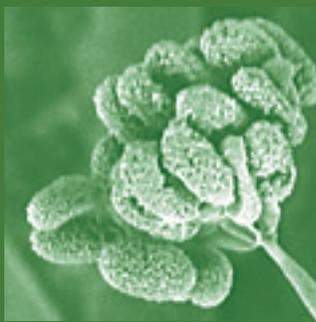


Guidelines for the Protection and Training of Workers Engaged in Maintenance and Remediation Work Associated with Mold



Sponsored by:

The National Institute of Environmental Health Sciences WETP
The Society for Occupational and Environmental Health
The Association of Occupational and Environmental Clinics
The Urban Public Health Program of Hunter College, CUNY
The New York City Department of Health and Mental Hygiene
The University of Medicine and Dentistry of New Jersey, School of Public Health

May 20, 2005

Edited by:

The National Clearinghouse for Worker Safety and Health Training
Operated by MDB, Inc.
1250 Connecticut Avenue NW, Suite 610, Washington DC, 20036
202-331-0060 Telephone
202-331-0044 Facsimile
<http://www.wetp.org>

This guidance is intended to be a “living document” that will be revised as our understanding of mold issues grows and matures. Correspondence concerning this document may be mailed to the National Clearinghouse for Worker Safety and Health, c/o MDB, Inc., 1250 Connecticut Avenue, Washington, D.C. 20036 or sent via email to info@wetp.org

Table of Contents

LIST OF TABLES.....	IV
LIST OF FIGURES	IV
PREFACE.....	1
ACKNOWLEDGMENTS	2
1.0 INTRODUCTION.....	2
1.1 BACKGROUND	2
1.2 PURPOSE	3
1.3 SCOPE.....	3
1.4 BASIC PRINCIPLES.....	4
2.0 GUIDANCE ON TRAINING DEVELOPMENT.....	5
2.1 BASIC FORMAT AND APPROACH.....	5
2.2 NEEDS ASSESSMENT.....	5
2.2.1 Characterization of the training audiences.....	5
2.2.2 Characterization of potential exposures and adverse health effects.....	6
2.2.3 What trainees are required to know and do.....	8
2.2.4 Job analyses and levels of remediation work.....	8
2.2.5 Site specific information	9
2.2.6 Special trainee abilities.....	9
2.2.7 Previous training provided to the trainees.....	10
2.2.8 Regulatory requirements and existing guidance.....	10
2.3 LEARNING OBJECTIVES AND PREREQUISITES	14
2.3.1 Description of learning objectives.....	14
2.3.2 Learning objectives for the courses.....	14
2.4 COURSE DESIGN	16
2.4.1 Content	16
2.4.2 Delivery methods.....	24
2.4.3 Time allocation	25
2.4.4 Evaluation strategy	25
3.0 REFERENCES.....	26
4.0 BIBLIOGRAPHY	27
5.0 APPENDICES	30
APPENDIX A. LIST OF PARTICIPANTS FROM JANUARY 2004 MANHATTAN WORKSHOP	30
APPENDIX B. WORK SHOP AGENDA	32
APPENDIX C. PRINCIPLES OF ADULT EDUCATION	34

LIST OF TABLES

Table 1. Airborne molds during initial inspection.....	7
Table 2. Airborne molds during demolition.	7
Table 3. Airborne molds during first final cleaning.	7
Table 4. Summary of training topics for maintenance workers engaged in general mold work and HVAC system work.	11
Table 5. Summary training topics for remediation workers engaged in general mold work and HVAC system work.	12
Table 6. Workers Protection Guidance, Maintenance and Remediation Workers Exposure Activity	13
Table 7. Recommended primary knowledge objectives for mold remediation worker training	15
Table 8. Recommended training topics for the maintenance worker course (excluding work practices. ...	17
Table 9. Recommended work practice training topics for maintenance workers.	18
Table 10. Low-level HVAC mold maintenance work course.	21
Table 11. Suggested training topics and instructional methods for mold remediation workers (excluding HVAC).....	22
Table 12. Recommended training techniques for the maintenance training course.....	24

LIST OF FIGURES

Figure 1: EPA Table - Water Damage - Cleanup and Mold Prevention from EPA’s “Mold Remediation in Schools and Commercial Buildings” (March 2001).....	19
--	----

PREFACE

This report is the product of two workshops each one attended by over sixty technical experts representing governmental agencies, industrial hygiene firms, abatement contractors, labor unions, universities, and trade associations. The first workshop, *Mold Worker Protection Training Workshop* was held January 27-28, 2004 in the city of New York. This workshop developed draft, 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 second workshop, *Mold-related Health Effects: Clinical, Remediation Worker Protection, and Biomedical Research Issues*, was held on June 28-29, 2004 in Washington, D.C. 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 appropriate training to protect these workers from mold exposures.

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. Their 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*.

The National Institute of Environmental Health Science (NIEHS) managed the workshops 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. The National Technical Workshop approach developed and refined since 1991 by the NIEHS Worker Education and Training Program provided the underlying framework for these workshops.

The outcome of these workshops, presented here as minimum-training criteria, is intended to serve as initial guidance to governmental agencies, trade organizations, labor unions, and professional associations in the future development of mold worker protection training programs. The training recommendations are based on a review of all major existing guidance. The intent is for this guidance to be a “living document” to be revised in the future as our understanding of mold issues continues to grow and mature.

Throughout the workshops the uncertainties were acknowledged regarding health effects of mold exposure and the nature and magnitude of mold exposures by the different target populations, which impacted related discussions on appropriate personal protective equipment (PPE), work practice controls, and, therefore, training. While the experts agreed that the uncertainties require additional research, it was recognized that certain adverse health outcomes are attributable to mold exposure and, even though there is clearly no dose-response data, thousands of workers are exposed to mold while removing and cleaning water-damaged materials and performing normal maintenance activities. The guidelines are based upon the need to protect these workers. Future research on mold health effects and exposures will undoubtedly require the content of this training curriculum to be modified.

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 meeting locations and logistical support for the first workshop 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 workshops:

- Vincent M. Coluccio, DrPH, Vincent M. Coluccio & Associates, Inc.
- Christopher D'Andrea, New York City Department of Health
- 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
- Pat Mastin, National Institute of Environmental Health Sciences
- 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

NIEHS acknowledges the significant efforts of John Moran of the National Clearinghouse for Worker Safety and Health Training who created the original draft guidelines that served as the basis for discussion at the Manhattan workshop. Larry Cooper is also recognized in his role as Chair of the Mold Remediation Standard Committee of the Institute of Inspection, Cleaning and Restoration, and for his active involvement in the workshop and for 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. NIEHS WETP greatly appreciates the work of Dr. Vincent Coluccio for coordinating the Manhattan workshop and revising the original draft document and Dr. Bruce Lippy for revising these final guidelines.

1.0 INTRODUCTION

1.1 Background

“Mold” is ubiquitous in nature and in buildings. 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 (Venkatesan, Perfect & Myers, 2004).

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. In the absence of regulations protecting these individuals from potentially harmful exposures to mold, concern for the health of these workers has continued to grow.

It should be noted that the OSHA Hazardous Waste Operations and Emergency Response standard at 29 CFR 1910.120 (a)(3)(B) defines hazardous substances to include:

“Any biologic agent and other disease-causing agent which after release into the environment and upon exposure, ingestion, or assimilation onto any person, either directly from the environment or indirectly by ingestion through food chains, will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions (including malfunctions in reproduction) or physical deformations in such persons or their offspring.”

