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Technical Data Bulletin

OH&ESD

#184 Above the Shoulders PPE for Flood Recovery and Clean-up

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Background

The devastation and human toll brought on by natural flooding can be enormous. Individuals participating in flood-related activities face a range of work-related hazards, such as hazardous materials, biological agents, eye/head/face hazards, noise, and heat stress. From the start of the recovery period as waters recede, through the clean-up and eventual rebuilding, the need for personal protective equipment (PPE) is essential.

The requirement for PPE applies not only to the professional worker, but also the businesses and homeowners attempting to protect and salvage their property, and the numerous volunteers who are willing participants. As these individuals represent such a diverse group, their knowledge and experience in the use of PPE may vary significantly. At a minimum, a basic understanding of the use and limitations of each type of PPE is necessary. For professional workers falling under the scope of the Occupational Safety and Health Administration (OSHA), specific regulatory requirements apply when using PPE. For others, following basic best practice guidelines will help reduce exposures to flood-related hazards. If questions arise concerning the proper use of PPE, refer to the product user instructions or contact the manufacturer directly.

The following is a discussion of above the shoulders PPE including respiratory, hearing and head/eye/face protection during flood recovery and cleanup efforts. Clearly, there may be a need in many situations for other full body protection in the form of protective footwear, clothing, gloves, etc. Refer to the following websites for a comprehensive discussion on this topic.
http://emergency.cdc.gov/disasters/floods/
http://www.cdc.gov/niosh/topics/flood/
http://www.osha.gov/OshDoc/flood-tornado-recovery.html

Respiratory Protection

Workers involved in flood recovery and clean-up face both obvious and hidden respiratory hazards. Many of these hazards do not become apparent until the waters have receded.

Mold[1]

The flood aftermath can create optimal conditions for mold growth. On August 29 and September 24, 2005, hurricanes Katrina and Rita, respectively, made landfall along the Gulf Coast resulting in massive flooding in New Orleans and surrounding parishes. The duration and extent of flooding in these areas made the likelihood of massive mold contamination a certainty. Many structures remained flooded for weeks after the hurricane. An assessment of homes in New Orleans and surrounding parishes of St. Bernard, East Jefferson, and West Jefferson (excluding the 9th Ward) identified an estimated 46% (>100,000 homes) with some mold contamination, and approximately 17% (40,000 homes) with heavy mold contamination. Similar massive flooding, although not on the same scale as New Orleans, has recently occurred in 1997 in Grand Forks, North Dakota and in 1999 in North Carolina after Hurricane Floyd.

Although molds can be found almost anywhere indoors or outdoors, they need moisture and nutrients to grow. Mold grows best in damp, warm environments. The availability of nutrients in indoor environments rarely limits mold growth as building materials including wood, wallboard, wallpaper, and

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upholstery can be nutrient sources. The main factor that limits mold indoors is lack of moisture. Flooding, particularly when floodwaters remain for days or weeks, provides an almost optimal opportunity for mold growth.

Subsequent to water damage, mold may begin to grow on a variety of building materials and surfaces, both in open and hidden locations. Hidden mold may occur in places such as the back-side of drywall, wallpaper or paneling, top side of ceiling tiles, and the underside of carpets and pads. Other areas of hidden mold may include areas inside walls around pipes, surface of walls behind furniture, inside ductwork, and in roof materials above ceiling tiles. Mold growth can occur in a relatively short time. Building contents constructed of absorbent materials (paper, cloth, wood, etc.) that have been wet for more than 48 hours are a likely location for mold growth. Disposal is typically the only remediation option for these materials. Smooth, hard surfaces such as metal and plastics can often be cleaned effectively.

Molds reproduce by means of tiny spores. The spores are invisible to the naked eye and become easily airborne. They're considered an inhalation hazard in that they release spores that are small enough to remain airborne. The typical size range for a mold spore is 2 microns (µm) – 10 µm aerodynamic diameter. Disturbing the mold in any manner can result in higher air concentrations. Aerosolization can occur in many ways, including disturbance of mold contaminated areas by human activity and dispersal of spores in contaminated surfaces of HVAC systems. Molds can also release low levels of volatile organic compounds (VOCs) that are thought to be the source of mold/mildew odors.

The Centers for Disease Control and Prevention (CDC) reports people with asthma, allergies, or other breathing conditions may be more sensitive to mold. Those with immune suppression (people with HIV infection, cancer patients taking chemotherapy, and people who have received an organ transplant) are more susceptible to mold infections[2].

