INDOOR AIR QUALITY PROGRAM UPDATE

ESSEX COUNTY SCHOOLS OF TECHNOLOGY

2022-2023

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Essex County Schools of Technology

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1.0 POLICY AND ADMINISTRATION

1.1 This notice is to inform employees that the Essex County Schools of Technology complies with the Public Employees Occupational Safety and Health (PEOSH) Program, Indoor Air Quality (IAQ Standard (N.J.A.C. 12:100-13) (2007), which was proposed on December 18, 2006 and adopted on May 21, 2007. A copy of the IAQ Standard is included in Appendix A.

1.2 The Essex County Schools of Technology recognizes that good indoor air quality is essential to an employee's health and productivity. We have established the following policies to promote good indoor air quality for employees in our School District facilities. These policies follow the requirements established by the PEOSH IAQ Standard as it applies to all of our school district facilities.

1.3 The Department of Buildings and Grounds under the direction of the Facilities Director is responsible for matters pertaining to Environmental Health and Safety in general and Indoor Air Quality in particular. In addition, the School Principals act as IAQ Building Coordinators and play an important role, facilitating the exchange of information between Facilities Director and the building occupants. A list of current Building Coordinators is included in Section 2.3.

2.0 PROGRAM IMPLEMENTATION BY THE ESSEX COUNTY SCHOOLS OF TECHNOLOGY

2.1 This Written Indoor Air Quality Program applies to all school district facilities within the Essex County Schools of Technology.

2.2 IAQ Program Designated Person: As required by the New Jersey PEOSH Indoor Air Quality Standard (N.J.A.C. 12:100-13), a person has been designed as the person responsible by the Essex County Schools of Technology' compliance with the standard. This person is:

NAME	TITLE	CONTACT INFORMATION
Bruce Scrivo	Director of Facilities & Operations	Essex County Schools of Technology 60 Nelson Place, 1 North Newark, NJ 07102 973-412-2258 bscrivo@essextech.org

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2.3 Building Coordinators: This table lists the person designated by the IAQ Program Designated Person to act as Building Coordinators in the management and reporting of Indoor Air Quality in each school district facility and to also assist in compliance with the New Jersey PEOSH Indoor Air Quality Standard (N.J.A.C. 12:100-13):

SCHOOL DISTRICT FACILITY	ADDRESS	PRINCIPAL/BUILDING COORDINATOR
Donald M. Payne, Sr. School of Technology	498-544 West Market Newark, NJ 07107	Eric Love
Essex County Newark Tech Campus	209 Franklin Street Bloomfield, NJ 07003	Carmen Morales
West Caldwell Tech Campus	620 Passaic Avenue West Caldwell, NJ 07006	Ayisha Ingram-Robinson

2.4 The IAQ Program Designated Person is the Essex County Schools of Technology's employee who has been trained and given the responsibility by the Essex County Schools of Technology to make routine visual inspections, oversee preventive maintenance programs, and maintain required visual inspections, oversee preventive maintenance programs, and maintain required records in order to ensure compliance with the IAQ Standard. The IAQ Program Designated Person is also assigned to receive employee concerns/complaints about indoor air quality, conduct investigations, facilitate repairs or further investigation as necessary, maintain required records, and updates the written program annually.

3.0 PREVENTIVE MAINTENANCE SCHEDULE

3.1 Preventive maintenance schedules that follow manufacturers' specifications or industry accepted practices are in place for heating, ventilation and air conditioning (HVAC) systems in this workplace. Scheduled maintenance of the HVAC systems includes: checking and/or changing air filters, checking and/or changing belts, lubrication of equipment parts, checking the functioning of motors and confirming that all equipment is in working order. Damaged and inoperable components will be repaired or replaced as appropriate, and a work order to show actions taken will be completed. In addition, any parts of this system with standing water will be checked visually for microbial growth.

4.0 RECORDKEEPING

4.1 Documentation of preventive maintenance and repairs to HVAC systems are retained for at least 3 years and include the following information:

A. Date that preventive maintenance or repair was performed
B. Person or company performing the work
C. Documentation of:
    i. Checking and/or changing air filters.
    ii. Checking and/or changing belts.
    iii. Lubrication of equipment parts.
    iv. Checking the functioning of motors.
    v. Confirming that equipment is in operating order.
    vi. Checking for microbial growth in condensate pans or standing water.

D. Documentation of preventive maintenance and work orders for repairs are maintained by the IAQ Program Designated Person.

E. Documentation for repairs performed by outside contractors will be maintained by the IAQ Program Designated Person.

F. Documentation for construction and renovation work will be maintained by the IAQ Program Designed Person.

5.0 INDOOR AIR QUALITY COMPLIANCE DOCUMENTS

5.1 The Essex County Schools of Technology will make reasonable efforts to obtain and maintain copies of IAQ compliance documents. Available IAQ compliance documents will be maintained by the IAQ Program Designated Person and will be available to PEOSH during an inspection. These documents include:

A. As-built construction documents. IF APPLICABLE
B. HVAC system commissioning reports, IF APPLICABLE
C. HVAC systems testing, adjusting, and balancing reports, IF APPLICABLE
D. Operations and maintenance manuals, IF APPLICABLE
E. Water treatment logs, IF APPLICABLE
F. Operator training materials, IF APPLICABLE

6.0 INVESTIGATING COMPLAINTS

6.1 If employees, students, or visitors to the Essex County Schools of Technology begito experience health symptoms that they believe are related to poor indoor air quality, they should notify the IAQ Program Designated Person or his designee so that their concerns can be documented and investigated.