1.2 Purpose

The purpose of the NIEHS-sponsored workshops was to develop these experience-based guidelines for protecting and training mold hazard assessors, mold remediation workers, and workers exposed to mold in the course of maintaining building systems. This guidance is intended to be used by competent professionals in government, industry, labor unions, academia, and trade associations to develop curricula for mold worker protection training programs. It is fully conceded that this guidance will need to be revised and improved in the future as understanding of mold issues continues to grow.

These guidelines are 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 Scope

These guidelines are solely recommendations and are intended to be applicable to individuals who must enter and disturb mold-contaminated environments to assess the extent of mold contamination and damage; clean, remove, and repair mold-damaged materials; or perform standard maintenance activities. The guidance should hopefully prove valuable for activities in governmental, commercial, and industrial facilities. The guidance does not contain full course curricula, only recommendations about what the curricula should cover.

The guidance does **not** apply to:

- Worker health and safety concerns related to any other microbial contaminants, such as bacteria;
- Issues, policies, or procedures related to occupant protection during remediation;
- Single unit, owner-occupied residential housing units;
- Agricultural use buildings
- Indoor industrial environments
- Health care facilities housing immunosuppressed patients;
- Homeowners attempting minor mold removal projects; and
- Training needed to develop skills to effectively conduct or perform assessments, remediation, or maintenance work involving mold or mold-contaminated materials. Additional training is needed to provide workers with job skills needed to perform their work tasks. This training guidance is to help workers receive the highest quality health and safety training.

1.4 Basic Principles

There are basic principles that emerged as points of consensus from the workshops that should be followed by professionals developing training based on this guidance:

- Fungal damage in buildings needs to be removed and the underlying cause fixed.
- When fungal damage is removed, it needs to be done 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 as part of the final decontamination.
- Based on existing data, it is not feasible to set an airborne exposure limit as is done with other airborne contaminants.
- In the absence of dose-response data for workers exposed to mold, it is prudent to provide respiratory protection and training. In keeping with recommendations by OSHA, EPA and the American Industrial Hygiene Association, NIOSH-approved N-95 disposable respirators should be the minimum level of respiratory protection provided. N-95 disposables are acceptable for the lower exposures in maintenance work, but half-face elastomeric respirators should be used, at a minimum, for full remediation work.
- Worker protection cannot be managed by measurement of exposure to mold. Personal protection should be based on specific tasks that increase mold exposure, not on measured exposure levels.
- General safety is as important as the protection of health during abatement and must be reflected in the training.
- Adult education principles are critical in the design of any training for workers. There are good resources for curricula designers included in Appendix D.
- The recommended training course is designed for workers who have no mold background nor have current asbestos or lead certification. Prior competency in these areas can be taken into consideration by the course designers and training directors.
- Removing mold from heating, ventilation, and air conditioning (HVAC) systems is beyond the scope of a basic mold remediation course, and workers who engage in that work should take a separate course for HVAC work. General knowledge of HVAC operation, however, such as how a plenum works and how it can impact mold remediation work, is important for mold remediators to understand and should be included in the basic course.
- 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 training commensurate with their exposure potential (as defined by the project size, work practice and duration variables).

- Unlike lead, mold is not a specific substance and many people are not affected by mold.

2.0 GUIDANCE ON TRAINING DEVELOPMENT

2.1 Basic format and approach

The sections in this guidance portion of the document follow the basic format used in the American National Standards Institute standard Z490.1-2001, *Criteria for Accepted Practices in Safety, Health, and Environmental Training*, which was published by the American Society of Safety Engineers (2001) and serves as excellent guidance for developing training.

2.2 Needs assessment

2.2.1 Characterization of the training audiences

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 tends to be low-level exposure and remediation is often seen as higher level exposure. 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).

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, i.e. any source in a home other than toilets) and black water (untreated sewage).

There was consensus at the workshops that maintenance workers are generally facility staff personnel and, as such, represent a different training target audience than a typical remediation contractor’s employees. 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. The two populations can be further differentiated by task, duration, and the size (area of mold contamination to be remediated).

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 smaller areas of mold contamination and undertake mold removal far less frequently.

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, 2) are in the vicinity of – but are not

participating in – uncontained mold remediation or demolition work, 3) are engaged as full-scale mold remediation workers, and 4) are engaged in hazardous waste site cleanup work involving exposures to mold. For these workers, training as maintenance workers is most appropriate.

There was a strong counterpoint argument among the experts that there cannot be definition by project size because concomitant health risks have not been identified. The consensus of the workshops was that the current absence of data in both exposure levels and associated health effects require defining hazard potential by the project size, work practice and duration variables.

Assessors/consultants are covered, for training purposes, as maintenance. The American Industrial Hygiene Association has created recent guidance that identifies the minimum qualifications and competencies of mold assessors (AIHA, 2004, p.3) and warns that the organization, “does not believe the skills necessary to conduct proficient mold assessments can be obtained through attendance at a training course held over a period of a few days.” The minimum qualifications that were stipulated:

- Bachelor of Science in industrial hygiene, environmental health, or an engineering, life science, chemistry, or physics discipline;
- Two years of experience under the direction of a CIH, CSP, and/or licensed Professional Engineer with significant experience in the following areas: building science, mold assessments, and exposure assessments. At least one of the two years must involve the performance of Indoor Environmental Quality (IEQ) assessments.

This guidance assumes that if mold assessors meet the AIHA qualifications and competencies they will have received most of the training on respiratory protection and other personal protective equipment needed as part of their professional development. Consequently, the recommendation is that assessors and consultants would only need short-duration training, like maintenance staff, not the longer training intended for mold remediation workers.

2.2.2 Characterization of potential exposures and adverse health effects

There is very limited published data on exposures to molds in residential, school, and office buildings. There currently are no exposure standards or health effects threshold exposure levels against which to base safe or unsafe exposures and sampling is expensive, time consuming, and difficult to apply. The American Conference of Governmental Industrial Hygienists (ACGIH, 1999) guidance provides a comprehensive discussion of sampling and analytical methods for a broad range of microbial agents.

There appears to be almost no personal sampling data in the published literature for maintenance or remediation workers engaged in mold-related activities. This means there is presently no way to link specific work practices and tasks to exposures, nor to estimate the effectiveness of exposure reduction techniques. The literature contains limited data on airborne concentrations before and after abatement, but no information on the impact of building maintenance activities specific to mold.

Rautiala and colleagues (1996) reported that during repairs of moldy buildings, “construction workers are exposed to high concentrations of microbes, perhaps causing health problems.” These researchers strongly recommended personal protection of both the respiratory system and eyes for workers and isolating the work to protect occupants. NIOSH (2003) corroborated these findings with data from Health Hazard Evaluations of remodeling work in moldy buildings. During remediation, the spore count has been documented to increase a thousand fold. Most clinicians

who participated in the companion *Clinical Aspects of Mold Exposure* meeting, hosted by the Johns Hopkins Bloomberg School of Public Health December 10-11, 2003 have seen remediation workers with adverse health effects.

Dr. Philip Morey, Vice President of Air Quality Sciences, provided the following data at the 2004 Manhattan workshop from a study he co-authored that contains exposure data for remediation workers (Morey and Hunt, 1995). Air sampling was conducted by spore trap under quiescent conditions in a building that had suffered severe mold contamination after an earthquake destroyed much of the roof above the second floor. Samples were then collected during demolition and after the first cleaning. The results indicate very the high levels of mold spores generated during demolition as well as the reductions that can be achieved from 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

Factors Affecting Mold Exposure Potential

The consensus from the workshops was that 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; and
- Amount of mold work time per day.

Buildings Typically Subject to Mold Remediation

The following buildings are very often subject to mold remediation and, therefore, important to address in training:

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

2.2.3 What trainees are required to know and do

The training recommendations for mold remediation workers was developed by the workshop participants after reviewing the existing course being provided by the Laborers-AGC Education and Training Fund called “Microbial Remediation.” This course contains seven modules that are covered in three days of training. Along with classroom learning, hands-on activities, including donning and doffing respirators and protective clothing, are an integral part of the course.