Dusts Containing Asbestos, Lead and Crystalline Silica

Cleanup and demolition in older buildings, both residential and commercial, can present exposure concerns to asbestos, lead and silica. All structures built prior to 1975 may contain significant amounts of asbestos. Asbestos containing materials were commonly used in boiler/pipe insulation, fireproofing, floor and ceiling tiles, roofing and siding materials. Many homes built prior to 1978 may contain lead-based paint. Prior to discovering the harmful health effects of lead, it was used in paint, gasoline, water pipes and many other products. Crystalline silica may be present naturally and in pulverized concrete. Any clean-up activity that involves disturbing debris can create airborne dusts, which may contain these and other harmful substances.

Bioaerosols

Floodwater often contains infectious organisms, including intestinal bacteria such as E. coli, Salmonella, and Shigella; Hepatitis A Virus; and agents of typhoid, paratyphoid and tetanus[3]. Pools of standing or stagnant water become breeding grounds for mosquitoes, which increase the risk of encephalitis, West Nile Virus or other mosquito-borne diseases. Although most cases of illness associated with flood conditions are brought about by ingesting contaminated food or water, exposures may also occur via skin contact and, to a lesser extent, inhalation. As a respiratory hazard, infectious agents may become airborne during certain clean-up activities such as pumping/aeration of floodwater.

Considerations for Respirator Selection

The general approach to respirator selection requires knowledge of the specific contaminant, the air concentration and the occupational exposure limit such as the OSHA permissible exposure limit (PEL) or the threshold limit value (TLV) published by the American Conference of Governmental Industrial Hygienists (ACGIH). In the case of mold, lack of recognized exposure limits

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requires use of other criteria in the selection process. The US Environmental Protection Agency (USEPA) and the New York City Department of Health have published recommendations for selecting respirators for mold remediation activities based upon the size of the contaminated area[4, 5]. The USEPA offers the following general guidelines for respirator selection:

- For areas less than 10 square feet, an N95 filtering facepiece respirator approved under 42 CFR Part 84 may be used in combination with non-vented goggles.
- For areas between 10 and 100 square feet, an N95 filtering facepiece respirator, or either a half mask with non-vented goggles or full facepiece respirator with 100 level particulate filters (e.g., P100) should be used.
- For areas greater than 100 square feet, a full facepiece respirator with 100 level particulate filters should be used.

Professional judgment that considers toxicity of the mold (if known), possibility of hidden mold, potential for aerosolization, and needs of the individual wearer should also be used when selecting respiratory protection.

For low-level microbial VOCs that may be produced by mold, a carbon-loaded particulate filter offering nuisance level organic vapor relief, or an organic vapor cartridge used with a particulate filter may also be used. Gases and vapors associated with disinfectants (chlorine, chlorine dioxide, ammonia, etc.) should be measured, and may also warrant the use of an appropriate chemical cartridge with a particulate filter.

The CDC has prepared a chart containing population-specific recommendations for PPE, including respiratory protection, for protection against mold in flooded buildings. Refer to http://www.bt.cdc.gov/disasters/mold/report/pdf/2005_moldtable5.pdf

Respirator selection for other potential air contaminants must also be considered. In many cases, respirators used for mold exposures may also be used for other anticipated air contaminants as well. Employers must select respirators based on OSHA requirements under 29 CFR 1910.134 Respiratory Protection Standard with consideration to the respirator manufacturer's product user instructions. Consistent with current respirator selection practices, the following additional guidelines are offered when selecting respiratory protection for flood recovery and clean-up applications:

- A 42 CFR Part 84 approved N-Series particle filter (e.g., N95, N100) may be used where no oil aerosols are present.
- An R-Series or P-Series particle filter may be used for both oil and non-oil aerosols. When used for oil aerosols, refer to the manufacturer product packaging for time use limitations.
- Dusts containing asbestos require a minimum of a half mask elastomeric respirator with a 100 level particulate filter. OSHA prohibits use of filtering facepiece respirators (disposables) for asbestos. Refer to 29 CFR 1926.1101 Asbestos Construction Standard for specific OSHA mandated respirator selection requirements.
- Dusts containing lead require a minimum of a 100 level filtering facepiece respirator or half facepiece respirator with 100 level particulate filters. Refer to 29 CFR 1926.62 Lead in Construction Standard for specific OSHA mandated respirator selection requirements.
- A filtering facepiece respirator or half facepiece respirator

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with appropriate cartridges/filters may be used up to 10X the PEL.