6.2 In addition, individuals should report to the Nurses Office in each school district facility (for students) or the Principal's Office (for employees).

6.3 The IAQ Program Designated Person has been trained and given the authority to conduct basic indoor air quality complaint investigations. In many cases, IAQ complaints can be resolved by the IAQ Program Designated Person.

6.4 The Essex County Schools of Technology has contracted with Rullo & Juillet Associates, Inc. to investigate occupant complaints on an as-needed basis.

7.0 RESPONDING TO SIGNED EMPLOYEE COMPLAINTS TO PEOSH

7.1 If the Essex County Schools of Technology receives a written notification from PEOSH that a signed employee complaint has been filed with PEOSH, the IAQ Program Designated Person will conduct an inquiry into the allegations. The findings of the initial inquiry and any planned actions will be provided in a written response to PEOSH within fifteen (15) working days of receipt. Copies of all responses to PEOSH will be maintained by the IAQ Program Designated Person.

8.0 NOTIFICATION OF EMPLOYEES

8.1 Employees and other building occupants (e.g. students, visitors) will be notified using a variety of means when work is to be performed on the building or other activities that may introduce air contaminants into the building. Notification will occur at least three working days in advance, or as soon as practable in emergency situations.

8.2 This notification will be in writing (either hardcopy or via broadcast email announcements) and will identify the planned project and the start date. The notification will also include information on how to access Material Safety Data Sheets (MSDS), Safety Data Sheets (SDS) or other hazard information, as well as who to contact if problems arise from the project.

8.3 For construction and renovation projects, maintenance and repair work conducted by the Buildings and Grounds Department, the notification will come from the IAQ Program Designated Person.

8.4 The IAQ Program Designated Person will maintain records of this notification for compliance recordkeeping purposes.

9.0 CONTROLLING MICROBIAL CONTAMINATION

9.1 Uncontrolled water intrusion into buildings (roof leaks, flooding, pipe condensation, plumbing leaks, or sewer backups) has the potential to support microbial growth. All employees should routinely observe their workplace for evidence of water intrusion (e.g. roof leaks, pipe leaks). Employees should notify their Building coordinator (Principal) immediately if they observe evidence of water intrusion. The Building Coordinator will then contact the IAQ Program Designated Person so that appropriate corrective action can be taken. Ceiling tiles, carpet, and wall boards not dried within 48 hours may be removed as directed by the IAQ Program Designated Person.

10.0 CONTROLLING AIR CONTAMINANTS

10.1 Outside Air- The IAQ Program Designated Person will identify the location of outside air intakes and identify potential contamination sources nearby, such as loading docks or other areas where vehicles idle, near exhaust stacks, or vegetation. Periodic inspections will be conducted to ensure that the intakes remain clear of potential contaminants. If contamination occurs, the IAQ Program Designated Person will eliminate the contaminant source and/or relocate the intake.

10.2 Point Source Contaminants- The IAQ Program Designated Person will identify point sources of contamination and arrange to capture and exhaust these sources from the building using local exhaust ventilation. Exhaust fans will be periodically inspected from outside air intakes.

11.0 TEMPERATURE AND ENVIRIONMENTAL CONDITIONS

11.1 Normal Operations

A. Climate Control: Except in research areas or other locations that require special climate controls, all centrally controlled facilities (classrooms, offices, etc.) that have a mechanical ventilation system capable of regulating temperature are operated within the range of 68 degrees-79 degrees F. The seasonal set points are: heating to a range of 68 degrees - 72 degrees F in winter and cooling to a range of 74 degrees- 78 degrees F

in summer when occupied. For energy conservation, unoccupied spaces may be set back to 55 degrees in winter and 90 degrees F in summer, unless there are special requirements for research or other special needs.

B. Environmental Conditions: Every reasonable effort will be made to ensure indoor air quality is maintained at suitable levels (carbon dioxide level, free of airborne irritants and mold), with the appropriate code-mandated mixture of fresh air from outside.

11.2 Problem Conditions

A. Climate control: If an Essex County Schools of Technology employee believes that a classroom, office, or lab is extremely uncomfortable, they should notify the Building Coordinator and the IAQ Program Designated Person at all times who will investigate the complaint and make every reasonable effort to correct the problem as quickly as possible.

B. If the problem can be corrected within a reasonable length of time, the Building Coordinator and/or building occupants will be notified directly. If the problem cannot be corrected within a reasonable length of time, and the IAQ Program Designated Person determines that the conditions present a potential hazard to student or employee health and safety, the following options may be executed at the discretion of the Principal and/or Superintendent:

i. Classes may be relocated to another more comfortable location, if one is available.

ii. In extreme conditions (i.e. where ambient room temperature rises above 85 degrees F or drops below 62 degrees F) the Building Coordinator in consultation with the Principal and/or Superintendent, may cancel classes or dismiss employees (other than essential employees) without penalty.

11.3 Environmental Conditions

A. Personal health and safety: If an Essex County Schools of Technology employee believes that environmental conditions (other than building temperature) may pose an immediate hazard to health and safety, the IAQ Program Designated Person should be notified immediately.