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. 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.

2.2.4 Job analyses and levels of remediation work

The NYC guidelines (NYCDOH, 2000) recommend five levels of remediation work based upon the size of the contaminated area and the magnitude of the remediation effort anticipated:

Level I: Small isolated areas of 10 sq. ft. or less.*

Level II: Mid-sized isolated areas between 10 and 30 sq. ft.*

Level III: Large isolated areas of 30-100 sq. ft.

Level IV: Extensive contamination of greater than 100 contiguous sq. ft.

Level V: HVAC systems

-Small isolated area of contamination of less than 10 sq. ft.*

-Areas of contamination greater than 10 sq. ft.

* Noted as appropriate for regular building maintenance staff to perform.

These mold work level categories have been widely recognized and used. OSHA's Brief Guide to Mold in the Workplace (OSHA, 2003) employs the Level I through IV categories generally as stated in the NYC Guide. Level V, HVAC systems, is not included except with a recommendation to consult NADCA or an EPA guide. Level I and II are stated as being appropriate for performance by building maintenance staff, as in the NYC Guide.

EPA's Mold Remediation in Schools and Public Buildings (EPA, 2001), includes three levels of remediation of "mold growth caused by clean water."

Small:	Less than 10 sq. ft.
Medium:	10-100 sq. ft.
Large:	Greater than 100 sq. ft.

Examples of materials or furnishings affected are provided in each category. HVAC is addressed separately and refers to the related EPA guide "Should you have the air ducts in your house cleaned?"

Health Canada (Health Canada, 1995) identifies three levels or categories of remediation work specific to mold contamination.

Small:	0.3 sq. m. or less.
Medium:	3 sq. m.
Large:	10 sq. m. (or more)

HVAC is not specifically addressed by the Health Canada document. (The NYC guides, 1993 edition, is referenced rather than the revised 2002 edition) Preventive maintenance is specifically addressed. The most recent Health Canada guidance (2004) is more focused on inspection than remediation. It specifically recommends quickly remediating problems and references the 2000 NYDOH guidelines.

ACGIH (1999) identifies three levels (minimal, moderate, and extensive) based upon the extent of visible mold growth without a size description. Detailed HVAC system contamination is addressed.

2.2.5 Site specific information

There was strong consensus that training developed from recommendations in this guidance must be tailored to meet the specific realities of the site where work is to be done. The HAZWOPER standard, for instance, requires providing additional training at the site to complement training received in the classroom.

2.2.6 Special trainee abilities

There was consensus that the cleaning of mold-contaminated HVAC equipment was too specialized and required training beyond what is recommended in this document. The courses offered by the National Air Duct Cleaners Association were noted as good examples of specialized training. Additionally, the International Union of Operating Engineers proposed appropriate training for maintenance workers who disturb less than ten square feet of insulation (see section 2.4.1.3).

2.2.7 Previous training provided to the trainees

Workshop 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. 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.

2.2.8 Regulatory requirements and existing guidance

OSHA does not have a standard that is specifically focused on mold or bioaerosols, but there are several standards that would impact a major mold remediation project and should be covered in any mold remediation course and possibly in awareness training. They include:

- Hazard Communication standard training per the applicable OSHA standard (29 CFR 1910.1200) with additional materials specific to microbial materials.
- Respiratory protection training in accordance with the OSHA standard at 29 CFR 1910.134 (or construction equivalent).
- Employers Site/Facility Safety and Health Plan required by OSHA standard 1910.38. It is assumed that the employer's Emergency Response Plan per applicable OSHA standard and a "working with mold procedures plan" (signs, disposal, etc.) would be included.

Even though there are very few applicable OSHA standards, there are several major guidelines from governmental organizations and consensus bodies. This guidance document is built upon the excellent recommendations, where applicable, from the following:

- 1993 NYC Department of Health and Mental Hygiene – "Guidelines on Stachybotrys"
- 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.
- 1998 – American Society of Testing and Materials E1971-98, "Standard Guide for Stewardship for the Cleaning of Commercial and Institutional Buildings" – provides a broad approach to keeping commercial and institutional buildings clean while protecting cleaning personnel and occupants.
- 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 Assessment and Remediation of Fungi in Indoor Environments" (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.
- 2004 American Industrial Hygiene Association – “Assessment, Remediation, and Post-Remediation Verification of Mold in Buildings” AIHA Guideline 3.
- 2004 Health Canada – “Fungal Contamination in Public Buildings: Health Effects and Investigation Methods”
- 2004 Institute of Medicine of the National Academies – “Damp Indoor Spaces and Health”

Recommended training topics for maintenance workers from existing guidance

Table 4. Summary of training topics for maintenance workers engaged in general mold work and HVAC system work.

Guidance Source	Training topics
NYC 2000	Cleanup methods Personal protection HAZCOM
OSHA	Same as NYC
EPA	No Recommendations
AIHA	No Recommendations
Health Canada	Per Canadian WHMIS standards and Provincial OSHA’s
ACGIH	No Recommendations

General notes: IICRC does not address maintenance work involving mold. Where respirators or other PPE are required, the applicable OSHA standard will require training. No instructional methods are presented in any of the guidance sources.

Recommended training topics for mold remediation workers from existing guidance

Table 5. Summary training topics for remediation workers engaged in general mold work and HVAC system work.

Guidance Source	Topics
NYC 2000	“Handling hazardous materials”
IICRC S520	Minimum topics: <ul style="list-style-type: none"> ▪ safety & health ▪ engineering controls ▪ containment methods ▪ work practices ▪ physical hazards ▪ chemical hazards ▪ microbial hazards ▪ PPE ▪ Building-related regulated substances (e.g. asbestos, lead) ▪ Other applicable OSHA standards, such as Hazcom, respiratory protection, and PPE
OSHA	Same as NYC 2000
EPA	No Recommendations
AIHA	No Recommendations
Health Canada	Per Canadian WHMIS standard and provincial OSHA’s
ACGIH	No Recommendations

General notes: The NYC2000 Level IV training is the basis for this table. If respirator use is required under 1910.134, training must be provided. There are no instructional techniques indicated in any of the guidelines.

Recommended worker protection for maintenance and remediation workers from existing guidance

Table 6. Workers Protection Guidance, Maintenance and Remediation Workers Exposure Activity¹

Guidance	Personal Protection	Maintenance General	Maintenance HVAC	Remediation General	Remediation HVAC
NYC 2000	Respiratory Eye Hand Full body ²	N95 Disposable Yes Yes Not addressed (NA)		Full Face-APR HEPA Yes (through full-face resp) Yes Yes	
OSHA	Respiratory Eye Hand Full body	N95 Disp Yes Yes NA	NA NA NA NA	FF-APR HEPA Yes (Resp) Yes Yes	NA NA NA NA
EPA 3/01 ³	Respiratory Eye Hand Full body	NA NA NA NA		N95 Yes Yes NA	NA NA NA NA
ACGIH 1999 ⁴	Respiratory Eye Hand Full body	N95 disposable NA Yes NA		N95 disposable Yes Yes NA	
IICRC S520 ⁵	Respiratory Eye Hand Full body Foot ⁶	NA NA NA NA NA		Based on spores/m ³ (N95 to PAPR) Yes Yes Yes Yes	
Health Canada 1995	Respiratory Eye Hand Full body	Yes (1/2 face) Not addressed Yes Not addressed	Not addressed Not addressed Not addressed Not addressed	FFP HEPA Yes (Resp) Yes Yes	Not addressed Not addressed Not addressed Not addressed
NIOSH Newhart 1997	Resp	Full Face APR at a minimum, PAPR FF recommended for Histoplasma capsulatum exposures (bird and bat)			

¹ AIHA 5/01 covers PPE in chapter 11. No recommendations beyond professional guidance are provided so AIHA was not included in the table.