A comprehensive exposure assessment conducted by a qualified health and safety professional is recommended prior to completing work tasks in flood-affected areas. For homeowners, use of a properly qualified contractor to handle and remove common clean-up hazards including mold, asbestos and lead, is often recommended in order to minimize exposures and potential adverse health effects.

Considerations for Respirator Training

Employers providing respiratory protection must comply with all requirements of OSHA's Respiratory Protection standard, 1910.134, including, but not limited to, medical evaluations, training and fit testing, prior to using respirators. The medical evaluation, which is used to determine if the person is physically able to wear a respirator, must be completed prior to the fit test. Fit testing provisions require that all workers wearing a tight-fitting, half or full facepiece respirator must pass a quantitative or qualitative fit test. Both respirator fit testing and employee training must be completed on a minimum annual basis.

Homeowners and volunteers, who don't necessarily have access to respirator training and fit testing programs, should, at a minimum, be made aware of basic information on the use and limitations of respirators. The following guidelines are offered for non-occupational users of respiratory protection during flood clean-up:

- Homeowners should check with the local health department for recommendations on selecting the proper respirator.
- Volunteers should check with the organization/agency to determine if they have a respirator program for their volunteers. If not providing respirators, ask if they can recommend an appropriate respirator for the anticipated work. *All users should read and follow the manufacturer's user instructions for the specific respirator to be used***.** Contact the respirator manufacturer if assistance is needed selecting a respirator.
- Wearing a respirator adds physical stress in the form of additional weight and increased breathing resistance. If you have any doubts concerning your ability to wear a respirator, contact your physician. Discuss the type of work you will be doing, the respirator you intend to use and the anticipated contaminants.
- Follow the respirator manufacturer's instructions for proper respirator donning and doffing procedures. A user seal check is required each time the respirator is worn. Also check instructions to determine if there are any time use limitations for the respirator.
- If wearing a reusable respirator, follow the respirator manufacturer recommendations for cleaning. Daily cleaning is typically recommended.

Other conditions including work rate, physical condition, and ambient temperature and humidity, should also be considered by the non-occupational user when making the personal decision to wear a respirator.

Hearing Protection

Between September and December, 2005, OSHA collected a variety of exposure data, including noise levels, on response and recovery workers in Gulf Coast regions impacted by hurricanes Katrina, Rita, and Wilma[6]. Twenty percent of the 324 employees evaluated had noise exposure levels above the 90 dBA 8-hour permissible exposure limit (PEL). Over 40 percent of the monitored employees were exposed to noise levels at or above 85

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decibels (dBA) 8-hour time weighted average (TWA). Hazardous levels of noise were most common among workers involved in debris collection, debris reduction, site clearing and transportation restoration activities. Some of the highest exposures (above 90 dBA) were associated with workers operating heavy equipment, chippers, chain saws and industrial vacuums.

In the United States, employers are required by OSHA to limit the 8-hour TWA noise exposure to 90 dBA or less. Employees exposed above 85 dBA 8-hour TWA must be enrolled in an employer-sponsored hearing conservation program, which includes annual audiometric testing and training.

Considerations for Selection of Hearing Protectors

There are a number of considerations when selecting an appropriate hearing protection device (HPD). Hearing protection is usually necessary when operating heavy machinery and power tools. Both ear plugs and ear muffs are available. Hearing protector ratings, such as the Noise Reduction Rating (NRR), were developed to help inform the buyer concerning the capability of the HPD to reduce noise exposures when worn correctly. The NRR of HPDs offered on the market today varies widely, from as little as 10 decibels (dB) to as much as 33 dB.

The NRR is the theoretical reduction (in decibels) that the HPD will provide when worn correctly. In the real world, noise reduction offered by the HPD is usually about one-third to one-half of the laboratory-derived value that the NRR is based upon. Although NRR values may vary between manufacturers for the same type of HPD, there may be little difference in noise reduction under actual use conditions. Several methods for evaluating whether or not a hearing protector provides enough noise reduction are described in 29 CFR 1910.95, Appendix B.