B. After receiving notification, IAQ Program Designated Person will be dispatched to investigate the complaint and make a determination regarding necessary actions, including notifying Emergency Services and external environmental consultants, if required.

C. If a problem can be corrected by Building Custodial staff within a reasonable length of time, the Building Coordinator and/or building occupants will be notified directly. If the problem requires further investigation (e.g. environmental testing for mold) or cannot be corrected within a reasonable length of time, the following options may be executed at the discretion of the IAQ Program Designated Person in consultation with the Principal and/or Superintendent:

i. Offices may be relocated to another more comfortable location, if one is available.
ii. In all cases, the IAQ Program Designed Person in consultation with the environmental consultant will make a recommendation regarding the suitability for use of the area.

D. An individual believed to be experiencing illness caused by environmental conditions should see their respective physician for evaluation and treatment.

11.4 Property Protection:

A. If an employee believes that the Essex County Schools of Technology property- including but not limited to building structure, technology, musical instruments, supplies, and other equipment- may be damaged by environmental conditions, the employee should notify the Building Coordinator promptly. After receiving notification, the Building Coordinator will determine the validity of the complaint and make a determination regarding necessary actions, including notifying the IAQ Program Designated Person.

B. If a problem can be corrected by Building Custodian staff within a reasonable length of time, the Building Coordinator will be notified directly. If the Problem requires further investigation or cannot be corrected within a reasonable length of time, the property may be relocated to another location, if one is available.

12.0 IAQ DURING CONSTRUCTION OR RENOVATION

12.1 Maintenance, renovation work and/or construction projects that have the potential to result in the diffusion of dust, stone and other small particles, toxic gases or other potentially harmful substances into occupied areas in quantities hazardous to health will be controlled in order to minimize employee exposure.

12.2 For construction and renovation projects managed by the Buildings and Grounds Department, notification will come from the IAQ Program Designated Person who will be responsible for maintaining appropriate indoor air quality throughout the project.

12.3 In either case, the appropriate personnel will utilize the following protocol to assure that employees' exposure to potentially harmful substances is minimized:

A. Obtain MSDS/SDS's for all products to be utilized on the project and maintain on-site throughout the duration of the project.
B. Choose the least toxic product that is technically and economically feasible.
C. Consider performing the renovation/construction project when the building is least occupied.
D. Consider temporarily relocating employees to an alternate worksite.
E. Notify potentially affected employees, in writing, at least 3 business days prior to commencement of chemical use or dust generation.
F. Isolate the work area from occupied areas.
G. Use mechanical ventilation and local exhaust ventilation to maintain a negative pressure gradient between the work area and occupied areas.

12.4 Before selection and use of paints, adhesives, sealants, solvents or installation of insulation, particle board, plywood, floor coverings, carpet backing, textiles, or other materials in the course of maintenance, renovation or construction, the IAQ Program Designated Person will check product labels or seek and obtain information from the manufacturer of those products on whether or not they contain volatile organic compounds such as solvents, formaldehyde or isocyanates that could be emitted during regular use. This information should be used to select the least volatile/hazardous products and to determine if additional necessary measures need to be taken to comply with the objectives of this section. The IAQ Program Designated Person will maintain records of this evaluation for compliance recordkeeping purposes.

12.5 The IAQ Program Designated Person will consider the feasibility of conducting maintenance, renovation, or construction work using appropriate barriers, during periods when the building is unoccupied, or temporarily relocating potentially affected employees to areas of the building that will not be impacted by the project.

12.6 Temporary barriers will be utilized to provide a physical isolation between the work area and occupied areas of the building.

12.7 Mechanical ventilation (i.e. fans, portable blowers, or existing HVAC equipment) will be used to maintain a negative pressure gradient between the work area and occupied areas to ensure the safety of employees. Renovation areas in occupied buildings will be isolated and dust and debris shall be confined to the renovation or construction area.

12.8 If work is being performed by an outside contractor, the IAQ Program Designated Person will maintain communication with contractor personnel to ensure they comply with the requirements of the PEOSH IAQ standard.

12.9 Employees who have special concerns about potential exposures during or after renovation, construction, or repair work should consult with their supervisor. If despite these preventive actions, employees are exposed to air contaminants resulting in health effects, they should report to their physician for consultation and referral. All exposures should also be reported to their supervisor and the IAQ Program Designated Person.

13.0 OBTAINING PERMITS AND PERFORMING WORK IN ACCORDANCE WITH THE NEW JERSEY UNIFORM CONSTRUCTIN CODE (N.J.A.C. 5:23)

13.1 Permits for renovation and construction-related work will be obtained as required by the New Jersey Uniform Construction Code (NJUCC), (N.J.A.C. 5:23). All work requiring a permit will be performed in compliance with N.J.A.C. 5:23. Additional information concerning the NJUCC can be obtained from the NJ Department of Community affairs, Division of Codes and Standards (www.state.nj.us/dca/codes, 609-984-760).

14.0 MAINTAINING NATURAL VENTILATION IN BUILDINGS WITHOUT MECHANICAL VENTILATION

14.1 In buildings not equipped with mechanical ventilation, the IAQ Program Designated Person will identify the location of non-mechanical ventilation systems, such as stacks and operable windows. Periodic inspections will be conducted to ensure that these systems are operable and the surrounding areas remain clear of obstructions and potential contaminants.