² Full body includes disposable coveralls, head covering, eye protection, gloves, and shoe covers.

³ EPA's guide is for remediation of building materials and furnishings contaminated with mold caused by "clean water."

⁴ ACGIH uses 3 categories: minimal, moderate, and extensive. Minimal is assumed to be maintenance work.

⁵ IICRC S520 provides extensive discussion of respirator selection in the "Reference Guide," Appendix B.

⁶ Rubber safety boots with booties

2.3 Learning objectives and prerequisites

2.3.1 Description of learning objectives

This guidance supports the ANSI recommendation that learning objectives be written for each course and that they include:

- the target audience;
- the desired knowledge, skill, or ability to be learned by the trainee;
- the conditions under which the knowledge, skill, or ability is to be demonstrated; and
- the criteria for determining that the learning objective has been achieved.

Additionally, learning objectives shall be observable and measurable, consider the required background and experience of the trainees, and state any prerequisites. A widely used mnemonic device for writing good objectives is SMART: Specific—Measurable—Action-oriented—Relevant—Timely.

2.3.2 Learning objectives for the courses

Primary knowledge objectives for mold remediation course

Participants came to the consensus that it was critical to develop training objectives for the knowledge and the skills essential for mold remediation workers. Individual learning objectives will need to be generated by training providers that are based on the specific needs analysis for their training populations. Table 7 provides a list of the broad recommended knowledge objectives that the workshop experts felt should be considered when creating learning objectives for a given set of students.

Table 7. Recommended primary knowledge objectives for mold remediation worker training.

<p>Learning objectives should be designed to allow students to demonstrate an understanding of:</p> <p>The rationale and procedures for removing particulate material down to the reasonably achievable level</p> <p>Safe work practices</p> <p>The nature of mold hazards, including safety hazards.</p> <ul style="list-style-type: none">▪ Chemical hazards▪ Physical hazards▪ Construction safety, such as ladders, walking-working surfaces, and scaffolds <p>The potential for mold exposures and hazards to the occupant population</p> <p>Health and safety plans</p> <p>Health effects of mold among susceptible individuals</p> <p>PPE and how these protect health</p> <p>Engineering controls and how they fit within the hierarchy of controls</p> <ul style="list-style-type: none">▪ Dryers▪ Dehumidifiers▪ Scalability of remediation: jobs should be small if caught early, which reduces the amount of containment.▪ Medium sized jobs may present the most risk because of intensive exposure with insufficient controls. <p>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.</p> <p>Dealing with lead paint and asbestos disturbances while remediating mold. In such cases, an industrial hygiene professional should be consulted to determine the safe and legal manner for addressing those materials to prevent lead or asbestos exposures to the maintenance worker and building occupants.</p> <p>Special considerations and precautions when conducting small-scale mold jobs</p>
--

Recommended primary skills objectives

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

2.4 Course design

Training courses should be developed to be consistent with the recognized principles of instructional design such as the ADDIE method (Analysis, Design, Development, Implementation, and Evaluation), the DOE Systematic Approach to Training manual (DOE-HDBK-1078-94), and ANSI Z-490. Useful additional references that specifically consider the NIEHS/WETP training target audience can be found in the WETP workshop report “Guidelines for Training of Workplace Safety and Health Programs: Guidance Document”, November 1998 and on the WETP web site specific to the several bi-annual trainers exchange workshops. The method used needs to be fully documented by the developer.

2.4.1 Content

2.4.1.1 Respirators and personal protective equipment

The following consensus points were reached about respirators and PPE, which should be reflected in training design.

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.
- There was a discussion noting that latex gloves cause 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.

Eye protection

The consensus was that workers should be given the opportunity to choose either safety glasses or vented goggles.

Full-body coveralls

- Full-body coveralls are generally not needed for maintenance work, except in some unusual circumstances involving heavy exposures to mold.
- For remediation, non-porous, full-body coveralls, boots, and head coverings are recommended.

Respirators for remediation workers

- NIOSH-approved, half-face elastomeric respirators with particulate cartridges of at least N-95 should be used, unless the environment might include oil mist exposures, in which case a P designation would be needed. Where heavy exposures are anticipated, improving the efficiency from 95 to 100 may be warranted.
- Although molds produce Microbial Volatile Organic Compounds (MVOCs), the general conclusion was that these are in such low concentrations (particularly considering the dilution inside containment from air handling equipment) that there is no need for charcoal filtration on the respirators.
- PAPRs should be recommended based on comfort and effectiveness.
- All respirators must be NIOSH certified.

Respirators for maintenance workers

- Governmental organizations, and expert associations have been recommending N-95 disposables, which was the general consensus for this guidance, although there were dissenting votes that N-95 disposables provided insufficient protection and tended to clog in humid environments, making breathing difficult.
- All respirators must be NIOSH certified

2.4.1.2 Maintenance worker training content

The following recommended training topics for maintenance workers were generated in the first workshop and revised in the second.

Table 8. Recommended training topics for the maintenance worker course (excluding work practices).

<p>Introduction to Mold</p> <p>The following questions should be addressed in the introduction:</p> <ul style="list-style-type: none">▪ What is mold?▪ What building conditions cause it to grow?▪ Where do we see it in the workplace?▪ What activities are okay for maintenance workers? Which are not? <p>Health Effects of Mold Exposure</p> <ul style="list-style-type: none">▪ What current medical knowledge on mold-related diseases should be communicated to maintenance workers?▪ What is the likelihood of experiencing a job-related health problem from mold exposure?▪ When should a worker seek medical attention and what should the doctor look for?▪ What are the signs and symptoms of adverse effects potentially due to mold? <p>Legal Rights, Regulations, and Codes</p> <ul style="list-style-type: none">▪ What are the applicable federal, state, and local regulations and building codes related to mold that affect your job? <p>Response and Reporting</p> <ul style="list-style-type: none">▪ When and how should a maintenance worker 1) respond to a mold problem and 2) refer it to management for follow-up? A series of photographs or examples of different size mold projects can be shown to convey a sense of what projects the worker can respond to directly.▪ What considerations should be part of deciding whether to respond directly on a mold project?<ul style="list-style-type: none">– 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 hidden mold– The source of moisture problem– Examples should lead the discussion, as it may not be possible to set specific criteria.

Table 9. Recommended work practice training topics for maintenance workers.

<p>Precautions before removing mold</p> <ul style="list-style-type: none">▪ Wear a mask when potential mold-contaminated material is present▪ During the period of mold removal, ask people to leave to immediate area <p>Containment techniques to reduce the spread of mold on small surfaces</p> <ul style="list-style-type: none">▪ Plastic drop cloth to protect▪ Supplies and equipment <p>Mold removal steps</p> <ul style="list-style-type: none">▪ Wipe off mold with soap and water▪ Throw away damaged materials; refer to <i>EPA Guidelines Table 1</i> (see below)▪ Cutting wall sections: misting or some form of containment may be appropriate▪ Damaged materials should be bagged, sealed, and thrown away▪ Adapt <i>EPA Guidelines Table 1</i> as a training tool <p>Cleanup</p> <ul style="list-style-type: none">▪ Refer to <i>EPA Guidelines</i>▪ Wet wipe and use HEPA vacuum▪ If using HEPA vacuum, use PPE <p>Prohibited Activities</p> <ul style="list-style-type: none">▪ Do NOT use bleach as a substitute for removal (be specific with state regulations and applicability); bleach also creates another hazard for the worker▪ Do NOT disturb suspect mold materials without respiratory protection▪ Do NOT use an air mover where dry materials can be disseminated▪ Do NOT just paint over mold contamination▪ Do NOT dry scrape off mold contamination
--

Figure 1: Water damage - cleanup and mold prevention from EPA's "Mold Remediation in Schools and Commercial Buildings" (March 2001).