OSHA has estimated that approximately 90% of workers in the United States have average daily noise exposures of 95 dB or less[7]. This suggests that 9 out of 10 workers need only about 10 dB of protection to bring their noise exposures to 85 dB or less. Virtually any model or brand of hearing protector, if worn properly, is capable of providing 10 dB of protection, *regardless of NRR*. Consideration of other factors, such as overall comfort, is probably as important when selecting a HPD. At the end of the day, the hearing protector that is worn more of the time during the noise exposure is the one that provides the most protection.

Head, Eye and Face Protection

NIOSH has identified potential eye, head and face hazards during emergency response and disaster recovery to include impact and airborne dusts from concrete and metal particles; falling or shifting clean-up debris, building materials and glass; smoke and irritating vapors and gases; welding light and electric arc; thermal hazards and fires and; bloodborne pathogens from blood or other body fluids[8]. Common injuries include corneal abrasions and conjunctivitis, concrete or metal particles embedded in the eye, chemical splash or burn, welder's flashburn, lacerations, facial contusion and black eye, and infectious agent exposure.

Head Protection

Head protection is necessary in any situation where:

- There is a risk from being struck by falling objects.
- A person may strike their head against a fixed or protruding object.
- Accidental head contact with an electrical hazard exists.
- If required to do so by an employer or other authority in control of the job site.

Selection of an appropriate safety helmet is dependent on the task performed. Look for a safety helmet that meets necessary impact and electrical insulation requirements of the American National Standards Institute (ANSI) Z89.1-2003. This standard describes the minimum physical and performance requirements for protective helmets. These requirements are classified by impact type and electrical class.

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A Type I helmet provides protection from top impact. These are the most common helmets in the industry. A Type II helmet provides protection from the top and lateral impact. These helmets are used where there is higher risk from objects swinging and hitting the worker on the side of the head. Electrical insulation requirements include Class C (Conductive), Class G (General) and Class E (Electrical). Class G and Class E helmets are proof-tested at 2200 volts and 20,000 volts (phase to ground), respectively. These voltages are not intended as an indication of the voltage at which the helmet protects the wearer.

The safety helmet consists of two main components, the outer shell and the suspension. The outer shell is a rigid material generally made from high density polyethylene, which offers a barrier against impact. The suspension is an integral part of the safety helmet. It is designed to stretch and absorb the shock of the blow. In combination, the safety helmet lessens the impact of the blow by stretching the duration of the blow over time while absorbing the severity of the impact.

Eye and Face Protection

Prevent Blindness America (www.preventblindness.org) reports that more than 700,000 workers suffer eye injuries at work each year in the United States, yet 90% of them could have been prevented by using proper protective eyewear. There are many criteria important in selecting the correct protective eyewear. These include:

- ANSI Z87.1-2003 approval
- Size and fit of eyewear
- Lens tint and color
- Scratch resistance and/or anti-fog coatings for harsh environments
- Splash and dust hazard protection
- Protection from irritant vapors and gases
- Compatibility with other PPE
- Need for secondary protection, such as a faceshield or welding shield
- Presence of electromagnetic radiation including ultraviolet (UV) and infrared (IR)
- Vision correction needs

ANSI Z87.1-2003 describes performance requirements for eye and face protection devices. The standard includes requirements for spectacles (safety glasses), goggles, face shields, welding helmets and respirators. Performance of products includes impact resistance level, classified as either “basic impact” or “high impact”. Safety glasses, goggles, faces shields and welding shields may be designated either basic impact or high impact. Respirators that also provide eye protection, such as tight-fitting full facepieces, loose fitting facepieces and helmets, must meet the high impact criteria. When a face shield or welding shield can be raised from the normal use position, the device must be used in combination with safety glasses or goggle in order to meet Z87.1-2003 requirements.

Under ANSI Z87.1-2003, manufacturers are required to provide specific markings. For safety glasses and goggles these include:

- The manufacturer’s mark or symbol
- “Z87” on the lens or frame indicating compliance with the standard and basic impact requirements
- “Z87+” or “+” for devices meeting high impact criteria
- Shade number for filter lenses
- “S” for special purpose lenses (tinted lenses)
- “V” for devices with photochromic lenses

Safety glasses with non-removable lenses require only one marking. The marking may be placed on the front or one of the temples and include the manufacturer’s mark or symbol, “Z87” indicating compliance with the standard, a shade number, if applicable, and “+” if the safety glasses meet high impact requirements. Goggles with non-removable lenses must bear the appropriate marking on the frame or lens.

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For additional assistance concerning the selection and use of PPE for flood recovery and clean-up, call 3M Technical Service at (800) 243-4630.

References

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