15.0 EMPLOYEE RESPONSIBILITEIS

15.1 Employees have a role in maintaining good indoor air quality within their workplace. Employees should ensure that they do not introduce unauthorized chemicals (i.e. fragrances, air fresheners, cleaning solvents, ozone generators) into the workplace. In addition, if employees observe situations which may lead to poor indoor air quality (i.e. inoperable windows, water leaks, and visible mold) they should notify the IAQ Program Designated Person of the situation so that it can be addressed promptly.

15.2 Employees are responsible for maintaining mechanical and passive ventilation systems by ensuring that louvers and diffusers remain clear to allow the free flow of air. Intentionally blocking, diverting, or otherwise manipulating components (i.e. thermostat,) of the ventilation system may result in disruption of the ventilation system in the immediate area or other occupied areas of the building.

16.0 PERIODIC REVIEW AND UPDATE

16.1 This Written Indoor Air Quality Program will be updated at least annually to reflect changes in policies, procedures, responsibilities, and contact information.

17.0 PROGRAM CERTIFICATION

All employees, or their designed representative, can obtain additional information on this written program, the PEOSH IAQ Program, which is located in the Central File at the

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Main Office and also at the Central File of each school district facility.

Reviewed and Approved:

B Scrivo

Bruce Scrivo, Coordinator of Facilities and Operations

October 2022

Date

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Appendix A

N.J.A.C. 12-100:13-1 - INDOOR AIR QUALITY STANDARD

TITLE 12. DEPARTMENT OF LABOR
CHAPTER 100. SAFETY AND HEALTH STANDARDS FOR PUBLIC EMPLOYEES
SUBCHAPTER 13. INDOOR AIR QUALITY STANDARD

N.J.A.C. 12:100-13.1 (2007)

§ 12:100-13.1 Scope

This subchapter shall apply to matters relating to indoor air quality in buildings occupied by public employees during regular work hours.

§ 12:100-13.2 Definitions

The following words and terms, when used in this subchapter, have the following meaning unless the context clearly indicates otherwise.

"Air contaminants" refers to substances contained in the vapors from paint, cleaning chemicals, pesticides, solvents, particulates, outdoor air pollutants and other airborne substances which together may cause material impairment to employees working within the enclosed workplace.

"Building-related illness" describes specific medical conditions of known etiology which can be documented by physical signs and laboratory findings. Such illnesses include sensory irritation when caused by known agents, respiratory allergies, asthma, nosocomial infections, humidifier fever, Legionnaires' disease, and the signs and symptoms characteristic of exposure to chemical or biologic substances such as carbon monoxide, formaldehyde, pesticides, endotoxins, or mycotoxins.

"Building systems" includes the heating, ventilation and air-conditioning (HVAC) system, the energy management system and all other systems in a facility which may impact indoor air quality.

"Department" means the Department of Health and Senior Services.

"Designated person" means a person who has been given the responsibility by the employer to take necessary measures to assure compliance with this subchapter.

"Employee" means the term as defined at *N.J.A.C. 12:100-2.1*.

"Employer" means the term as defined at *N.J.A.C. 12:100-2.1*.

"HVAC system" means the collective components of the heating, ventilation and air-conditioning system including, but not limited to, filters and frames, cooling coil condensate drip pans and drainage piping, outside air dampers and actuators, humidifiers, air distribution ductwork, automatic temperature controls, and cooling towers.

"HVAC System Commissioning Report" means a document normally prepared by an architect or engineer that provides verification that the HVAC system is operating in conformity with the design intent.

"Office building" means a building in which administrative, clerical or educational activities are conducted. Examples of facilities and/or operations, which are not office buildings, include repair shops, garages, print shops and warehouses.

"Renovation and remodeling" means building modification involving activities that include but are not limited to: removal or replacement of walls, roofing, ceilings, floors, carpet, and components such as moldings, cabinets, doors, and windows; painting; decorating; demolition; surface refinishing; and removal or cleaning of ventilation ducts.

"Sick Building Syndrome" describes a situation in which a workplace is characterized by a substantial number of building occupants experiencing health and comfort problems that can be related to working indoors. Additionally the reported symptoms do not fit the pattern of any particular illness, are difficult to trace to any specific source and relief from these symptoms occurs upon leaving the building. It is important to distinguish Sick Building Syndrome from

problems of building-related illness. The latter term is reserved for situations in which signs and symptoms of diagnosable illness are identified and can be attributed directly to specific airborne contaminants.