This EPA table presents strategies to respond to water damage within 24-48 hours. These guidelines are designed to help avoid the need for remediation of mold growth by taking quick action before growth starts. If mold growth is found on the materials listed in **Table 1**, refer to EPA's Table 2 for guidance on remediation. Depending on the size of the area involved and resources available, professional assistance may be needed to dry an area quickly and thoroughly.

EPA Table 1: Water Damage - Cleanup and Mold Prevention	
Guidelines for Response to Clean Water Damage within 24-48 Hours to Prevent Mold Growth*	
Water-Damaged Material†	Actions
Books and papers	<ul style="list-style-type: none"> • For non-valuable items, discard books and papers. • Photocopy valuable/important items, discard originals. • Freeze (in frost-free freezer or meat locker) or freeze-dry.
Carpet and backing - dry within 24-48 hours§	<ul style="list-style-type: none"> • Remove water with water extraction vacuum. • Reduce ambient humidity levels with dehumidifier. • Accelerate drying process with fans.
Ceiling tiles	<ul style="list-style-type: none"> • Discard and replace.
Cellulose insulation	<ul style="list-style-type: none"> • Discard and replace.
Concrete or cinder block surfaces	<ul style="list-style-type: none"> • Remove water with water extraction vacuum. • Accelerate drying process with dehumidifiers, fans, and/or heaters.
Fiberglass insulation	<ul style="list-style-type: none"> • Discard and replace.
Hard surface, porous flooring§ (Linoleum, ceramic tile, vinyl)	<ul style="list-style-type: none"> • Vacuum or damp wipe with water and mild detergent and allow to dry; scrub if necessary. • Check to make sure underflooring is dry; dry underflooring if necessary.
Non-porous, hard surfaces (Plastics, metals)	<ul style="list-style-type: none"> • Vacuum or damp wipe with water and mild detergent and allow to dry; scrub if necessary.
Upholstered furniture	<ul style="list-style-type: none"> • Remove water with water extraction vacuum. • Accelerate drying process with dehumidifiers, fans, and/or heaters. • May be difficult to completely dry within 48 hours. If the piece is valuable, you may wish to consult a restoration/water damage professional who specializes in furniture.
	<ul style="list-style-type: none"> • May be dried in place if there is no obvious swelling and the seams are

Wallboard (Drywall and gypsum board)	<ul style="list-style-type: none"> intact. If not, remove, discard, and replace. Ventilate the wall cavity, if possible.
Window drapes	<ul style="list-style-type: none"> Follow laundering or cleaning instructions recommended by the manufacturer.
Wood surfaces	<ul style="list-style-type: none"> Remove moisture immediately and use dehumidifiers, gentle heat, and fans for drying. (Use caution when applying heat to hardwood floors.) Treated or finished wood surfaces may be cleaned with mild detergent and clean water and allowed to dry. Wet paneling should be pried away from wall for drying.

* If mold growth has occurred or materials have been wet for more than 48 hours, consult Table 2 guidelines. Even if materials are dried within 48 hours, mold growth may have occurred. Items may be tested by professionals if there is doubt. Note that mold growth will not always occur after 48 hours; this is only a guideline.

These guidelines are for damage caused by clean water. If you know or suspect that the water source is contaminated with sewage, or chemical or biological pollutants, then Personal Protective Equipment and containment are required by OSHA. An experienced professional should be consulted if you and/or your remediators do not have expertise remediating in contaminated water situations. Do not use fans before determining that the water is clean or sanitary.

† If a particular item(s) has high monetary or sentimental value, you may wish to consult a restoration/water damage specialist.

§ The subfloor under the carpet or other flooring material must also be cleaned and dried. See the appropriate section of this table for recommended actions depending on the composition of the subfloor.

Recommendations for trainers

- 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.
- The generic curriculum should be tailored to individual needs, management concerns, local concerns, etc.
- This training may be potentially combined with required hazard communication training to reduce costs and scheduling difficulties.
- The maintenance training course is appropriate for other building trades workers who come into intermittent contact with mold in the course of their work such as utility workers.
- Time permitting, training should include other worksite safety hazards that the worker will come into contact with when addressing mold problems. Avoiding electrical shock when washing surfaces, avoiding contact with corrosive cleaning agents, and not disturbing asbestos are examples.
- Mold remediation of HVAC systems is a highly specialized skill requiring specialized training, such as that provided by NADCA. 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; and
 3. when it is appropriate to recommend that HVAC mold remediation workers be hired.

Representatives from the International Union of Operating Engineers, which represents licensed building operators, provided a minority opinion that it was not realistic to recommend advanced HVAC training for maintenance workers who will be dealing with the minor amounts of mold growth routinely encountered inside ventilation systems. They proposed the following training for maintenance staff who encounter less than 10 square feet of mold in ventilation systems.

Table 10. Low-level HVAC mold maintenance work course.

(Never to exceed 10 square feet in size)

1. Respiratory Protection in accordance with OSHA respiratory protection standard (29 CFR 1910.134) (e.g., use of the N95 disposable respirator)	2 hours
2. Proper PPE selection, i.e. gloves and eye protection	0.5 hours
3. Area containment to avoid mold from spreading to other areas. How to create a positive or negative pressure with your facilities HVAC system and the benefits of doing so. Mold suppression methods. Lockout/tag out.	1 hour
4. Removal of contaminated material and proper disposal, discussion on the variety of biocides used by HVAC manufactures.	0.75 hours
5. Final area cleanup using a HEPA vacuum and cleaned with a damp cloth and/or mop with a detergent solution.	0.75 hours
6. Areas left to dry and visibly free from contamination and debris.	0.5 hours
7. Prevention fixing-the-leak discussion on the causes of HVAC contamination, humidification, dehumidification, and condensation.	1.5 hours
8. Performance based test.	1 hour

Additionally, if written verification is available that a worker has attended, and has successfully completed a 40-hour HAZWOPER, an OSHA 500, or an OSHA 501 course, the classroom duration should be reduced to four hours.

2.4.1.3 Mold remediation worker training

General caution to trainers

Mold is not a carcinogen like asbestos, nor a heavy metal like lead. Consequently, asbestos and lead paint abatement trainers need to be careful not to overlay other training on mold and describe terms, work practices, and personal protections that are inappropriate to mold remediation. Examples of this problem include 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 turn instead to unqualified contractors whose faulty remediation may put the owner and others at risk.

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.

Recommended course for mold remediation workers

Table 11. Suggested training topics and instructional methods for mold remediation workers (excluding HVAC).

