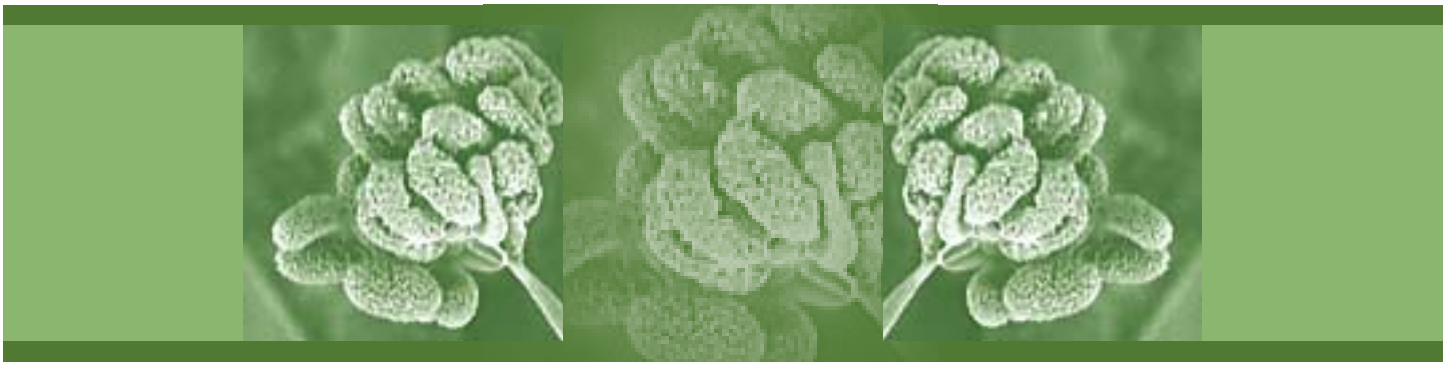
Interim Final Guidelines for the Protection and Training of Workers Engaged in Maintenance and Remediation Work Associated with Mold

Report of a National Technical Workshop

Held in New York, NY
January 27-28, 2004



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PREFACE

This report is the product of a *Mold Worker Protection Training Workshop* held January 27-28, 2004 in New York City. The purpose of the workshop was to develop experience-based guidelines for the health and safety training of mold hazard assessors, mold remediation workers, and workers who are exposed to mold in the course of maintaining building systems. The need for these training guidelines has grown out of an increase in the population of mold-exposed workers and the absence of federal regulations or generally accepted professional guidance on work practices and procedures, personal protective equipment, or training protocols to protect these workers from mold exposures.

The National Institute of Environmental Health Science (NIEHS) managed the *Workshop* in co-sponsorship with the Society for Occupational and Environmental Health (SOEH), the Association of Occupational and Environmental Clinics (AOEC), the Urban Public Health Program of Hunter College of the City University of New York, the New York City Department of Health and Mental Hygiene, and the School of Public Health of the University of Medicine and Dentistry of New Jersey. Sixty professionals representing various governmental agencies, industrial hygiene and remediation firms, labor and training organizations, academia, and building owners/managers participated in this workshop.

The two-day workshop characterized work practices and associated (potential) mold exposures among the affected worker groups and identified worker protection training topics and training techniques appropriate for these exposure scenarios. The outcome of these deliberations, presented here as minimum training criteria, is intended to be used as the initial training guidance by governmental agencies, trade organizations, labor unions, and professional associations in the future development of mold worker protection training programs. This product will serve as a training curriculum guideline to be revised and improved in the future as our understanding of mold issues continues to grow and mature.

Throughout the workshop uncertainties arose regarding health effects from mold exposure and the nature and magnitude of mold exposures which, as a consequence, impacted the related matters of personal protection equipment (PPE) selection, work practice controls, and, therefore, training. While the areas of uncertainty require additional research, it was recognized that certain adverse health outcomes are attributable to mold exposure and the draft guidelines emerging from the workshop were based upon the acknowledged necessity of assuring the protection of workers engaged in mold work. Future research on mold health effects and exposures may serve as a basis for modifying the content of this draft training curriculum.

Workshop deliberations benefited from the outcomes of an earlier companion meeting on *Clinical Aspects of Mold Exposure* held December 10-11, 2003 at the Johns Hopkins University Bloomberg School of Public Health. This workshop was comprised of an expert panel whose findings relative to the evaluation, diagnosis, treatment and management of mold-related health problems were presented during the opening plenary session of the *Mold Worker Protection Training Workshop.*

Guidance generated by both the *Mold Worker Protection Training Workshop* and the *Clinical Aspects of Mold Exposure Meeting* will be presented in a larger national meeting. *Mold-Related Health Effects: Clinical, Remediation Worker Protection, and*

Biomedical Research Issues, will be held June 28-29, 2004 at the Washington Court Hotel in Washington, D.C., with wide participation encouraged among diverse interested parties and policy makers. This cross-disciplinary national meeting will bring together experts in clinical science, basic research, and worker protection and education to advance efforts to prevent, diagnose, and treat conditions related to exposure to indoor mold. Co-sponsors of this meeting include SOEH, AOEC, the Johns Hopkins University Bloomberg School of Public Health, the Urban Public Health Program of Hunter College, the University of Medicine and Dentistry New Jersey School of Public Health, and NIEHS.

ACKNOWLEDGMENTS

The National Institute of Environmental Health Sciences' Worker Education and Training Program (NIEHS WETP) acknowledges the Society for Occupational and Environmental Health (SOEH) and the Association of Occupational and Environmental Clinics (AOEC) for their foresight and assistance in developing this workshop. NIEHS WETP gratefully acknowledges Hunter College of the City University of New York for providing workshop meeting locations and logistical support, and the University of Medicine and Dentistry of New Jersey School of Public Health for financial support. The technical expertise contributed by the New York City Department of Health and Mental Hygiene is also appreciated.

The following Workshop Steering Committee members were significantly involved in planning and executing the workshop:

- Vincent M. Coluccio, DrPH, Vincent M. Coluccio & Associates, Inc.
- Albert DeVita, Laborers, AGC Education and Training Fund
- Denny Dobbin, Society for Occupational and Environmental Health
- Susan Klitzman, DrPH, Hunter College Urban Public Health Program
- Bruce Lippy, PhD, National Clearinghouse for Worker Safety and Health Training
- Clifford Mitchell, M.D., Johns Hopkins Bloomberg School of Public Health
- John Moran, National Clearinghouse for Worker Safety and Health Training
- Ted Outwater, National Institute of Environmental Health Sciences
- Glenn Paulson, Ph.D., UMDNJ School of Public Health

Additionally, the following breakout session co-chairs are gratefully acknowledged:

Co-Chairs	**Breakout Session**
▪ Richard E. Dwyer and Steven Silicato, CIE	Work Practices, Exposures, Work Practice Exposure Categories
▪ Christopher D'Andrea, MS and Donald Weekes, CIH	Worker Protection by Work Practice Exposure Categories
▪ David Jacobs, CIH and Denise Bland Bowles	Training Topics and Techniques: Maintenance Workers
▪ John Tiffany and Albert DeVita	Training Topics and Techniques: Remediation Workers

NIEHS WETP also acknowledges the accomplishments of Larry Cooper in his role as Chair of the Mold Remediation Standard Committee of the Institute of Inspection, Cleaning and Restoration, and appreciates his active involvement in the workshop and the copies of the *S520 Standard and Reference Guide for Professional Mold Remediation* he shared with workshop participants. NIEHS WETP also wishes to thank Al DeVita and the Laborers-AGC for providing their mold remediation worker training curricula, which was a core model in shaping this document. Finally, NIEHS WETP greatly appreciates the work of Dr. Vincent Coluccio for coordinating the workshop and revising the original draft document.

EXECUTIVE SUMMARY

A rise in concern for the potential health effects and property damage claims associated with the presence of mold in buildings has led to an increase in the number of mold remediation workers. These workers, along with maintenance workers who are at times tasked with cleaning surfaces of mold contamination, conduct their activities in mold contaminated environments in the absence of federal regulations or generally accepted professional guidance on work practices and procedures, personal protective equipment, or training protocols to protect them from mold exposures. Although at least one participant felt that the mold remediation industry appears to be regulating itself efficiently without the need for government intervention or voluntary guidelines, most participants agreed that training guidelines would prove beneficial.

Under coordination of NIEHS, this workshop brought together 60 experts on the health effects and management of mold exposures to characterize work practices and associated (potential) mold exposures among the affected worker groups, and worker protection training topics and training techniques appropriate for these exposure scenarios. The product of this effort is a set of minimum training criteria that may be utilized as foundation data by governmental and industry organizations in the development of effective and efficient mold worker protection training programs. This product, which has now undergone two revisions, will serve as a "final interim" training curriculum guideline to be revised and improved in the future as our understanding of mold issues continues to grow and mature.