§ 12:100-13.3 Compliance program

(a) The employer shall identify a designated person who is given the responsibility to assure compliance with this section. The employer shall assure that the designated person is familiar with the requirements of this subchapter. The designated person shall assure that at least the following actions are implemented and documented:

1. Establishing and following a preventive maintenance schedule in accordance with the manufacturer's recommendations or with accepted practice for the HVAC system. Scheduled maintenance of the HVAC system shall include checking and/or changing air filters, checking and/or changing belts, lubrication of equipment parts, checking the functioning of motors and confirming that all equipment is in operating order. Damaged or inoperable components shall be replaced or repaired as appropriate. Additionally, any parts of this system with standing water shall be checked visually for microbial growth;

2. Implementing the use of general or local exhaust ventilation where housekeeping and maintenance activities involve use of equipment or products that could reasonably be expected to result in hazardous chemical or particulate exposures, above the applicable Permissible Exposure Limit (PEL), as adopted by reference under *N.J.A.C. 12:100-4.2*, to employees working in other areas of the building or facility;

3. When the carbon dioxide level exceeds 1,000 parts per million (ppm), the employer shall check to make sure the HVAC system is operating as it should. If it is not, the employer shall take necessary steps as outlined in (a)1 above;

4. When temperatures in office buildings are outside of the range of 68 to 79 degrees Fahrenheit, the employer shall check to make sure the HVAC system is in proper operating order. If it is not, the employer shall take necessary steps as outlined in (a)1 above;

5. If contamination of the make-up air supply is identified and documented, then the make-up inlets and/or exhaust air outlets shall be relocated or the source of the contamination eliminated. Sources of make-up air contamination may include contaminants from sources such as, but not limited to, cooling towers, vents, and vehicle exhaust;

6. Assuring that building without mechanical ventilation are maintained so that windows, doors, vents, stacks and other portals designed or used for natural ventilation are in operable condition;

7. Promptly investigating all employee complaints of signs or symptoms that may be associated with building-related illness or sick building syndrome;

8. The employer shall have a written plan describing how it will achieve compliance with this subchapter, which plan shall list the identity and responsibilities of the designated person referred to in (a) above and which shall include procedures which, at a minimum, address the following issues:

i. Following of a preventive maintenance schedule;

ii. Keeping of required records;

iii. Locating of Indoor Air Quality compliance documents;

iv. Investigating of employee complaints;

v. Responding to signed employee complaints that have been submitted to the State alleging violation of the Public Employees' Occupational Safety and Health Act, *N.J.S.A. 34:6A-25* et seq.;

vi. Notifying employees of work that may introduce air contaminants;

vii. Controlling microbial contamination;

viii. Controlling air contaminants;

ix. Responding to temperature and/or carbon dioxide exceedences;

x. Maintaining air quality during renovations and remodeling;

xi. Obtaining permits and performing work as required by the New Jersey Uniform Construction Code, *N.J.A.C. 5:23*; and

xii. Maintaining natural ventilation in buildings without mechanical ventilation; and

9. The employer shall review and update the written compliance plan referred to in (a)8 above at least annually, and whenever necessary to reflect new or modified tasks and procedures and to reflect new or revised employee positions.

§ 12:100-13.4 Controls of specific contaminant sources

(a) Regarding other indoor air contaminants, when general ventilation is inadequate to control air contaminants emitted from point sources within work spaces to below the applicable PEL, as adopted by reference under *N.J.A.C. 12:100-4.2*, the employer shall implement other control measures such as local source capture exhaust ventilation or substitution.

(b) The employer shall control microbial contamination in the building by promptly repairing water intrusion that can promote growth of biologic agents.

(c) The employer shall remediate damp or wet materials by drying, replacing, removing or cleaning same within 48 hours of discovery and shall continue such remediation until the water intrusion is eliminated.

(d) The employer shall take measures to remove visible microbial contamination in areas such as ductwork, humidifiers, dehumidifiers, condensate drip pans, heat exchange components, other HVAC and building system components, or on building surfaces, such as carpeting and ceiling tiles, when found during regular or emergency maintenance activities or during visual inspection.

§ 12:100-13.5 Air quality during renovation and remodeling

(a) Renovation work and/or new construction that results in the diffusion of dust, stone and other small particles, toxic gases or other harmful substances in quantities hazardous to health shall be safeguarded by means of local ventilation or other protective devices to ensure the safety of employees. Renovation and/or new construction work in occupied buildings shall be isolated and air contaminants, dust and debris shall be confined to the renovation or construction area by use of measures such as, but not limited to, physical barriers, pressure differentials, and/or performing the work during periods of minimal occupancy.

1. Before re-occupancy, work areas shall be cleaned and aired out as necessary.

2. Hazard information shall be used to select products and to determine necessary measures to be taken to comply with (a) above.

(b) Before selection and use of paints, adhesives, sealants, solvents, or installation of insulation, particle board, plywood, floor coverings, carpet, textiles, or other materials in the course of renovation or construction, the employer shall check product labels and Material Safety Data Sheets or seek and obtain information from the manufacturers of those products on whether or not they contain volatile organic compounds such as solvents, formaldehyde or isocyanates that could be emitted during regular use.

(c) The employer shall notify employees at least 24 hours in advance, or promptly in emergency situations, of work to be performed on the building that may introduce air contaminants into their work area.

§ 12:100-13.6 Recordkeeping

a) The maintenance schedule shall be updated to show all maintenance performed on the building systems. The schedule shall include the date that such maintenance was performed and the name of the person or company performing the work.

(b) The records required to be maintained by this section shall be retained for at least three years.

(c) The records required to be maintained by this section shall be available on request to Department representatives for examination and copying.

(d) The records required to be maintained by this section shall be made available to employees and employee representatives for examination and copying upon written request as soon as possible after receipt by the employer of the written request, but no later than 10 working days from the date upon which the employer has received the request.