Sections	Topic	Instructional Method	Suggested time (hours)
1	Introduction to course <ul style="list-style-type: none"> ▪ 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 <ul style="list-style-type: none"> ▪ Nature of hazard ▪ Mold remediation materials (chemicals) ▪ Hazard to other trades and bldg occupants ▪ Construction safety 	Classroom	3.0
5	PPE <ul style="list-style-type: none"> ▪ 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, demonstration, and hands-on	2.0
6	Respiratory protection <ul style="list-style-type: none"> ▪ Requirements of 29 CFR 1910.134 ▪ Respirator types (APR, PAPR) ▪ Respirator selection ▪ Use, care, limitations, inspection, and cleaning ▪ Fit checking, positive and negative 	Classroom, demonstration, and hands-on	2.0
7	PPE/Respirator exercise <ul style="list-style-type: none"> ▪ 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 <ul style="list-style-type: none"> ▪ Remediation plan ▪ Tasks, equipment, and materials ▪ Safety and health work practices including worker & waste decontamination for large and small-scale projects ▪ Engineering controls <ul style="list-style-type: none"> ○ Containments ○ Negative Air ○ Clean ○ HEPA vacs ▪ Remediation work practices 	Classroom and demonstration	3.0
9	Mold remediation work practices, procedures, and methods exercise <ul style="list-style-type: none"> ▪ 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

2.4.2 Delivery methods

The final selection of the actual delivery method – written materials, online training, and audiovisuals – is the decision of the trainer, but should reflect good adult learning principles. This guidance supports the recommendation of ANSI Z490.1 that whatever delivery method is chosen, it shall ensure adequate feedback mechanisms for trainee questions and concerns.

The following table represents an example of the delivery methods the workshop participants suggested trainers consider when delivering awareness training.

Table 12. Recommended training techniques for the maintenance training course.

Techniques	Comments
Use 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	This is a key element of the NIEHS WETP training approach.
Use 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

2.4.3 Time allocation

Mold remediation worker course

The general consensus was that mold remediation training should be three days (21 hours) in duration, and that to keep trainees interested and engaged, 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.

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.”

He recommended 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

Maintenance worker awareness training

The duration of maintenance worker training should be flexible and appropriate to the needs of the trainees. Considering that this is a voluntary guideline and cost is a concern, employers may be more willing to send employees to relatively short sessions. 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 later selected to be trained as a remediation worker, employers should be encouraged to support longer duration training.

Mold assessor training

Training for assessors, like maintenance workers, should be between 30 minutes and 2 hours, depending on their familiarity with donning, doffing, inspecting, and cleaning respirators as well as performing respirator fit checks.

2.4.4 Evaluation strategy

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

3.0 REFERENCES

American Industrial Hygiene Association. (2004). Assessment, remediation, and post-remediation verification of mold in buildings. AIHA Guideline 3 – 2004. Fairfax, VA: AIHA.

American National Standards Institute. (2001). Criteria for accepted practices in safety, health, and environmental training. ANSI Z-490.1-2001. Des Plaines, IL: American Society of Safety Engineers.

Health Canada. (1995, June). Fungal Contamination in Public Buildings: A Guide to Recognition and Management. Federal-Provincial Committee on Environmental and Occupational Health, Environmental Health Directorate. Ottawa, Ontario, Canada. [Online]. Available: http://www.hc-sc.gc.ca/hecs-sesc/air_quality/pdf/fungal.pdf

Health Canada. (2004). Fungal Contamination in Public Buildings: Health Effects and Investigation Methods. Federal-Provincial Committee on Environmental and Occupational Health, Environmental Health Directorate. Ottawa, Ontario, Canada. [Online]. Available: http://www.hc-sc.gc.ca/hecs-sesc/air_quality/pdf/fungal_contamination.pdf

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

National Institute for Occupational Safety and Health (NIOSH). (2003). Health Hazard Evaluation Report: Somerset County Assistance Office, Somerset, PA. (No. HETA #2001-0067-2896). Cincinnati, OH: Goe, S., Park, J., Choe, K., Akpınar-Elci, M., & Kreiss, K.

OSHA. (2003, Oct.14). A brief guide to mold in the workplace. Directorate of Science, Technology and Medicine. SHIB 03-10-10. [online] Available: <http://www.osha.gov/dts/shib/shib101003.html>

Rautiala, S., Reponen, T., Hyvarinen, A. et al. (1996). Exposure to airborne microbes during the repair of moldy buildings. Am. Ind. Hyg. Assoc. J. 57:279-284.

Venkatesan, P., Perfect, J.R., & Myers, S.A. (2004, Jan.) Evaluation and management of fungal infections in immunocompromised patients. Dermatologic Therapy. 18.1: 44.

4.0 BIBLIOGRAPHY

American Bar Association. (2003, Fall). The Brief, Tort Trial and Insurance Practice Section. American Bar Association, 33 No. 1.

American College of Occupational and Environmental Medicine. (2002, October 27). Evidence-Based Statement: Adverse Human Health Effects Associated with Molds in the Indoor Environment. [Online]. Available: <http://www.acoem.org/guidelines/pdf/mold-10-27-02.pdf>

American Conference of Governmental Industrial Hygienists. (1999). Bioaerosols: Assessment and control. Macher, J. (Ed.). Cincinnati, OH: American Conference of Governmental Industrial Hygienists.

American Industrial Hygiene Association. (2003, September 3). The facts about mold: For the professional. [online]. Retrieved October 6, 2003. Available: <http://www.aiha.org/governmentaffairs-pr/html/mold-professional.htm>.

American Society of Safety Engineers. (2003, Nov. 5). American Society of Safety Engineers to Develop Mold Standard for Worker Protection. American Society of Safety Engineers. Press Release. Des Plaines, IL.

Anyanwu, E., Campbell, A.W., Vojdani, A., Ehiri, J.E., & Akpan, A.I. (2003, November). Biochemical changes in the serum of patients with chronic toxigenic mold exposures: a risk factor for multiple renal dysfunction. Scientific World Journal, 3(11), 1058-1064.

Carlson. (1992, September). Fungal Glossary. Retrieved October 2, 2003 from University of Minnesota Web site: <http://www.dehs.umn.edu/iaq/fungus/glossary.html>

Chapman, J.A., Terr, A.I., Jacobs, R.L., Charlesworth, & Bardana, Jr. (2003, September). Toxic mold: phantom risk vs. science. Ann Allergy Asthma Immunol, 91(3), 222-232.

Davis, P.J. (March 2001). Mold, Toxic Molds and Indoor Air Quality. CRB Note. Vol. 8 No. 1. California Research Bureau, California State Library. Prepared at the Request of Assemblymember Alan Lowenthal

Eduard, W., Sandven, P., & Levy, F. (1993, August). Serum IgG antibodies to mould spores in two Norwegian sawmill populations: relationship to respiratory and other work-related symptoms. Am J Ind Med, 24(2), 207-222.

Epling, C.A., Rose, C.S., Martyny, J.W., Zhen, B., Alexander, W., Waldron, J.A., & Kreiss, K. (1995, August). Endemic work-related febrile respiratory illness among construction workers. Am J Ind Med, 28(2), 193-205.

Fung, F. & Hughson, W.G., (2003, July). Health effects of indoor fungal bioaerosol exposure. Appl Occup Environ Hyg., 18 (7): 535-544.

Fung, F., Tappen, D., & Wood, G. (2000, December). Alternaria-associated asthma. Appl Occup Environ Hyg, 15(12), 924-927.

Gautrin, D., Vandenplas, O., DeWitte, J.D., L'Archeveque, J., Leblanc, C., Trudeau, C., Paulin, C., Arnoud, D., Morand, S., Comtois, P., et al. (1994, February). Allergenic exposure, IgE-mediated sensitization, and related symptoms in lawn cutters. J Allergy Clin Immunol, 93(2): 437-445.

Gottlieb, S.J., Garibaldi, E., Hutcheson, P.S., and Slavin, R.G. (1993, December). Occupational asthma to the slime mold *Dictyostelium discoideum*. IJ. Occup Med, 35(12): 1231-1235.

Hardin, B.D., Kelman, B.J., and Saxon, A. (2003, May). Adverse human health effects associated with molds in the indoor environment. J Occup Environ Med, 45(5): 470-478.

