments/pdfs/mold_key.pdf |
| Guidance for Clinicians on the Recognition and Management of Health Effects Related to Mold Exposure and Moisture Indoors | http://doem.uchc.edu/consultation_outreach/indoor_environments/pdfs/mold_guide.pdf |
| Allergy, Mold and Moisture in the Indoor Environment | http://mediasite.uchc.edu/Mediasite41/Play/b1ea1e4bc3f646ec814e75f2fd44a8a4 |

| Rebuilding with Resiliency Links | |
|--|---|
| Title | Website |
| Natural Hazards Mitigation | http://www.wbdg.org/design/resist_hazards.php |
| Flooding: How to Prepare, Respond, Recover | https://www.disastersafety.org/flood/prepare-respond-recover/ |
| Home Improvements to Consider Before a Flood | https://www.disastersafety.org/flood/home-improvements-consider-flood/ |
| Choosing the Right Materials: Flood | https://www.disastersafety.org/flood/choosing-the-right-materials/ |
| Flood Resistance of the Building Envelope | http://www.wbdg.org/resources/env_flood.php?r=resist_hazards#funda |
| Flood and Hurricane Resistant Buildings | http://www.buildingscience.com/documents/digests/bsd-111-flood-and-hurricane-resistant-buildings |
| Building a Durable and Energy Efficient Home in Post-Katrina New Orleans | http://www.buildingscience.com/documents/bareports/ba-0704-building-a-durable-and-energy-efficient-home-in-post-katrina-new-orleans/view |
| Moving Back Home to New Orleans | http://www.buildingscience.com/documents/dtw-related-articles/cs-hem-moving-back-home-to-new-orleans-project-home-again/view |
| Designing for Flood Levels Above the BFE After Hurricane Sandy | http://www.fema.gov/media-library-data/1381405016896-8bdeadf634c366439c35568a588feb24/SandyRA5DesignAboveBFE_508_FINAL2.pdf |
| Crawlspace Construction: for Buildings Located in Special Flood Hazard Areas National Flood Insurance Program Interim Guidance | http://www.fema.gov/media-library-data/20130726-1511-20490-0716/tb_11_rev.pdf |
| HIGHLIGHTS OF ASCE 24-05 Flood Resistant Design and Construction | http://www.fema.gov/media-library-data/20130726-1643-20490-4974/asce24_highlights_dec2010.pdf |
| Homeowner's Guide to Retrotting: Six Ways to Protect Your House From Flooding | http://www.fema.gov/media-library-data/20130726-1510-20490-1464/fema_l235_brochure_web.pdf |
| House Raising | http://www.nachi.org/house-raising.htm |

9. Inclusion of Gender and Minority Study Subjects.

| PART A. TOTAL ENROLLMENT REPORT: Number of Subjects Enrolled to Date (Cumulative) by Ethnicity and Race | | | | |
|--|----------------|--------------|---------------------------|--------------|
| Ethnic Category | Females | Males | Sex/Gender Unknown | Total |
| Hispanic or Latino | 0 | 0 | | ** |
| Not Hispanic or Latino | | | | |
| Unknown (individuals not reporting ethnicity) | 26 | 19 | | 45 |
| Ethnic Category: Total of All Subjects* | 26 | 19 | | 45 * |
| Racial Categories | | | | |
| American Indian/Alaska Native | 0 | 0 | | |
| Asian | 1 | 0 | | 1 |
| Native Hawaiian or Other Pacific Islander | 0 | 0 | | |
| Black or African American | 6 | 4 | | 10 |
| White | 19 | 15 | | 34 |
| More Than One Race | 0 | 0 | | |
| Unknown or Not Reported | | | | |
| Racial Categories: Total of All Subjects* | 26 | 19 | | 45 * |
| PART B. HISPANIC ENROLLMENT REPORT: Number of Hispanics or Latinos Enrolled to Date (Cumulative) | | | | |
| Racial Categories | Females | Males | Sex/Gender Unknown | Total |
| American Indian or Alaska Native | 0 | 0 | | |
| Asian | 0 | 0 | | |
| Native Hawaiian or Other Pacific Islander | 0 | 0 | | |
| Black or African American | 0 | 0 | | |
| White | 0 | 0 | | |
| More Than One Race | 0 | 0 | | |
| Unknown or Not Reported | | | | |
| Racial Categories: Total of Hispanics or | | | | ** |

10. Materials Available for Other Investigators.

A comprehensive project website, *Hurricanes: What you need to know about mold/moisture/bioaerosols and human health* <http://hurricane-weather-health.doem.uconn.edu> provides access to materials developed in this project. Materials that may be useful for other investigators include:

- Recruitment and information sheets used in organizing focus groups, <http://hurricane-weather-health.doem.uconn.edu/focus-groups/>
- Seven risk messaging flyers individually designed for workers, volunteers and residents, <http://hurricane-weather-health.doem.uconn.edu/health-and-safety/>
- *After the Storm- Mold and Moisture Cleanup A Guide to your Safety*, <http://hurricane-weather-health.doem.uconn.edu/1268-2/>, a detailed flow chart guiding individuals to select appropriate PPE and to work practices that reduce exposure to mold and associated bioaerosols
- Presentation materials and small group exercises used in workshops, *Hurricanes and mold: The health concerns; reducing personal risk; and rebuilding with resiliency* <http://hurricane-weather-health.doem.uconn.edu/1197-2/>
 - Hurricane Sandy and mold
 - Small group discussion: Priorities
 - It is all about health: Mold and health basics
 - Reducing risk: Protecting your and others' health when you work in moldy places
 - Providing a future: Moving toward resilient building construction-
 - Small group discussion: PPE: Donning respirators and doing self-check
 - Mold and moisture cleanup guide
 - Hurricane Play and wrap- up

UConn HEALTH

February 23, 2016

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RE: Award # 1U01OH010627-01 (PI: Paula Schenck)

Dear Ms. Cassell and Captain Inserra,

Enclosed is our final report, for Award # 1U01OH010627-01 entitled "Recovery from catastrophic weather: mold exposure and health-related training".

Thank you for your support of this project. We very much appreciate the opportunity to have worked with you to complete this project.

Sincerely,



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