The workshop format consisted of an opening plenary session, two expert panel sessions to review the state of the science on mold exposures and worker protection strategies during mold remediation and maintenance work, and four breakout sessions wherein detailed safety and health training topics and techniques were developed for both maintenance and mold remediation workers.

The opening plenary session explored the medical consequences of mold exposures and provided consensus on the following: Certain adverse health outcomes are attributable to mold and therefore it is reasonable and prudent to protect people who are working with visible mold. Based on existing data, it is not feasible to set an airborne exposure limit as is done with other airborne contaminants; personal protection should be based on specific tasks that increase mold exposure, not on measured exposure levels. In addition, there is no medical rationale to exclude workers from performing mold remediation work based on their previous medical history or screening tests.

Discussions during the expert panel sessions supported the above medical position and the following principles: Fungal damage in buildings needs to be removed and the underlying cause fixed; fungal damage needs to be removed under safe conditions, the complexity of which depends on the extent of the damage and the circumstances; a thorough cleaning of fine particles is needed, and; worker protection cannot be managed by measurement of exposure to mold.

An initial focus of the breakout sessions was the manner in which current mold remediation guidelines (including worker protection provisions) generally classify mold work as either "maintenance" or "remediation," based on the scale of the mold work involved. Maintenance is a shorthand definition of low-level exposure and remediation is high-level exposure. Remediation work is assumed to be large-scale, extensive work usually employed by a specialized contractor.

A full exploration of this issue led to a general agreement that maintenance workers are facility staff personnel and, as such, represent a different training target audience than do a typical remediation contractor's employees. Furthermore, task, duration, and project size (area of mold contamination to be remediated) should define maintenance and remediation. A counterpoint argues that we cannot define by project size because we haven't defined the particular health risk; however; the current unknowns in both exposure levels and associated health effects constrain us to defining hazard potential by the project size, work practice and duration variables.

The framework for developing maintenance worker training guidelines was straight forward: At the end of a training session workers should know how to identify the characteristics of mold, the requirements for mold growth, how to protect themselves from mold and associated remediation hazards, when to bring this to the attention of a supervisor, and how to clean it up. The duration of maintenance worker training should be flexible and appropriate to the degree of training required. Participants recommended that maintenance training should be a maximum of two hours if it involves personal protective equipment (PPE), but should otherwise be shorter (between 30 minutes and 2 hours), if PPE is covered in other training.

In-depth discussions on the nature of maintenance-level mold remediation tasks, required knowledge and skills, and appropriate levels of personal protection, led to development of detailed criteria for training topics and training techniques for maintenance workers.

The general consensus was that mold remediation training should be three days (21 hours) in duration [see Table 3 below for breakdown of the course by topic and time intervals], and that to prevent trainees from becoming bored and distracted, the didactic (classroom) sessions should be relatively brief and workshop exercises and demonstrations should be emphasized. Workshop participants repeatedly stressed that the mold remediation worker training guidelines must include a clear differentiation between the remediation techniques for mold and those for asbestos and lead-based paint.

Mold remediation of heating, ventilation, and air conditioning (HVAC) systems was determined to be beyond the scope of a general mold remediation course, and workers who engage in that work should take a separate NADCA or equivalent course for HVAC work. However, there was consensus that general knowledge of HVAC operation, such as how a plenum works and how it can impact mold remediation work, was important for mold remediators to understand.

Participants recognized some overlap in work practices and personal protections employed on asbestos/lead remediation sites and on mold sites, and that it would be reasonable to exempt mold trainees from training on these topics if they recently completed asbestos/lead training and can demonstrate proficiency. However, time limitations did not permit participants to address either this issue or the issue of mold remediation refresher training.

Subsequent to deliberations on the requisite primary knowledge and skills objectives of mold remediation worker training, a detailed syllabus including training topics, instructional methods, and time sequences for mold remediation worker training was developed.

1.0 INTRODUCTION

1.1 Background

"Mold" is ubiquitous in nature and in human structures. Molds and yeasts comprise one of the five major types of microbes and are believed to number over 1.5 million species, only 100,000 of which have been described. Molds, fungi, and bacteria have always been a concern associated with flooding of structures occupied by humans and there has been growing concern about adverse health consequences associated with exposures to mold in residential structures, largely in relation to allergy and asthma. Some molds can also cause invasive disease in immune-compromised individuals.

Publicity associated with potential mold-related health consequences, an increase in workplace health problems attributed to mold exposures, and increased litigation over the consequences of mold exposure, have greatly expanded attention to mold in our workplaces, public buildings, schools, and homes. In turn, this attention has led to a growing number of individuals engaging in the assessment, management, and remediation of mold contamination and, as a result, experiencing frequent exposures to mold spores. As there are no regulations or generally accepted guidelines for the protection of these individuals from potentially harmful exposures to mold, concern for protecting the health of these workers has continued to grow.

This Report is the product of the *Mold Worker Protection Training Workshop,* held January 27-28, 2004 in New York City, to address these concerns. Another category of workers receiving the *Workshop's* attention were those likely to experience elevated mold exposures in the course of building maintenance tasks.

1.2 Purpose of the Workshop

The purpose of the *Workshop* was to develop experience-based guidelines for the protection and training of mold hazard assessors, mold remediation workers, and workers exposed to mold in the course of maintaining building systems.

The outcome of these deliberations, presented herein as minimum training criteria, is intended to be utilized as foundation data by governmental and industry organizations in the development of effective and efficient mold worker protection training programs. This product will serve as a training curriculum guideline to be revised and improved in the future as our understanding of mold issues continues to grow and mature.

These deliberations were expressly not intended as a precursor to or lobbying for governmental regulations on mold remediation. The working assumption was that the dose-response and health effects data essential for any regulatory effort will not be available for the foreseeable future and these voluntary guidelines can help stakeholders protect workers in the absence of any governmental policy or regulation.

1.3 Workshop Format

The two-day workshop focused on characterizing work practices and associated (potential) mold exposures among the affected worker groups, then identifying worker protection training topics and training techniques appropriate for these exposure scenarios.

The National Technical Workshop approach developed and refined since 1991 by the National Institute of Environmental Health Sciences' Worker Education and Training Program (NIEHS -WETP) provided the underlying framework for this workshop.

Two weeks prior to the *Workshop*, participants were provided a draft document outlining these issues and providing a starting point for dialogue and deliberations during the *Workshop*. The draft included: 1) background discussion on mold assessment, remediation and building maintenance work; 2) a preliminary analysis of step-by-step tasks that may be expected among the affected worker groups; 3) a job-hazard analysis of those tasks including potential mold and other work hazards and appropriate administrative and engineering controls, recommended personal protection equipment, and recommended work practices; 4) a summary of what topics a worker should know based on the job hazard analysis; and 5) with regard to better health and safety training, information that a worker needs to know, educational methods that may be appropriate and an estimate of the time needed to effectively convey the information for each topical category.

The *Workshop* included an opening plenary session with detailed presentations from differing perspectives. *Workshop* participants were then assigned to a topical breakout working session (to ensure diversity of representation in each breakout session). These breakout sessions solicited open discussion in an effort to reach consensus on major points. Plenary sessions were held, within time constraints, to allow feedback and participant discussion of the results of each of the breakout sessions. Individuals were invited to participate in the *Workshop* based upon their professional experience.

A copy of the *Workshop* agenda is provided in Appendix B.

Detailed note taking of participant comments allowed a Draft Workshop Report to be prepared and submitted to all participants for review following the *Workshop*. This Final Workshop Report was prepared after review and consideration of comments received from participants.

The workshop process does not attribute comments, opinions, or recommendations offered by any participant during breakout sessions, unless permission has been granted to do so, to facilitate truly open discussions. Consequently, these workshops do not follow the typical conference structure.

1.4 Clinical Meeting

As a companion effort to this workshop, the Association for Occupational and Environmental Clinics (AOEC) and the Society for Occupational and Environmental Health (SOEH) co-sponsored a two-day *Clinical Aspects of Mold Exposure* meeting, hosted by the Johns Hopkins Bloomberg School of Public Health December 10-11, 2003. The following physicians participated in this meeting:

- Clifford S. Mitchell, MS, MD, MPH (Chair), Johns Hopkins Bloomberg School of Public Health
- Eileen Storey, MD, MPH (Co-Chair), University of Connecticut
- James Cone, MD, MPH, New York City Department of Health and Mental Hygiene
- Eckhardt Johanning, MD, MSc, Eastern New York Occupational & Environmental Health Center
- Kay Kreiss, MD, National Institute for Occupational Safety and Health
- Dorr G. Dearborn, MD, PhD, Case Western Reserve University
- Michael Hodgson, MD, MPH, Department of Veterans Affairs

The purpose of the meeting was to begin the process of developing clinical recommendations for evaluating, diagnosing, treating, and managing mold-related health problems. This meeting also addressed a series of mold-specific worker safety and health questions. The answers to those questions were presented by Dr. Mitchell during the *Worker Protection and Training Workshop* opening plenary session and are summarized in the next section of this report.