§ 12:100-13.7 Employer's response to a signed PEOSH complaint

(a) Within 15 working days of receipt by the employer of notification from the Department that a complaint has been filed against the employer under the Public Employees' Occupational Safety and Health Act, *N.J.S.A. 34:6A-25* et seq., the employer shall respond in writing to the Department. The response may include any combination of the following:

1. A statement that the complaint is unfounded;

2. A description of any remedial action already taken;

3. An outline of any remedial measures planned but not yet taken with a timetable for completion; and/or

4. A statement that a study of the problem, with a timetable for completion of the study, has been initiated.

(b) Where remedial measures are planned or a study initiated, they shall be completed as soon as feasible. The employer shall submit, to the Department, a written report describing the remedial measures implemented and/or a copy of a study's report within 15 working days of completion.

(c) Permits for remedial work shall be obtained as required by *N.J.A.C. 5:23* (the New Jersey Uniform Construction Code). All work requiring a permit shall be performed in compliance with *N.J.A.C. 5:23*.

§ 12:100-13.8 Indoor air quality (IAQ) compliance documents

(a) In response to an employee complaint to the Department, the employer shall provide any of the following documents, if available, and requested by the Department:

1. As-built construction documents;

2. HVAC system commissioning reports;

3. HVAC systems testing, adjusting and balancing reports;

4. Operations and maintenance manuals;

5. Water treatment logs; and

6. Operator training materials.

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Appendix B

PEOSH INDOOR AIR QUALITY STANDARD INSPECTION CHECKLIST

PEOSH Indoor Air Quality Standard
Inspection Checklist

Location: _____

Inspection #: _____

Inspector: _____ **Date:** _____

COMPLIANCE PROGRAM - GENERAL REQUIREMENTS		Y	N	N/A
N.J.A.C. 12:100-13.3(a)	Has a designated person been identified to handle the implementation and documentation of the New Jersey indoor air quality standard? Name/Title/Phone #: _____ _____	☐	☐	☐
13.3(a)	Has the employer ensured that the designated person is familiar with all the requirements of the standard?	☐	☐	☐
13.3(a)1	Is there an established, operating and documented preventive maintenance schedule for the heating, ventilation and air conditioning (HVAC) system in accordance with the manufacturer's recommendations or accepted practice for the HVAC system?	☐	☐	☐
13.3(a)1	Does the HVAC preventive maintenance schedule include: checking and/or changing air filters, checking and/or changing belts, lubrication of equipment parts, checking the functioning of motors and confirming that all equipment is in operating order?	☐	☐	☐
13.3(a)1	Are damaged or inoperable components of the HVAC system replaced or repaired as appropriate?	☐	☐	☐
13.3(a)1	Are parts of the HVAC system with standing water checked visually for microbial growth?	☐	☐	☐
13.3(a)2	Is general or local exhaust ventilation used where housekeeping and maintenance activities could reasonably be expected to result in exposure to hazardous substances above applicable exposure limits?	☐	☐	☐
13.3(a)3	When the carbon dioxide level exceeds 1,000 parts per million, is the HVAC system checked and repaired as necessary to ensure the system is operating properly?	☐	☐	☐
13.3(a)4	In office buildings/schools, when the temperature is outside of the range of 68 to 79 degrees Fahrenheit, is the HVAC system checked and repaired as necessary to ensure the system is operating properly?	☐	☐	☐
13.3(a)5	When a contaminant is identified in the make-up air supply, is the source of the contaminant eliminated or the make-up inlets and/or exhaust air outlets relocated to avoid entry of the contaminant into the air system?	☐	☐	☐
13.3(a)6	If buildings do not have mechanical ventilation, are windows, doors, vents, stacks, and other portals used for natural ventilation operating properly?	☐	☐	☐
13.3(a)7	Are complaints promptly investigated that involve signs or symptoms that may be associated with Building-Related Illness or Sick Building Syndrome?	☐	☐	☐
13.3(a)8	Does the employer have a written plan that meets the requirements of the subchapter?	☐	☐	☐
13.3(a)9	Is the written compliance plan reviewed and updated annually to reflect new or updated procedures?	☐	☐	☐

PEOSH Indoor Air Quality Standard
Inspection Checklist (cont.)

CONTROLS OF SPECIFIC CONTAMINANTS		Y	N	N/A
13.4(a)	When point sources generate airborne levels of contaminants above applicable limits, is local exhaust ventilation or substitution used to reduce the exposure levels to below the limits?	☐	☐	☐
13.4(b)	Does the employer control microbial contamination by promptly repairing water intrusion that can promote growth of biologic agents?	☐	☐	☐
13.4(c)	Does the employer remediate damp or wet materials by drying, replacing, removing, or cleaning same within 48 hours of discovery and continue remediation until water intrusion is eliminated?	☐	☐	☐
13.4(d)	Are visible microbial contaminants removed from ductwork, humidifiers, dehumidifiers, condensate drip pans, heat exchange components, and other HVAC and building system components, or on building surfaces, such as carpeting and ceiling tiles, when found during regular or emergency maintenance activities or during visual inspection?	☐	☐	☐
RENOVATION/REMODELING		**Y**	**N**	**N/A**
13.5(a)	During renovation work and/or new construction, are local ventilation or other protective devices used to safeguard employees and students from dust, stone and other small particles, toxic gases or other harmful substances in quantities hazardous to health?	☐	☐	☐
13.5(a)	Are renovation areas in occupied buildings isolated so that air contaminants, dust, and debris are confined to the renovation or construction area by use of measures such as physical barriers, pressure differentials, and/or performing work during periods of minimal occupancy?	☐	☐	☐
13.5(a)(1)	Are work areas cleaned and aired out as necessary prior to re-occupancy?	☐	☐	☐
13.5(a)(2)	Is hazard information used to select products and to determine necessary measures to be taken?	☐	☐	☐
13.5(b)	Before selection and use, are product labels and MSDS sheets checked or is information obtained on whether the use of paints, adhesives, sealants, solvents or installation of insulation, particle board, plywood, floor coverings, carpet backing, textiles or other materials contain volatile organic compounds such as solvents, formaldehyde, or isocyanates that could be emitted during regular use?	☐	☐	☐
13.5(c)	Are employees notified at least 24 hours in advance, or promptly in emergency situations, of work to be performed on the building that may introduce air contaminants into their work area?	☐	☐	☐