Health Canada. (1995, June). Fungal Contamination in Public Buildings: A Guide to Recognition and Management. Federal-Provincial Committee on Environmental and Occupational Health, Environmental Health Directorate. Ottawa, Ontario, Canada. [Online]. Available: http://www.hc-sc.gc.ca/hecs-sesc/air_quality/pdf/fungal.pdf

Health Canada. (2004). Fungal Contamination in Public Buildings: Health Effects and Investigation Methods. Federal-Provincial Committee on Environmental and Occupational Health, Environmental Health Directorate. Ottawa, Ontario, Canada. [Online]. Available: http://www.hc-sc.gc.ca/hecs-sesc/air_quality/pdf/fungal_contamination.pdf

Institute of Inspection, Cleaning and Restoration Certification (IICRC). (1999). S500 Standard and Reference Guide for Professional Water Damage Restoration (2nd ed.). Vancouver, WA.

Institute of Inspection, Cleaning and Restoration Certification (IICRC). (2003). S520 Standard and Reference Guide for Professional Mold Remediation (1st ed.). Vancouver, WA.

Institute of Medicine of the National Academies. (2004). Damp Indoor Spaces and Health. Washington, D.C.: National Academies Press.

Jaakkola, M.S., Nordman, H., Piipari, R., Uitti, J., Laitinen, J., Karjalainen, A., Hahtola, P., & Jaakkola, J.J. (2002, May). Indoor dampness and molds and development of adult-onset asthma: A population-based incident case-controlled study. Environmental Health Perspectives, 110(5): 543-547.

Johanning, E. Introduction to the Proceedings of the Third International Conference on Fungi, Mycotoxins, and Bioaerosols: Health Effects, Assessment, Prevention, and Control.

Kuhn, D.M. and Ghannoum, M.A. (2003, January). Indoor mold, toxigenic fungi, and *Stachybotrys chartarum*: Infectious disease perspective. Clinical Microbiology Reviews, 16(1): 144-172.

Miller J.D. (2001). Technical Bulletin 823. National Council for Air and Stream Improvement. Research Triangle Park, NC.

Miller, J.D., Rand, T.G., and Jarvis, B.B. (August, 2003). *Stachybotrys chartarum*: cause of human disease or media darling? Medical Mycology, 41: 271-291.

Mirer, F. (2002). Hypersensitivity Pneumonitis. UAW Health and Safety Department Newsletter Number 3.

Morey, P.P. (2000). Cleaning Procedures for Mold. Proceedings of Healthy Buildings 2000, Vol. 3, pages 39-48. [Online]. Retrieved October 3, 2003. Available: http://www.aeris.org/Cleaning_Procedures_for_Mold.pdf

National Institute for Occupational Safety and Health (NIOSH). (2003). Health Hazard Evaluation Report: Somerset County Assistance Office, Somerset, PA. (No. HETA #2001-0067-2896). Cincinnati, OH: Goe, S., Park, J., Choe, K., Akpınar-Elci, M., & Kreiss, K.

NIOSH. (2002). Health Hazard Evaluation Report: Benefits Healthcare, Great Falls, Montana. (HETA 2000-0255-2868). Cincinnati, OH: Cox-Ganser, J. & Rao, C.Y.

NIOSH. (2001). Health Hazard Evaluation Report: Independent Leather EPA Superfund Site (No. HETA 2001-0316-2865). Cincinnati, OH: Delaney, L.

NIOSH. (2002). Health Hazard Evaluation Report: Nassau Community College, Garden City, New York. (HETA 2000-0168-2871). Cincinnati, OH: Schleiff, P.L., Park, J.H. and Yereb, D.J.

NIOSH. (n.d.) Health Hazard Evaluation Report: Kaiser Northlake Atrium, Atlanta, Georgia. (HETA 92-0244-2373). Cincinnati, OH: Deitchman, S., Martinez, K., & Upham, S.

New York City Department of Health & Mental Hygiene, Bureau of Environmental & Occupational Disease Epidemiology. (2000). Guidelines on Assessment and Remediation of Fungi in Indoor Environments [Online]. Available: <http://www.ci.nyc.ny.us/html/doh/html/epi/moldrpt1.html>.

Occupational Safety and Health Administration (OSHA).(October 10, 2003) A brief guide to mold in the workplace. [Electronic Version] (SHIB 03-10-10). Washington, DC: U.S. Department of Labor.

Rylander, R., Thorn, J., and Attefors, R. (1999). Airways inflammation among workers in a paper industry. Eur Resp J 13: 1151-1157.

Schleiff, P.L., Park, J., and Kreiss, K. (2003). Building-related respiratory disease in college employees. American Journal of Respiratory Critical Care Medicine, 167 (7), A503.

Seuri, M., Husman, K., Kinnunen, H., Reiman, M., Kreuz, R., Kuronen, P., Lehtomaki, K., and Paananen, M. (2000, September). An outbreak of respiratory diseases among workers at a water-damaged building -- a case report. Indoor Air, 10(3), 138-145.

Sigler, L., Abbott, S.P., and Gauvreau, H. (1996). Assessment of worker exposure to airborne molds in honeybee overwintering facilities. American Industrial Hygiene Association Journal (AIHA). 57 (5).

U.S. Environmental Protection Agency. (1994). Indoor air pollution: An introduction for health professionals. U.S. Government Printing Office Publication No. 1994-523-217/81322. [Online]. Available: <http://www.epa.gov/iaq/pubs/hpguide.html>.

U.S. Environmental Protection Agency. (2001, March 25). Mold Remediation in Schools and Commercial Buildings. [Online]. Retrieved October 2, 2003, from <http://www.epa.gov/iaq/molds/images/moldremediation.pdf>.

Van Emon, J.M., Reed, A.W., Yike, I., and Vesper, S.J. (2003, June). ELISA measurement of stachylysin in serum to quantify human exposure to the indoor mold *Stachybotrys charatarum*. J Occup Environ Med, 45(6), 582-591.

Wijnands, L.M., Deisz, W.D., and van Leusden, F.M. (2000, September). Marker antigens to assess exposure to molds and their allergens. I. *Aspergillus fumigatus*. Allergy, 55(9), 850-855.