2.0 WORKSHOP INTRODUCTORY SESSIONS

2.1 Introduction to the Workshop

Dr. Susan Klitzman, Associate Professor and Director of the Urban Public Health Program, Hunter College, City University of New York, opened the workshop proceedings and, together with Dr. Bruce Lippy, Director of the National Clearinghouse for Worker Safety and Training, set the stage for the *Workshop* proceedings. The *Workshop* structure is patterned after other National Technical Workshops, which have a history of success. Examples include: The NIEHS "minimum criteria" for training hazardous waste workers, adopted by OSHA as Appendix E to HAZWOPER training; SOEH guidance used by OSHA for the Interim Final Lead in Construction standard; and NIEHS guidance adopted by U.S. Department of Energy on safety of new environmental technologies.

John Moran of the National Clearinghouse developed the Workshop draft document with a focus on training. Following review by the workshop steering committee, the draft was sent to all *Workshop* participants as "a starting point for a dialogue and deliberations among the workshop participants." The *Workshop* final report is based on participant discussions and feedback on the document.

The following were established as key issues for *Workshop* deliberations:

- Mold related health effects;
- Appropriate work practices and work practice exposures for both maintenance and remediation workers;
- Appropriate worker protection for these practices;
- Importance of considering maintenance and remediation workers separately;
- Importance of considering HVAC work separately; and
- Validity of the assumption that all mold exposures for these workers can present a serious potential health threat.

The requisite *Workshop* focus was development of appropriate health and safety training guidelines for maintenance workers and remediation workers. Questions were posed to participants on whether different training approaches for these two worker categories were warranted, and whether consideration should be given to health and safety topics trainees may have covered in prior asbestos, lead paint or other hazardous materials training courses.

The *Workshop* agenda was explained and participants were advised that no attribution of comments made during the Workshop would be reported without prior consent of the commenter.

A "charge" was issued for participants to focus their discussion on topics raised in the draft document and relevant to worker mold protection training.

2.2 Plenary Session - Mold Health Effects

An opening plenary session on mold health effects was presented by Dr. Clifford S. Mitchell, Associate Public Health Professor and Director of the Occupational Medicine Residency Program at the Johns Hopkins Bloomberg School of Public Health. Dr. Mitchell presented the outcome of a two-day *Clinical Aspects of Mold Exposure* meeting, hosted by the Bloomberg School of Public Health at Johns Hopkins on December 10-11, 2003 and described in detail in Section 1.4 of this report.

During the *Clinical Aspects* meeting, specific questions were posed to the clinical experts on the current state of medical science regarding health effects from exposures to mold. Presented below are summary notes of the ensuing discussion, as they parallel Dr. Mitchell's plenary presentation to the W*orker Protection Training Workshop*. As a disclaimer, the following questions and answers represent a summary of the *Clinical Aspects* meeting discussion and is not intended as a policy statement or consensus document on the part of any of the participants or organizations involved.

The following consensus points were reached at the clinician workshop:

1. Workers should be protected when working with visible mold.
2. Based on existing data, it is not feasible to set an airborne exposure limit as is done with other airborne contaminants. Personal protection should be based on specific tasks, not on exposure levels.
3. Workers should not be excluded from performing mold remediation work based on their previous medical history or screening tests.

Questions & Answers from the *Clinical Aspects of Mold Exposure* Meeting

Are there any specific mold species that have adverse health consequences?

The general feeling of the physicians was that it is not possible to definitively say at this point. To the reversed question of whether any are documented *not* to cause health effects, the answer is no. The group decided that the question of whether there are any red flag species is the wrong question. The focus should be on the conditions that create the problem, generally moisture and water infiltration. Workers should be protected regardless of the species if there is visible mold. The question may need to be qualified in terms of degree of exposure, as in the New York City Department of Health & Mental Hygiene (NYC DOHMH) guidelines.

The participants asked themselves if there should be a different standard for buildings with health complaints compared with those where there are no complaints. The physicians were doubtful that it would be possible to implement two sets of standards in practice. They questioned whether there was sufficient evidence of risk to workers. The discussion also touched on the difficulty of focusing solely on mold without considering bacteria or other biological aerosols. For instance, to prevent hypersensitivity pneumonitis (HP) you need to provide respirators with high efficiency particulate air (HEPA) cartridges, given the much smaller size of bacteria and bacterial components compared to molds or mold spores. Supporting this conclusion, recent work at the University of Cincinnati found that many fine particles are associated with aerosolization of fungal spores and hyphae. It was also noted that the "affected populations" discussion

needs to be expanded. Some trades are not getting enough attention for potential exposure; for instance, one physician reported examining a person who installed sprinklers and was diagnosed with HP.

Is there any information that suggests what exposure level or mold disturbance activities may result in an adverse outcome?

NIOSH Health Hazard Evaluation (2003) data show adverse health effects for workers who do remodeling in buildings. During remediation, the spore count has been documented to increase a thousand fold. Most clinicians participating in the *Clinical Aspects* meeting have seen remediation workers having adverse health effects.

There was agreement that there is no way to set airborne concentrations for protection, as OSHA did with the lead standard. The physicians felt that respiratory protection should be based on specific tasks and **not** on sampling. The participants further asked themselves if they could recommend personal protective equipment, other than respirators, for potential para-occupational exposures (i.e., workers not performing abatement or maintenance, but who have regular, albeit limited, exposure). Should they recommend a change of clothes, for instance? There was no consensus on specific protection. They agreed that this adds greater importance to the role of training. This group was also interested in what standard operating procedures covering personal protective equipment are being used among private sector firms that perform mold abatement.

Can we identify susceptible individuals?

No, but we could suspect that individuals with asthma or allergies are at higher risk. The potential susceptibility of atopic individuals (i.e., individuals with a history of generalized allergy to many common allergens) was discussed, but the physicians couldn't reach consensus about whether such individuals were at increased risk of developing specific allergies to building-related molds and fungi. People with pre-existing respiratory allergic disorders such as asthma, or previously documented medical problems in similar work, may be at increased risk and should be provided consultation with appropriate medical personnel as a part of a comprehensive respiratory protection program. The physicians felt the level of understanding was insufficient to purposely exclude any individuals on the basis of medical history or screening test. This includes blood tests for mold antibodies and skin prick tests used to assess sensitivity to common molds. One reviewer felt the physicians should reconsider whether immunocompromised individuals should be treated differently, either giving them a high level of respiratory protection or not permitting them to conduct certain activities that create the greatest amount of airborne particles, e.g., demolition of moldy drywall, etc

If a worker presents for treatment potentially due to exposure to molds, should that worker be removed from further exposures on the job, if he or she is a remediation worker?

There was consensus that there is not sufficient information to recommend to workers that they stop exposures by not working. Clinical judgment on a case-by-case basis was recommended instead.

Will workers who present for treatment have a greater likelihood of developing a sensitivity to mold?

The group of physicians felt they were unable to speculate in an informed manner.

Are there any significant exposure effects data available?

The physicians agreed there were no strong data on dose response.

Is duration of exposure or magnitude of exposure more important with respect to adverse outcomes?

The feeling was that with allergies, duration increases risk whereas for sensitization, peak exposure may be more important. However, much more research is needed on this subject.

Additional Points

Participants raised these additional points during the *Workshop* Plenary Session:

- Development of health-based standards requires understanding of the relationship between exposure and health effects; we do not have this understanding with respect to mold.
- Atopy, an allergic reaction in a sensitized person, is not static.
- Unlike lead, mold is not a specific substance and many people are not affected by mold.
- We will not come up with a single standard for mold.
- We should look at mold worker protection on a case-by-case basis

2.3 Plenary Session – Guidelines, Exposures, and Work Practices

An overview of Guidelines for the Protection of Mold Workers was presented by Christopher D'Andrea, Environmental Scientist for the New York City Department of Health and Mental Hygiene (NYC DOHMH), Office of Environmental and Occupational Disease Epidemiology. Mr. D'Andrea is editor of NYC's current *Guidelines on Mold Assessment and Remediation*.

Mr. D'Andrea described development of the NYC DOHMH Mold Guidelines, which has served as the basis for subsequent mold guidelines developed by many other jurisdictions and organizations. The following are points from the NYC Guidelines, which specify different provisions for maintenance workers and remediation workers based on the higher mold exposure potential of the latter group.

- For maintenance workers, training focuses on cleaning and PPE (gloves, half-face respirators), and health effects.
- For remediation workers, training focuses on hazardous materials handling and PPE (gloves, full face respirators both air purifying and powered air purifying, and disposable coveralls).

- Mr. D'Andrea pointed out that maintenance workers are likely to work on correcting sources of building moisture, while remediation workers remove mold that generally results from lack of maintenance.