PEOSH Indoor Air Quality Standard Inspection Checklist (cont.)

RECORDKEEPING		Y	N	N/A
13.6(a)	Is the maintenance schedule updated to show all maintenance performed on the building systems?	☐	☐	☐
13.6(a)	Does the maintenance schedule include the dates that the building systems maintenance was performed and the names of the persons or companies performing the work?	☐	☐	☐
13.6(b)	Are maintenance schedules with the information required by the indoor air quality standard retained for at least three years?	☐	☐	☐
13.6(c)	Are the records required to be maintained by this section available for inspection by PEOSH?	☐	☐	☐
13.6(d)	Are the records required to be maintained by this section available for inspection by employees and employee representatives for examination and copying within 10 working days of request?	☐	☐	☐
EMPLOYER'S RESPONSE TO A SIGNED COMPLAINT		**Y**	**N**	**N/A**
13.7(a)	If the employer receives a complaint notification from the PEOSH Program about an indoor air quality problem, is a written response sent back to PEOSH within 15 working days?	☐	☐	☐
13.7(a)	Do the employer's written responses to complaint notifications received from the PEOSH Program about an indoor air quality problem include any combination of the following: 1) A statement that the complaint is unfounded; 2) A description of any remedial action already taken; 3) An outline of any remedial measures planned but not yet taken with a timetable for completion; and/or 4) A statement that a study of the problem, with a timetable for completion of the study, has been initiated?	☐	☐	☐
13.7(b)	If the employer plans remedial measures or a study initiated in response to a complaint notification received from the PEOSH Program, is a written report describing the remedial measures implemented and/or a copy of a study's report submitted to the PEOSH Program within 15 working days of completion?	☐	☐	☐
13.7(c)	If remedial work is initiated in response to a complaint notification from the PEOSH Program, are permits obtained and work performed as required by N.J.A.C. 5:23 (the New Jersey Uniform Construction Code)?	☐	☐	☐
13.8(a)	If available, are the following documents provided to the PEOSH Program when requested in response to an employee complaint: 1) As-built construction documents; 2) HVAC system commissioning reports; 3) HVAC systems testing, adjusting and balancing reports; 4) Operations and maintenance manuals; 5) Water treatment logs; and 6) Operator training materials?	☐	☐	☐

Essex County Schools of Technology

Indoor Air Quality Program Update **2022-2023 School Year**

Public Employees Occupational Safety and Health

Appendix C

SAMPLE HVAC PREVENTIVE MAINTENANCE LOG

HVAC Preventive Maintenance (PM) Log

Employer Name: _____
Facility Name: _____
Air Handling Unit _____
Area Served _____

Date	PM Action	Initials

Note: N.J.A.C. 12:100-13.6 requires that this maintenance log be maintained on site by the employer's designated person for3 years and must be made available to PEOSH, employees, and employee representatives upon request.

Essex County Schools of Technology

Indoor Air Quality Program Update **2022-2023 School Year**

Public Employees Occupational Safety and Health

Appendix D

MOLD IN THE WORKPLACE - PREVENTION AND CONTROL

Mold in the Workplace Prevention and Control

Public Employees Occupational Safety and Health Program

This Information Bulletin is not a standard or regulation, and it creates no new legal obligations. The Bulletin is advisory in nature, informational in content, and is intended to provide guidance to New Jersey public employees and to assist building managers, custodians, and others who are responsible for building maintenance, and who respond to mold and moisture situations in buildings.

The New Jersey Public Employees Occupational Safety and Health (PEOSH) Program modified the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) and the U.S. Environmental Protection Agency (EPA) publications to address New Jersey's public sector needs. (See References, p.12.)

Introduction

Indoor exposure to mold can cause a variety of health effects and symptoms, including allergic reactions. Heightened public awareness has increased concern about mold growth inside buildings. This safety and health information bulletin provides recommendations for the prevention of mold growth and describes measures designed to protect the health of building occupants and workers involved in mold clean-up and prevention. This bulletin is designed primarily for building managers, custodians, and others responsible for building maintenance, but may also be used as a basic reference for those involved in mold remediation. By reading this safety and health information bulletin, individuals with little or no experience with mold remediation may be able to reasonably judge whether mold contamination can be managed in-house or whether outside assistance is required. This document will help those responsible for building maintenance in the evaluation of remediation plans. The document also provides information on mold to all New Jersey public employees.