5.0 APPENDICES

Appendix A. List of Participants from January 2004 Manhattan Workshop

<u>Contact</u>	<u>Organization</u>	<u>E-mail Address</u>
Rusty Amarante	Belfor Remediation	rusty.amarante@us.belfor.co
Jack Anderson	National Center for Health Housing	janderson@enterprisefoundation.org
Eula Bingham, PhD	University of Cincinnati	eula.bingham@uc.edu
Denise Bland Bowles	AFSCME International	boc@afscme.org
Patrick Brown	OAI, Inc.	pbrown@oaiinc.org
Jack Caravanos, DrPH, CIH	Hunter College Urban Public Health Program	jcaravan@hunter.cuny.edu
Eugene C. Cole, DrPH	Brigham Young University	gene_cole@byu.edu
Vincent M. Coluccio	Vincent M. Coluccio & Associates, Inc.	VColuccio@hvc.rr.com
Jim Cone, MD, MPH	New York City Department of Health and M...	jcone@health.nyc.gov
Charlie Cook	BMS CAT Remediation	ccook@bmscat.com
Larry Cooper	Textile Consultants	textilecon@aol.com
Bryan Cranston	OSHA	
Christopher D'Andrea, MS	New York City Department of Health and M...	cdandrea@health.nyc.gov
Gene Daniels	CPWR	homerblue@aol.com
Albert DeVita	Laborers-AGC Education and Training Fund	aldevida@laborers-agc.org
Denny Dobbin	Society for Occu. and Env. Health	rdobbin@worldnet.att.net
Richard E. Dwyer	New York District Council of Carpenters	rdwyer@nyccarpenterslm.org
Donald J. Garvey, CIH	St Paul Cos.	don.garvey@stpaul.com
Dr. Frank Goldsmith	Local 100 -- Transport Workers of America	crinum@juno.com
David M. Governo, Esq.	Governo Law Firm LLC	dgoverno@GOVERNO.COM
Vicki Hawkins, CIH	USACHPPM (MCHB-TS-OFS)	Vickie.Hawkins@APG.AMEDD.ARMY.mil
Steve M. Hayes, PE	Gobbell Hays Partners, Inc.	shays@ghp1.com
Michael Hejazi, PhD	Occupational Safety And Health Administration	hejazi.michael@dol.gov
Michael Hodgson, MD, MPH	Veterans Health Administration	muh7@mail.va.gov
Jim Holland, REA	Restoration Consultants	jholland@restcon.com
Elliot Horner, PhD	Air Quality Sciences, Inc.	ehorner@aqsc.com
David Jacobs, CIH	U.S. Dept. of Housing & Urban Development	david_e_jacobs@hud.gov
Susan Klitzman, DrPH	Hunter College Urban Public Health Program	sklitzma@hunter.cuny.edu
Laura S. Kolb	USEPA Headquarters	kolb.laura@epa.gov
Mary Ann Latko, CIH	Aon Safetylogic	mary_ann_latko@safetylogic.com
Lawrence Lee	Argus Pacific, Inc.	larrylee@arguspacific.com
Bruce Lippy, PhD	National Clearinghouse	blippy@michaeldbaker.com
Kevin MacDonald	NW Laborers-Emp Training Trust	kmacdonald@nwlaborerstraining.org
David Masrud	A.T. Industries, Inc.	dmasrud@atindustriesinc.com
John McGrail	NYC District Council of Carpenters	YankeeCarpenter@aol.com
James Melius, MD	NY State Laborers' Health and Safety Fund	info@nysliuna.org
J. David Miller, PhD	Carleton University	David_Miller@carleton.ca
Clifford Mitchell, M.D.	Johns Hopkins Bloomberg	cmitchel@jhsph.edu
John Moran	National Clearinghouse	jjbmoran@aol.com
Alan J. Neumann, Ph.D.	ATC Associates, Inc.	neumann88@atc-enviro.com
David Newman	NYCOSH	dave@nycosh.org
Michael O'Reilly	Tradewins	moreilly@tradewindsenvironmental.com
Ted Outwater	NIEHS	outwater@niehs.nih.gov

Glenn Paulson, Ph.D.	UMDNJ School of Public Health	paulsogl@UMDNJ.EDU
Terri A. Pearce, Ph.D.	NIOSH/DRDS/FSB	TPearce@cdc.gov
Judith A. Reilly, CIH	FEMA	Judith.Reilly@dhs.gov
Coreen A. Robbins, Ph.D., CIH	GlobalTox	crobbins@globaltox.com
Kevin Shane	Marsh Risk & Insurance Services	Kevin.Shane@marsh.com
Richard Shaughnessy, PhD	University of Tulsa	Rjstulsau@aol.com
REM, CIE Steven Silicato	Marcor Environmental Remediation, Inc.	silicato@marcor.com
John Tiffany, MS	Tiffany-Bader Environmental Inc.	TBEnvir@aol.com
Douglas B. Trout, MD	NIOSH, R-10	dvt1@cdc.gov
Ira Wainless	OSHA	wainless.ira@dol.gov
Paul Watson, CIH	ATC Associates, Inc.	watson62@atc-enviro.com
Donald Weekes, CIH	Abacus Environmental	dweekes@abacusenvironmental.com

Appendix B. Work Shop 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. Panelists: J. David Miller, Ph.D., Carleton University Douglas B. Trout, MD, MHS, NIOSH Michael O'Reilly, Tradewins	President's Conf. Room 1700E
11:30 – 12:30	Lessons Learned Panel: Worker Protection During Maintenance and Remediation Moderator: Eugene Cole, Dr.P.H., Brigham Young University Panelists: Jim Holland, REA, Restoration Consultants Steve M. Hays, PE, Gobbell Hays Partners, Inc. Terri Pearce, Ph.D., NIOSH	President's Conf. Room 1700E
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

Appendix C. Principles of Adult Education

These principles are taken from the newly updated 2005 NIEHS draft document, *Minimum Health and Safety Training Requirements Criteria: Guidance for Hazardous Waste Operations and Emergency Response (HAZWOPER) and All-Hazards Disaster Prevention, Preparedness, and Response*. The vast majority of the WETP awardees students are adults who already possess the knowledge, skills, and abilities to work in their current occupations such as fire fighters, EMS, rail workers, construction trades, chemical process operators, utilities, and the like. The objective of HAZWOPER training is to provide the additional knowledge, skills, and abilities specific to this high-hazard environment to permit these workers to perform in their occupation in a safe manner in the unique HAZWOPER setting. The ability to effectively achieve this in the instructional setting requires that instructional materials, teaching techniques and methods, the instructional staff, and the instructional setting are based upon sound and proven principles of adult education that are tailored to the individual awardees training target audience.

The following describe the basic principles of adult education:

- Adults learn best by doing. This is the basic foundation of the OSHA policy with respect to computer-based training: knowledge alone is insufficient in the HAZWOPER environment particularly without demonstration of the necessary skills in hands-on exercises.
- The training environment must be conducive to learning. HAZWOPER training has two distinct learning environments: the core off-site training and the site-specific training. The off-site training must provide the knowledge required to perform the work in the HAZWOPER environment and verify the satisfactory attainment of the related skills. On-site training is intended to verify that the student has gained the necessary knowledge and skills and can apply them in the actual workplace. Approaches to the on-site component vary according to the occupation, of course.
- New skills should be based upon current skills. The new skills required by a fire fighter, heavy equipment operator, or laborer in order for them to safely perform their work in a HAZMAT or hazardous waste cleanup operation must be constructed on the individual's current occupational skills. You train the heavy equipment operator, for example, to operate his/her equipment in which he/she is already qualified under the unique circumstances of the hazardous waste cleanup site. This approach greatly facilitates learning, peer interaction, and retention as well.
- Adults learn best when the training objectives and goals are relevant in their "real working world."
- Adult learners need direct experience to apply new skills in the work environment. This principle is the underpinning of the need for the hands-on component of skills training. Scores on a knowledge test are not a satisfactory indication that new skills can be effectively and safely applied in the work setting.
- Adults need frequent non-judgmental feedback. Adult learners need to know how they are doing in a manner that is not judgmental. Training must respect students existing knowledge, skill, experiences, and circumstances. Opportunities must be provided for constructive feedback to each student in the training course.
- Small group activities are important to adult learners. This approach provides an opportunity for individual learners to share and discuss what they have learned with their peer students.
- Adult learners respond better to learning when they have the opportunity to interact with peers. The WETP has recognized the critical importance of peer instructors since the inception of the program, and continues to do so.
- Adult learning must be reinforced. The knowledge and skills learned for work in the HAZWOPER environment must be retained if such are to be of value to the student. This is the primary purpose of refresher training, which must include critical skills aspects. Site-specific

training and periodic drills also serve as reinforcement mechanisms as newly learned knowledge and skills are applied in an actual or simulated work environment.

- Adult learning utilizing computer-based training may be challenging in itself to some adult learners. Not all adult learners are fluent in the effective use and application of technology-enhanced training tools, such as computer-based or web-based methods. The students comfort level and fluency with technology must be considered before choosing technology-enhanced instructional methods and also during curriculum design.
- Adult education is empowering. The knowledge, skills, and experiences adults gain in education programs should facilitate their becoming and remaining active participants in determining and improving the conditions under which they work and live.