- The NYC Mold Guidelines recommend stepped up worker and worksite protection based on the size of the job in terms of square feet of mold contaminated surface area. Mr. D'Andrea explained that the mold removal methods that are employed were based on the size categories, with small areas posing minimal hazard potential that can safely be addressed by maintenance workers and larger areas requiring remediation (abatement) methods.

- There are no adequate techniques for assessing personal exposures to mold and their health impacts. The use of respiratory protection is based primarily on (1) the extent of mold contamination and (2) the level of worksite containment.

Mr. D'Andrea also presented an overview of the development and major aspects of the following mold remediation guidelines. His slide presentation contains some additional notes on these guidelines and is available as an electronic file that can be downloaded from the following website: *http://www.niehs.nih.gov.*

- 1993 NYC DOH – "Guidelines on Stachybotrys" (discussed above)
- 1995 Health Canada – "Fungal Contamination in Public Buildings: Guide to Recognition and Management" - addresses training (Workplace Hazardous Materials Information System) and specifies PPE similar to that recommended by NYC DOHMH.
- 1996 National Air Duct Cleaners Association (NADCA) – "Microbial Contamination in HVAC" - evolved into the "Assessment, Cleaning, & Restoration Industry Standard ACR" in 2002.
- 1999 American Conference of Governmental Industrial Hygienists (ACGIH) – "Bioaerosols: Assessment and Control" - differentiates PPE recommendations based on small, medium, and large schemes, and respiratory protection ranges from N95 to full face (PAPR).
- 2000 NYC DOH – "Guidelines on Fungi" (discussed above)
- 2001 US EPA – "Guidelines on Fungi" - Respiratory protection also ranges from N95 to full face (PAPR).
- 2003 OSHA – Advisory on Mold in the Workplace (Not a Regulation) - Failure to implement is not a violation of General Duty Clause; closely follows provisions of EPA and NYC DOHMH Guidelines; excludes HVAC.
- 2003 IICRC S520 - Mold Remediation - This recent document is the most comprehensive and most focused on mold remediation work presently available. However, it does not substantively address training.

3.0 EXPERT PLENARY SESSION

3.1 Lessons Learned: Exposures During Maintenance and Remediation

Dr. Elliott Horner, Director of the Microbial Laboratory for Air Quality Sciences, Inc., served as Moderator for the expert plenary session "Lessons Learned: Exposures During Maintenance and Remediation." Panelists for this session included:

Dr. J. David Miller, Carleton University and Visiting Scientist, Health Canada

Mr. Michael O'Reilly, President of Tradewinds Environmental, Inc.

Dr. Douglas Trout, Medical Officer in the Centers for Disease Control and Prevention (CDC), National Institute for Occupational Safety and Health (NIOSH) Health Hazard Evaluation Program. (Invited, but unable to attend the *Workshop* due to severe winter weather conditions.)

Panel Presentations

Dr. Miller offered the following opinions:

- Fungal damage in buildings needs to be removed and the underlying cause fixed.
- Fungal damage needs to be removed under safe conditions, the complexity of which depends on the extent of the damage and the circumstances.
- A thorough cleaning of fine particles is needed.
- Worker protection cannot be managed by measurement of exposure to mold. While risks to mold exposure may be greater than exposure to inert particles, fungal spores should not be considered as hazardous as radioactive carcinogens.

Dr. Miller's slide presentation contains additional information and is available as an electronic file that can be downloaded from the following website: *http://www.niehs.nih.gov*.

Considerable discussion was devoted to the efficacy of N95 half-face respirators for protection against exposures to mold. Mr. O'Reilly pointed out that on mold remediation sites with high humidity and high levels of airborne dust, these respirators are prone to overload and clog and workers will remove them and thus be unprotected. However, other participants indicated that conditions faced by maintenance workers in the course of addressing mold problems during normal building maintenance activities are not likely to overburden the N95 respirator.

Although Dr. Trout was unable to attend the *Workshop*, he did submit a slide presentation, which was summarized during this plenary session. Dr. Trout's presentation provides an excellent overview of mold exposure and health effects. Selected portions of this presentation that are most pertinent to the

Workshop are summarized below and the full slide presentation is available on the following website: *http://www.niehs.nih.gov*.

In his presentation, Dr. Trout draws the following distinctions between Sick Building Syndrome (SBS) and Building-Related Illnesses (BRI):

- SBS refers to a group of common, nonspecific symptoms, such as headache, fatigue, irritability, difficulty concentrating, mucous membrane irritation, chest tightness, and skin irritation. These symptoms occur while in the building, but resolve shortly after leaving it. There typically are no objective findings.

- Potential causes of SBS symptoms have been extensively researched, but in most cases no identifiable cause in the workplace can be found. Distinct from these non-specific symptoms of unknown cause are "building-related illnesses."

- BRI include a variety of recognized disease entities characterized by objective clinical findings related to specific exposures in the indoor environment. Examples include: allergic rhinitis, asthma, hypersensitivity pneumonitis, Legionnaires' Disease, and humidifier fever. A number of microorganisms, including many species of bacteria and fungi, are well established as potential etiologic agents of building-related illnesses.

- The point of this information is to clarify that we must not attribute BRI symptoms to exposure to fungi. Those symptoms are not well understood and clearly relate to many different factors. It is evident BRI can be caused by fungi, but for the most part these are illnesses that can be diagnosed using objective medical tests.

The following are Dr. Trout's responses to some specific questions posed to the panel members in advance of the *Workshop*:

What lessons have you learned with respect to exposures during maintenance / remediation work?

Attempts at relevant quantitative exposure assessment have not been successful. The ability to determine who is "exposed" to fungi or mycotoxins from a particular exposure is limited.

What exposures are of most concern?

Respiratory.

Do we know enough to link specific work practices, exposures, potential adverse health effects, and training?

No, however bioaerosols (including fungi) can be associated with building-related illnesses. Illnesses should be evaluated using standard medical guidelines (objective testing). Allergy/hypersensitivity reactions are of most concern. The 'complexity' of adverse health effects is frequently overstated, for instance, there is no evidence supporting central nervous system effects.

With respect to toxic effects, it is not appropriate to equate rare reported effects of mycotoxins with symptoms/illnesses in the indoor environment. "Toxigenic fungi" is a term that should not be used in relation to indoor environment.

Mold (fungi) growth in the indoor environment should be prevented, and if present, remediated properly. "The fact that a mold is growing in a home {building} is not good evidence for exposure of any kind, and certainly not evidence of danger."[1] It is reasonable, however, to assume that the potential for exposure increases with the amount of mold present.

A review of the literature indicates inadequate evidence to support the conclusion that exposure to mycotoxins in the indoor (non-industrial) environment is causally related to symptoms or illness among building occupants. Research involving the identification and isolation of specific fungal toxins in the environment and in humans is needed before a more definitive link between health outcomes and mycotoxins can be made.

> To support hypotheses regarding potential adverse health consequences of mycotoxin exposure in the non-industrial environment, objective measures of adverse health effects must be associated with some measure of airborne mycotoxin exposure and comparisons must be made with appropriate control populations.
>
> Dr. Trout offer the following "take home" messages regarding health effects:

- Molds are a potential health hazard. They cause allergies and in some cases, and infections in other cases (usually among immunocompromised). There is evidence of clinical illness (in humans and animals) from ingestion of significant quantities of mycotoxin-contaminated foodstuffs. Illness associated with bioaerosol exposures in agricultural or industrial environments has also been reported.
- Relevance of these findings to the indoor (non-industrial) environment is unclear because either the route of exposure or the dose would be significantly different in the indoor environment.

3.2 Lessons Learned Plenary Session: Worker Protection During Maintenance and Remediation

Dr. Eugene Cole, Professor of Environmental Health at the Department of Health Science, Brigham Young University, Provo, Utah, and contributor and editor of the IICRC S520 Mold Remediation Standard, served as moderator of the Lessons Learned Plenary session on Worker Protection During Maintenance and Remediation. The panelists invited to participate in the session were:

> Dr. Terri A. Pearce, Ph.D., Senior Service Fellow in the Field Studies Branch of the Division of Respiratory Disease Studies at the National Institute for Occupational Safety and Health
>
> Mr. Steven M. Hays, Partner and Chairman of the Board of Gobbell Hays Partners, Inc. (invited)
>
> Mr. James Holland, RestCon Environmental, Sacramento, California (invited)

[1] Burge H.A.(2001). Fungi: toxic killers or unavoidable nuisances? Ann Allergy Asthma Immunology. 87(6 Suppl 3):52-56.

Mr. Hays and Mr. Holland were unable to attend the *Workshop* due to severe winter weather conditions; however, both provided slide presentations that were presented during the plenary session. Slide presentation of Dr. Cole and all panelists except for Dr. Pearce are available for downloading from the following website: *http://www.niehs.nih.gov.*

Panel Presentations

Major points presented during this plenary session included:

- When mold-contaminated materials are disturbed during the mold cleaning process, spore counts may be 10 to 10,000 times higher than background outdoor levels; these indoor species include molds that are considered by the EPA as "potentially toxigenic fungi" and their "presence indoors may indicate a concern for health of the occupants."

- Since a Permissible Exposure Limit (PEL) has not been established for airborne mold, it was suggested by Dr. Cole that a "subPEL" for mold be to establish a respirator selection process. The subPEL could be based on substituting the outdoor mold count level at which most individuals with sensitivities to mold spores will likely suffer symptoms, for the highest concentration to which a worker should be exposed during the remediation process. This substitution includes a "conservative" assumption that all the molds are categorized as "water requiring fungi" or "potentially toxigenic fungi," which would not be the case for outdoor mold spores.

- An in-depth description of the subPEL concept is provided in the Institute of Inspection, Cleaning and Restoration Certification (IICRC) 2003 publication, S520 Standard and Reference Guide for Professional Mold Remediation, Appendix B. Vancouver, WA.

- The subPEL concept was not well received by participants, nor by reviewers after the conference. Objections were raised to incorporating the acronym "PEL" into the process, as PEL implies establishment of health-based worker exposure limits and legally binding worker protection measures by employers. In addition, certain underlying assumptions on human health effects were contested. Comments received from several reviewers after the conference pointed out that there are no dose-response data for any fungal species, which makes setting a sub-PEL far too problematic. One pointed out that the concept had not been subjected to peer-review. There is also a real danger that the public will use the number as if a regulatory level had been set. Consequently, several reviewers said to reject the idea, at least until there are dose-response data.In the words of one reviewer, "Setting a number is dangerous at this point in the game." Another opined that, "The SubPEL is contrived, lacks a significant scientific foundation, and has absolutely no place in the workshop findinThe following are selected portions of Steven Hays' slide presentation:

- Mr. Hays cites the following successful mold "gross removal" strategies which are specified by Gobbell Hays Partners (GHP):
  - Protective strategies are not dependent on surface area of mold, in most cases, although this approach was challenged by a reviewer who wanted to know what other mold variable should be considered, if not surface area..
  - Half-face, "HEPA filtered" respirators (not disposable) with goggles and full-face, "HEPA-filtered" respirators are specified
  - Gloves, full body coveralls
  - Negative pressure containment (sometimes)
  - HEPA filtered unit(s) in work area (sometimes)
  - Wet methods (sometimes)
  - OSHA compliance
  - No options for less protection
  - Workers not required to make choices

- GHP believes these specifications to be adequate, however:
  - "This is overkill in some instances" e.g., removal of drywall by cutting where there is no mold versus cleaning drywall surfaces
  - Size and geometry of work area are important
  - Work practices are critical

- As proof that these specifications are adequate, Mr. Hays claims:
  - No complaints, no incidents, and no known adverse worker health effects

- Recommendations:
  - Workers should be trained in PPE, techniques (wet methods, disposal)
  - Projects should be assessed before work begins
  - Large and/or complex projects should be thoroughly specified (means and methods).
  - PAPRs should be considered for some situations
  - Disposable respirators may be adequate for some jobs/tasks
  - Surrounding environments are very important
  - A complete understanding of the building systems is crucial
  - Professional judgment is important
  - Using unnecessary PPE is detrimental

- Comments from a reviewer:
  - Mold removal and cleaning of stucco and EIFS structures is performed routinely in the Pacific Northwest outdoors and much of this work is performed without, or with minimal, respiratory protection (N-95) or PPE (disposable Tyvek suits) with no ill-effect reported.
  - Some degree of respiratory protection seems appropriate in that common sense dictates that the most significant route of exposure as inhalation. However, there is nothing in the literature to support the exclusive use of non-porous full-body coveralls during mold removal and clean-up as a means of protecting workers.

Worker Exposure Data

Dr. Philip Morey, Vice President of Air Quality Sciences, provided the following data from a 1995 study he co-authored that contains actual exposure data for remediation workers.[2] Air sampling was conducted by spore trap under quiescent conditions in a building that had suffered severe mold contamination after an earthquake. Samples were then collected during demolition and after the first cleaning.

Table 1. Airborne molds during initial inspection

Average Spore Concentration per m^3

Sample Description	Total	P-A*	Stachy*	Cla*
Outdoor air, N=5	17,600	2,200	ND	5,000
Floor One, N=15	5,500	100	ND	1,800
Floor Two, N=6	9,800,000	9,200,000	100,000	450,000

*P-A= *Penicillium-Aspergillus*; Stachy= *Stachybotrys*; Cla=*Cladosporium*

Table 2. Airborne molds during demolition

Average Spore Concentration per m^3

SampleDescription	Total	P-A	Stachy	Cla
Outdoor air, N=5	5,700	1,300	50	3,500
Floor One, N=15	2,200,000	2,080,000	28,500	5,000
Floor Two, N=6	32,000,000	30,500,000	180,000	700

Table 3. Airborne molds during first final cleaning

Average Spore Concentration per m^3

SampleDescription	Total	P-A	Stachy	Cla
Outdoor air, N=7	1,960	220	35	1,070
Indoors, both floors, N=17	39,000	35,300	750	1,700

[2] Morey, P. &Hunt, S. (1995). Mold contamination in an earthquake damaged building. Proceedings of Healthy Buildings 95. pp.1377-1380.

4.0 WORKSHOP BREAKOUT FOCUS SESSIONS

4.1 Session A - Work Practices, Exposures, Work Practice Exposure Categories

Mr. Steven R. Silicato, Vice President of MARCOR Remediation, Inc., and Richard Dwyer, Director of Health and Safety for the Carpenters Labor Technical College, New York District Council of Carpenters, served as co-chairs of this breakout session. The purpose of this breakout session was to develop consensus recommendations with respect to three sub-topics:

- Work Practice Categories
- Exposures
- Work Practices

1. Overview of Work Practice Categories

A review of current mold remediation guidelines (including worker protection provisions) reveals that mold work generally has been classified as either "maintenance" or "remediation," based on the scale of the mold work involved. Further, each of these categories includes HVAC system contamination work. Maintenance is defined as involving small areas of mold contamination (Levels I and II in the NYC Guide) and includes minor contamination cleanup in HVAC systems (Level V Small in the NYC Guide).

Maintenance workers are facility staff personnel and, as such, represent a different training target audience than do a typical remediation contractor's employees. Remediation work is assumed to be large-scale, extensive work usually employing a specialized contractor. It may include HVAC system remediation as well as contamination with clean water, grey water (wastewater from bathtubs, showers, bathroom sinks, washing machines, dishwashers and kitchen sinks: any source in a home other than toilets) and black water (untreated sewage).

The breakout session group was prompted to discuss this work distinction and agree with it, modify it, or develop a different approach. If it was modified or a different approach developed, it would be applied in the subsequent sub-topic discussions.

2. Overview of Exposure Issues

Discussion on mold exposures could usefully address what is known and what new information may have been presented in the opening plenary session panel presentations with respect to mold maintenance and remediation exposures, including HVAC decontamination work. This is particularly important in that it could influence work practices, worker protection, and training.

3. Overview of Work Practices

The primary emphasis was for the breakout group to agree on work practices for various mold work categories. Major points presented during this plenary session included:

- Need For Training
- Definition of Maintenance
- Building Trades and Utility Workers
- Approaches

4. Summary of Session Discussions

Need for Training

1. Medical consensus: certain adverse health outcomes are attributable to mold, therefore it is reasonable to presume that protecting people from mold exposure is "a good idea" (i.e., prudent policy).

2. It does not help clinicians to label maintenance vs. remediation work. It is the health risk associated with specific tasks that matters. However, definition by potential health effect and structural damage was not the purpose of this workshop. We need to clearly define maintenance workers and what exposure they get and then clearly define remediation workers and what exposures they get. Concern was expressed that in the absence of regulations specifying training requirements for different risk groups, even high risk groups will get the maintenance training.

Definition of Maintenance

1. Maintenance workers should be expected to come into contact with mold. When they do, they are likely to correct the source of moisture and clean small amounts of mold (relative to remediation workers). Ongoing preventive maintenance is very different from removing mold.

2. Maintenance is a shorthand definition of low-level exposure and remediation is high-level potential exposure. Task and duration should define maintenance and remediation. A counterpoint argues that we cannot define by project size because we haven't defined the particular health risk; however; the current unknowns in both exposure levels and associated health effects constrain us to defining hazard potential by the project size, work practice and duration variables.

3. There is a need to define work practices and training guidelines appropriate to the nature of mold work (as a surrogate for exposure potential) that maintenance workers undertake in the normal course of their operations, and to define more intensive practices and training guidelines for mold work conveying greater exposure risks.

Building Trades and Utility Workers

1. Building trades and utility workers are at risk of exposure to mold when they (1) contact mold-contaminated surfaces in the normal course of their work, and/or (2) are in the vicinity of – but are not participating in – uncontained mold remediation or demolition work, and/or (3) and when they are engaged as full-scale mold remediation workers, and/or (4) are engaged in hazardous waste site cleanup work involving exposures to mold.

2. There exists a gradation in mold exposure potential across work categories. On the low end, common building maintenance tasks involve intermittent, low-level mold exposures involving short duration and small surface area projects, and full time mold remediation workers would encounter the high-end exposure potential. In keeping with the premise that "protecting people from mold exposure is prudent policy," all of these worker groups require work practices and training guidelines commensurate with their exposure potential (as defined by the project size, work practice and duration variables).

Approaches

1. The minimal level of training for workers with foreseeable and incidental contact with mold (i.e., they are not actively involved in mold removal work) is mold hazard awareness training. It was suggested that this training be subsumed into OSHA-required hazard communication (HAZCOM) training, thereby negating the need and cost to develop separate programs for mold. However, a point was raised that the biological nature of mold contamination might preclude its coverage under OSHA HAZCOM.

2. The mold hazard awareness training should convey (1) recognition of mold hazards, such as observing moisture and mold colors and odors, and (2) knowledge of how workers can protect themselves when in contact with mold.

3. It was pointed out that unscrupulous employers might provide only hazard awareness training where heavy exposure potential exists, such as during active removal of mold, and warrants more intensive training. However, this problem cannot be resolved by issuance of a guideline. Furthermore, the hazard awareness training guidelines should stipulate worksite conditions that require additional training and protections.

4. Participants recommended the definitions of training levels by type of worker, square footage of surface mold contamination and, for the awareness training, the activity/task, as shown in Table 1. Duration of exposure and environmental conditions were recognized as potentially important, but specific definitions were not developed for these variables.

Table 1
Recommended Definitions of Training Levels

Training	Type of Worker	Square Footage	Duration of Exposure	Activity/Task	Neighborhood/ Environment
Awareness Training	Potential foreseeable contact with mold.	<10ft_		Building maintenance, electricity installation, incidental encounters with mold.	
Maintenance Level Training -HAZCOM	Contact with mold and remove mold but do not disturb	>10ft_			
Remediation Training	Disturbance/Removal	≥100ft_			

5. Discussion revolved around a set of criteria for assessing mold remediation levels, which is utilized by a major mold remediation firm and is purported to be a useful means of defining the level of personnel, minimum standard for PPE, and minimum standard for containment levels for a remediation project. These criteria, summarized in Table 2, were presented as an example of a guide to defining training levels and are based on "potential for mold to become aerosolized".

Table 2
Criteria For Assessing Mold Remediation Levels

	Density of Growth		
Coverage Size Sq ft	>25% (light)	25-75% (moderate)	>75% (heavy)
0-30	1	2	2
30-100	2	2	3
>100	2	3	3

In Table 2, a Level 1 project (i.e., 0-30 sq ft of mold and greater than 25% of the remediation surface is covered with visible mold) would be characterized by the following:

Level 1:

- Maintenance Training
- Cleaning, no disturbance.
- N-100/Gloves/Goggles

A Level 2 project would require the same as Level 1 with the following additions: half face respirator with HEPA/organic vapor cartridges and sealing of the work area, preferably as a negative pressure enclosure. A Level 3 project would add a full-face respirator and Tyvek protective outerwear.

A Level 0 project (involving no intentional mold disturbance) would trigger awareness training; an example would be a plumber, maintenance worker, or carpenter in presence of moldy wood or moldy dry wall but not involved in mold removal.

6. Although the discussion focused on developing training and not work practices, some participants felt strongly that site-specific conditions should dictate the appropriate combination of methods. For example, with regard to "regulating the work area" it is not always possible or desirable to vacate occupants or fully contain work areas. However, there was generally agreement that training must address the following work practices:

    - Regulating the work area
    - Preparation techniques: sheeting/taped
    - Dust suppression: damp wipe, wet vacuum, HEPA vacuum
    - Contaminated waste: bag, seal and remove
    - Post cleanup
    - Post inspection

7. General guidance on work practices was discussed:

    - When feasible, conduct mold work in commercial properties after normal business hours.
    - Always use PPE and HEPA vacuum the area upon completion.
    - When feasible, require occupants to vacate the work area (this could not be done in a hospital setting or other 24-hour facilities).

8. Time was not sufficient during this session to discuss training in relation to HVAC mold remediation. (However, as discussed previously, participants reached overall consensus that mold remediation of HVAC systems was beyond the scope of a general mold remediation course, and that workers who engage in that work should take a separate NADCA or equivalent course for HVAC work.

4.2 Session B - Worker Protection by Work Practice Exposure Categories

Mr. Christopher D'Andrea of the New York City Department of Health and Mental Hygiene and Mr. Donald Weekes, President and Founder of Abacus Environmental Inc. served as co-chairs of this breakout session.

The purpose of this breakout session was to develop guidance on personal protections for maintenance and remediation worker exposure activities. In approaching this effort, breakout participants were to carefully review the assumptions and subsequent definitions of the maintenance and remediation work categories presented in the draft guidelines.

Distinguishing Between Maintenance and Remediation

- Maintenance work is associated with routine tasks performed in one or several specific buildings, whereas mold remediation workers will work under a variety of conditions and in many different buildings over time
- Maintenance workers perform a variety of tasks, including tasks unrelated to mold, but mold remediation workers focus on mold removal
- Maintenance workers will encounter relatively smaller areas of mold contamination (less than 30 square feet) than remediation workers
- Maintenance workers will undertake mold removal far less frequently (less than 30 days per year) than remediation workers
- Assessors/consultants are covered as maintenance
- Most commercial buildings have a crew that can handle limited mold work, but the larger mold remediation work is farmed out.

Factors Affecting Mold Exposure Potential

The following factors should be considered as criteria for mold exposure potential:

- Project size, square footage of mold that is present
- Type of dust control
- Amount of potential release (destructive v. non-destructive), and
- Amount of mold work time per day.

Buildings Typically Subject to Mold Remediation

The guidance document should identify the types of buildings typically subject to mold remediation, including:

- Office buildings
- Public-access buildings
- Schools
- Governmental buildings/correctional facilities
- Commercial space
- Multi-family, four units and above

Buildings to be excluded include**:**

- Private homes (single-family, owner occupied)
- Agricultural use buildings
- Indoor industrial environments
- Health care facilities

Personal Protective Equipment – Gloves

- Use of gloves is typically dependent on whether wet work or dry work is performed. Wet work requires that the glove choice be based on the liquid. Some felt that a standard work glove would work sufficiently.
- Appropriate gloves should be specified, with examples.
- There was a discussion noting that latex causes allergic reactions in some wearers and their use should be discouraged.
- During dry work, the minority opinion was that reusable rough work gloves are acceptable.

Personal Protective Equipment - Eye Protection

Consensus is that workers should be given the opportunity to choose either safety glasses or vented goggles.

Personal Protective Equipment - Full-Body Coveralls

- Maintenance – Generally not needed, some exceptional circumstances involving heavy exposures to mold
- Remediation – Non-porous, full-body boots and head covering are recommended

Respirators for Remediation

- Must provide a minimum of half-face HEPA
- MVOCs were discussed in terms of whether there is a need for charcoal, but consensus was that air changes inside of containment will dilute MVOCs sufficiently. In addition, protection is required from bleach and other chemical agents used to clean or remediate.
- PAPRs should be recommended based on comfort and effectiveness.
- Must be NIOSH certified.

Respirators for Maintenance

- Expert associations have been recommending N95
- Must be NIOSH certified

4.3 Session C - Training Topics and Techniques: Maintenance Workers

David Jacobs, Director of the U.S. Department of Housing and Urban Development's Office of Healthy Homes and Lead Hazard Control and Carolyn Denise Bland-Bowles, a Certified Environmental Trainer and member of the National Environmental Training Association, served as co-chairs for this breakout session.

The purpose of the breakout session was to develop consensus on training topics and techniques for maintenance workers, including those engaged in HVAC system decontamination as described in the draft document. The results of these deliberations are presented below.

Discussion Summary

Duration of Maintenance Worker Training

The duration of maintenance worker training should be flexible and appropriate to the degree of training required. All are reminded that this is a voluntary guideline, that employers may be more willing to send employees to relatively short duration (2- or 3-hour) sessions, and that cost of training (also a function of duration) is a major concern to employers. Participants recommended that maintenance training should be a maximum of two hours if it involves PPE, but should otherwise be shorter (between 30 minutes and 2 hours), assuming PPE is covered in other training.

In cases where a maintenance worker is selected to be trained as a remediation worker, employers will more likely will be encouraged to support longer duration training.

Emphasis of Maintenance Worker Training

- Identify key messages or training objectives. At the end of the training session we want the worker to know how to identify the characteristics of mold, the requirements for mold growth, how to protect themselves, when to bring this to the attention of a supervisor, and how to clean it up. The following questions were posed:

- What is mold?
- What makes it grow? Importance of moisture.
- What does it look like for identification purposes?
- Where do we see it in the workplace?
- What are potential health effects?
- What to do? What not to do?
- What are your legal rights?

- Training should also emphasize "fix the leak," which is a maintenance/engineering function and not an industrial hygiene function, and should be tailored to concerns and conditions faced by employees and result in workers not having a fear of addressing mold.

- Participants supported a generic curriculum that could be tailored to individual needs, management concerns, local concerns, etc.

- Some participants advised that the maintenance training course is appropriate for other building trades workers who come into intermittent contact with mold in the course of their work (this would not include remediation workers).

- Consideration should be given to worksite hazards, other than mold, that the worker will come into contact with when addressing mold problems. Avoiding electrical shock when washing surfaces, and avoiding contact with corrosive cleaning agents are two of many examples cited.

PPE Training for Maintenance Workers

- Concern was expressed that effective use of PPE will in some cases be glossed over by trainers not competent on PPE issues. (This concern relates to the broader issue of trainer qualifications, which was not addressed in this Workshop due to limited time and focus on developing minimum training criteria.)

- Participants debated whether PPE should be covered under separate training. Some felt it more efficient to keep PPE as part of the course. Others agreed it would be ideal to provide full training, but pointed out that since PPE could take two hours and there is a need to limit course time, a separate PPE module should be available. One participant expressed the view that for projects of less than three square feet, respiratory protection may not be needed, although this was clearly a minority opinion.

Training on HVAC System

Participants had decided that mold remediation of HVAC systems was a highly specialized skill requiring specialized training, such as that provided by NADCA. It was recognized, however, that maintenance workers need to be trained to understand:

1. why mold contamination in an HVAC system is of concern and how to prevent this from occurring;
2. when it is appropriate to isolate (shut down) an HVAC system;
3. when it is appropriate to recommend that HVAC mold remediation workers be called in;
4. and other HVAC-related issues.

Topics for Maintenance Worker Training Course

Table 3 provides a listing of training topics, excluding work practices, recommended by participants for maintenance worker training courses. A separate listing of recommended work practices is provided in Table 4.

Table 3
Recommended Training Topics
Maintenance Worker Training Course
(Excluding Work Practices)

Introduction to Mold

- What is mold?
- What building conditions cause it to grow?
- Where do we see it in the workplace?
- What to do? What not to do?

Health Effects of Mold Exposure

- Communicate the current medical knowledge on mold-related diseases
- What is the likelihood of experiencing a job-related health problem from mold exposure?
- When to seek medical attention and what your doctor should be looking for
- Signs and symptoms of adverse effects potentially due to mold

Legal Rights, Regulations, and Codes

- Identify all applicable federal, state, and local regulations and building codes related to mold.

Response and Reporting

- Explain when and how a maintenance worker should (1) respond to a mold problem, and/or (2) refer it to management for follow-up.
- A series of photographs or examples of larger and smaller mold projects can be shown to convey a sense of what projects the worker can respond to directly.
- Considerations in deciding projects that a worker can directly respond to include:
  - Size and duration of the mold contamination
  - Equipment available on hand to respond
  - Patterns of worker illnesses or symptoms that may be mold related
  - Presence of extensive water damage, or of hidden mold.
  - Source of moisture problem
  - Examples should lead the discussion, as it may not be possible to set specific criteria.

Topics for Maintenance Worker Training Course

Table 4 provides a listing of recommended work practice training topics for maintenance workers.

Table 4
Recommended Work Practice Training Topics
Maintenance Worker Training Course

Precautions before removing mold
- Wear a mask when fuzzy material is present
- During mold removal time, ask people to leave to immediate area

Containment techniques to reduce the spread of mold on small surfaces
- Plastic drop cloth to protect
- Supplies and equipment

Mold removal steps
- Wipe off mold with soap and water
- Throw away damaged materials; refer to *EPA Guidelines Table 1*
- Cutting wall sections: misting or some form of containment may be appropriate
- Damaged materials should be bagged, sealed, and thrown away
- Adapt *EPA Guidelines Table 1* as a training tool

Cleanup
- Refer to *EPA Guidelines*
- Wet wipe and use HEPA vacuum
- If using HEPA vacuum, use PPE

Prohibited Activities
- Do NOT use bleach as a substitute of removal (be specific with state regulations and applicability); bleach also creates another hazard for the worker
- Do NOT disturb fuzzy materials without respiratory devices
- Do NOT put an air mover on
- Do NOT just paint over it
- Do NOT dry scrape it off

Training Techniques for Maintenance Workers

Table 5 provides a listing of specific training techniques that participants developed for training maintenance workers.

Table 5
Recommended Training Techniques
Maintenance Training Course

Techniques	***Comments***
Utilize photographs, video presentations, computer-based training, other audio visuals	Some participants felt audiovisuals ineffective, others felt it should be used only in conjunction with hands-on components
Maximize trainee participation in discussions	Tailor topics and images to trainee worksites as much as possible
Set up small group sessions and provide hands-on experience	
Utilize teleconferences where necessary and appropriate	Allow trainees to submit email or phone in questions
Have trainees fill out a course evaluation	Have trainees evaluate course and utilize feedback to improve course effectiveness
Provide take-away supplement	Provide a clear written synopsis of the main points of training

Awareness Training

Mold hazard awareness training was discussed during this session. It was suggested that awareness training involve rudimentary tools including training on how maintenance workers should respond to and clean up small-scale mold contamination; however, these activities involve work practices and thus are beyond the scope of awareness training. Awareness training alone was not supported for maintenance workers who will be actively involved in addressing mold contaminated surfaces.

4.3 Session D - Training Topics and Techniques: Remediation Workers

Mr. John A. Tiffany, Principal in the firm of Tiffany-Bader Environmental, Inc., and Mr. Al DeVita, Curriculum Development Manager for Laborers-AGC Education and Training Fund, served as co-chairs of this breakout session.

The purpose of the breakout session was to develop consensus on training topics and techniques for remediation workers including those engaged in HVAC system decontamination as described in the draft document. Results of these deliberations are presented below.

Discussion Summary

1. Mold is not a carcinogen like asbestos, nor is mold a heavy metal like lead. Participants noted problems posed by asbestos and lead paint abatement trainers who "miss the boat" on mold (i.e., they use certain terminology, work practices and personal protections that are inappropriate to mold remediation).

Examples of this problem were cited, including: Specifying expensive and burdensome worker protections and worksite containment - appropriate for asbestos sites, but not warranted for low risk mold removal sites. The high cost of over-priced mold remediation quotes can discourage building owners from undertaking any appropriate remediation, and they will instead turn to unqualified contractors whose faulty remediation may put the owner and others at risk.

The need to educate trainees on the differences between mold hazards and remediation approaches, from those of asbestos and lead based paint, was sounded throughout this session.

2. Workplace monitoring should be covered only briefly, including the difference between clearance procedures for asbestos and lead sites versus mold sites. Topics should include a focus on settled dust and use of "white glove" surface sampling, and the difficulties with personal sampling of mold exposures. Mold remediation workers and construction workers must also be trained on how to avoid inadvertently taking worksite mold contamination home to their family.

3. Participants also recognized some overlap in work practices and personal protections employed on asbestos/lead remediation sites and on mold sites, and that it would be reasonable to exempt mold trainees from training on these topics if they recently completed asbestos/lead training and can demonstrate proficiency. This applies to workers engaged in hazardous waste operations remediation and trained in accordance with the OSHA HAZWOPER standard as well. For example, a worker who was recently trained and fit tested to wear a respirator, and who can demonstrate competence in wearing and maintaining it, may be exempted from additional training on this particular respirator. However, time limitations did not permit participants to address either this issue or the issue of mold remediation refresher training.

4. The general consensus was that mold remediation should be three training days (21 hours) in duration [see Table 3 below for breakdown of course by topic and time intervals], and that to prevent trainees from becoming bored and distracted the didactic (classroom) sessions should be relatively brief and workshop exercises and demonstrations should be emphasized.

5. There was a consensus that mold remediation of HVAC systems was beyond the scope of a general mold remediation course, and that workers who engage in that work should take a separate NADCA or equivalent course for HVAC work. However, there was consensus that general knowledge of HVAC operation, how to seal the system off, how a plenum works, and how it can impact mold remediation work, including as an engineering controls, was important for mold remediators to understand.

Primary Knowledge Objectives

Participants came to the consensus that it was critical to develop training objectives for the knowledge and the skills essential for mold remediation workers before proceeding further. Table 6 provides a listing of the recommended knowledge objectives.

Table 6
Recommended Primary Knowledge Objectives
Mold Remediation Worker Training Course

Rationale and procedures for removing particulate material down to the reasonably achievable level

Understanding of safe work practices

Understanding the nature of mold hazards, including safety hazards.
- Chemical hazards
- Physical hazards
- Construction safety: ladders, scaffolds

Understanding the potential for mold exposures and hazards to the occupant population

Knowledge of health and safety plans

Understanding the health effects of mold among susceptible individuals

Knowledge of PPE and how these protect health

Knowledge of engineering controls and the hierarchy of controls
- Dryers
- Dehumidifiers
- Scalability of remediation; jobs should be small if caught early and containment could be avoided if the job is small enough.
- Medium sized jobs may present the most risk because of intensive exposure with insufficient controls.

Knowledge of HVAC operation, how to seal the system off, how a plenum works, and how it can impact mold remediation work, including as an engineering controls.

Knowledge that mold remediation may entail disturbance of lead paint and asbestos. In such cases, an industrial hygiene professional should be consulted to determine the safe and legal manner for addressing those materials in order to prevent lead or asbestos exposures to the maintenance worker and building occupants.

Training should cover special considerations and precautions when conducting small-scale mold jobs

Recommended Primary Skills Objectives

Participants recommended the following primary skills objectives: Donning and doffing respirators, and ability to construct and use decontamination units and negative air units. It was suggested that construction of decontamination units could be omitted in order to save time, and that use of specialized decontamination practices be taught for small-scale mold removal projects.

Course Evaluation

Participants supported course evaluation and trainee testing (multiple choice) procedures. Trainees should demonstrate proficiency in PPE use and work practice skills (performance-based).

Recommended Training Topics, Methods and Time Segments

Table 7 presents recommended training topics, methods and time segments for mold remediation workers.

Table 7
Suggested Training Topics and Instructional Methods for Mold Remediation Workers (Excluding HVAC)

Sections	Topic	Instructional Method	Suggested time (hours)
1	Introduction to course ▪ Introduction of instructors ▪ Introduction of participants ▪ Objectives of the course	Classroom	0.5
2	Introduction to indoor air pollution, indoor mold contamination in building and HVAC systems; diff Pb/Asb; monitoring & sampling	Classroom	3.0
3	Health & Safety Hazards ▪ Nature of hazard ▪ Mold remediation materials (chemicals) ▪ Hazard to other trades and bldg occupants ▪ Construction safety	Classroom	3.0
5	PPE ▪ Requirements of 29 CFR 1910.132 ▪ Full body coveralls ▪ Eye protection ▪ Hand protection ▪ Head protection ▪ Foot protection ▪ Integrated ensembles ▪ Use, care, limitation, inspection, and cleaning	Classroom and demonstration	2.0
6	Respiratory protection ▪ Requirements of 29 CFR 1910.134 ▪ Respirator types (APR, PAPR) ▪ Respirator selection ▪ Use, care, limitations, inspection, and cleaning ▪ Fit checking, positive and negative	Classroom and demonstration	2.0
7	PPE/Respirator exercise ▪ Don, doff, fit check, inspect, clean ▪ Ensembles ▪ Qualitative fit testing	Exercise (Assumes all trainees are medically approved to wear respirators)	2.0
8	Mold remediation work practices, procedures, and methods ▪ Remediation plan ▪ Tasks, equipment, and materials ▪ Safety and health work practices including	Classroom and demonstration	3.0

	worker & waste decontamination for large and small-scale projects ▪ Engineering controls o Containments o Negative air o Clean o HEPA vacs ▪ Remediation work practices		
9	Mold remediation work practices, procedures, and methods exercise ▪ Set-up containment, negative air, and decon airlock. ▪ Perform operation and then tear-down. ▪ Perform selected work practices and procedures. ▪ Demonstrate understanding of the remediation plan elements. ▪ Demonstrate contents remediation procedure.	Exercise	4.0
10	Review and Test		1.5

Minority view

Laurence Lee of Argus Pacific, Inc. provided the following dissenting view with the suggested approach:
I believe that the 3-day mold remediation worker training is excessive and unnecessary. The workers are simply being trained to remove, clean, and control dusts.

The curriculum does not need containment building because the simple engineering controls are limited to negative pressure and critical barriers. Asbestos-style negative pressure enclosures are not needed for controlling simple dusts and asbestos-style abatement and decontamination practices are excessive. No test is needed.

I recommend that the training hours be reduced as follows:

- 0.5 hours – Intro to indoor air pollution
- 1.5 hours – Health & Safety
- 3.0 hours – Respiratory protection, PPE, & hands-on practice
- 3.0 hours – Work practices and hands-on practice
- 8 hours total

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APPENDICES

A. Attendance List

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B. Workshop Agenda

National Technical Workshop

Preliminary Guidelines for the Protection and Training of Workers Engaged in Maintenance and Remediation Work Associated with Mold

Hunter College — East 68th Street Campus, Manhattan, NYC — January 27-28, 2004

Agenda

DAY ONE — Tuesday, January 27, 2004

8:00 – 9:00	**Registration and Continental Breakfast**	President's Conf. Room 1700E
9:00 – 9:15	**Welcome and Overview**	
	Susan Klitzman, Dr.P.H. Hunter College	President's Conf. Room 1700E
9:15 – 9:30	**Overview of the Draft Strawman Document**	
	John Moran National Clearinghouse for Worker Safety and Health Training	President's Conf. Room 1700E
9:30 – 9:55	**Summary Review: Mold Health Effects**	
	Clifford Mitchell, MS, MD, MPH Johns Hopkins Hospital	President's Conf. Room 1700E
9:55 – 10:20	**Summary Review: Guidelines, Exposures, and Work Practices**	
	Chris D'Andrea, MS New York City Department of Health and Mental Hygiene	President's Conf. Room 1700E
10:20 – 10:30	**Break**	President's Conf. Room 1700E
10:30 – 11:30	**Lessons Learned Panel: Exposures During Maintenance and Remediation Procedures**	
	Moderator: Elliott Horner, Ph.D. Air Quality Sciences, Inc.	President's Conf. Room 1700E
	Panelists: J. David Miller, Ph.D., Carleton University Douglas B. Trout, MD, MHS, NIOSH Michael O'Reilly, Tradewins	
11:30 – 12:30	**Lessons Learned Panel: Worker Protection During Maintenance and Remediation**	
	Moderator: Eugene Cole, Dr.P.H., Brigham Young University	President's Conf. Room 1700E
	Panelists: Jim Holland, REA, Restoration Consultants Steve M. Hays, PE, Gobbell Hays Partners, Inc. Terri Pearce, Ph.D., NIOSH	
12:30 – 1:30	**Luncheon**	Faculty Dining Room, 8th Floor West

Sponsored by:
Society for Occupational and Environmental Health | Association of Occupational and Environmental Clinics | Urban Public Health Program of Hunter College, CUNY
National Institute of Environmental Health Sciences | New York City Department of Health | University of Medicine and Dentistry of New Jersey, School of Public Health

1:30 - 1:45 **Charge to the Breakout Groups**

John Moran — President's Conf. Room 1700E

Concurrent Breakout Sessions A and B

1:45 - 4:30 A **Session A: Work Practices, Exposures, Work Practice Exposure Categories**

Co-Chairs:

Richard Dwyer, Ph.D. United Brotherhood of Carpenters
Steven Silicato, REM, CIE, MARCOR Environmental Remediation, Inc. — Room 707B West

B **Session B: Worker Protection by Work Practice Exposure Categories**

Co-Chairs:

Donald Weekes, CIH, Abacus Environmental
Chris D'Andrea, MS, New York City Department of Health — Room 707C West

4:30 - 5:00 **Plenary: Report of Breakout Sessions A and B** — President's Conf. Room 1700E

DAY TWO — Wednesday, January 28, 2004

8:30 - 9:00 **Analysis of Outcomes of Sessions A and B** — Room 714 West

Concurrent Breakout Sessions C and D

9:00 - 12:00 C **Session C: Training Topics and Techniques: Maintenance Workers**

Co-Chairs:

Denise Bland Bowles, AFSCME International
David Jacobs, CIH, U.S. Dept. of Housing & Urban Development — Room 707B West

D **Session D: Training Topics and Techniques: Remediation Workers**

Co-Chairs:

Albert DeVita, Laborers-AGC Education and Training Fund
John Tiffany, Tiffany-Bader Environmental Inc. — Room 707C West

12:00 - 1:00 **Lunch** — Faculty Dining Room 8th Floor West

1:00 - 2:30 **Plenary Report and Discussion: A&B and C&D Sessions**

Moderator: John Moran — Room 714 West

2:30 - 3:00 **Next Steps and Closing Plenary**

Moderator: Susan Klitzman — Room 714 West