The advice of a medical professional should always be sought if there are any emerging health issues. The information in these guidelines is intended only as a summary of basic procedures and is not intended, nor should it be used, as a detailed guide to mold remediation. These guidelines are subject to change as more information regarding mold contamination and remediation becomes available.

Mold Basics

Molds are part of the natural environment. Molds are fungi that can be found anywhere – inside or outside – throughout the year. About 1,000 species of mold can be found in the United States, with more than 100,000 known species worldwide.

Outdoors, molds play an important role in nature by breaking down organic matter such as toppled trees, fallen leaves, and dead animals. We would not have food and medicines, like cheese and penicillin, without mold.

Indoors, mold growth should be avoided. Problems may arise when mold starts eating away at materials, affecting the look, smell, and with respect to wood-framed buildings, possibly affecting the structural integrity of the buildings.

Molds can grow on virtually any substance, as long as moisture or water, oxygen, and an organic source are present. Molds reproduce by creating tiny spores (viable seeds) that usually cannot be seen without magnification. Mold spores continually float through the indoor and outdoor air.

Molds are usually not a problem unless mold spores land on a damp spot and begin growing. They digest whatever they land on in order to survive. There are molds that grow on wood, paper, carpet, foods and insulation, while other molds feast on the everyday dust and dirt that gather in the moist regions of a building.

When excessive moisture or water accumulates indoors, mold growth often will occur, particularly if the moisture problem remains uncorrected. While it is impossible to eliminate all molds and mold spores, controlling moisture can control indoor mold growth.

Since mold requires water to grow, it is important to prevent excessive moisture in buildings. Some moisture problems in buildings have been linked to changes in building construction practices since the 1970s, which resulted in tightly sealed buildings with diminished ventilation, contributing to moisture vapor buildup. Other moisture problems may result from roof leaks, landscaping or gutters that direct water into or under a building, or unvented combustion appliances. Delayed or insufficient maintenance may contribute to moisture problems in buildings. Improper maintenance and design of building heating/ventilating/air-conditioning (HVAC) systems, such as insufficient cooling capacity for an air conditioning system, can result in elevated humidity levels in a building.

All molds share the characteristic of being able to grow without sunlight; mold needs only a viable seed (spore), a nutrient source, moisture, and the right temperature to proliferate. This explains why mold infestation is often found in damp, dark, hidden spaces; light and air circulation dry areas out, making them less hospitable for mold.

Molds gradually damage building materials and furnishings. If left unchecked, mold can eventually cause structural damage to a wood framed building, weakening floors and walls as it feeds on moist wooden structural members. If you suspect that mold has damaged building integrity, consult a structural engineer or other professional with the appropriate expertise.

Health Effects

Scientific research on the relationship between mold exposures and health effects is ongoing. This section provides a brief overview, but does not describe all potential health effects related to mold exposure.

Currently, there are no federal standards or recommendations, (e.g., OSHA, NIOSH, EPA) for airborne concentrations of mold or mold spores. The NJDHSS PEOSH Program, however, enforces an Indoor Quality Standard for public employees in New Jersey that addresses visible microbial contamination in buildings (N.J.A.C. 12:100-13.4 (c)). For further information on the Standard, contact the NJDHSS PEOSH Program (see p. 12).

There are many types of mold. Most typical indoor air exposures to mold do not present a risk of adverse health effects. However, molds can cause adverse effects by producing allergens (substances that can cause allergic reactions). Allergic responses include hay fever-type symptoms such as runny nose and red eyes.

Molds may cause localized skin or mucosal infections but, in general, do not cause systemic infections in humans, except for persons with impaired immunity, AIDS, uncontrolled diabetes, or those taking immune-suppressive drugs.

Molds can also trigger asthma attacks in some individuals who are allergic to mold. In addition, exposure to mold can irritate the eyes, skin, nose and throat in certain individuals. Symptoms other than allergic and irritant types are not commonly reported as a result of inhaling mold in the indoor environment.

Some specific species of mold produce mycotoxins under certain environmental conditions. Potential health effects from mycotoxins are the subject of ongoing scientific research and are beyond the scope of this document.

Potential health concerns are important reasons to prevent mold growth and to remediate existing problem areas.

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PEOSH PROGRAM
READER RESPONSE CARD

Mold in the Workplace

Dear Reader:

Please take a few minutes to help us evaluate this publication. Please check the following:

Check the category that best describes your position:

- ☐ manager
- ☐ safety professional
- ☐ researcher
- ☐ employee
- ☐ occupational health professional
- ☐ health care worker
- ☐ educator
- ☐ other (specify) _____

Check the category that best describes your workplace:

- ☐ academia
- ☐ state government
- ☐ county government
- ☐ municipal government
- ☐ municipal utilities authority
- ☐ labor organization
- ☐ other (specify) _____

Describe how thoroughly you read this publication:

- ☐ cover-to-cover
- ☐ sections of interest only (specify) _____
- ☐ other (specify) _____

How will you use this information (check all that apply):

- ☐ change the work environment
- ☐ change a procedure
- ☐ assist in research
- ☐ change training curriculum
- ☐ provide information
- ☐ copy and distribute
- ☐ in training
- ☐ not used
- ☐ other (specify) _____

Which section did you find most useful?

The least useful and why?

Other occupational health topics on which you would like to see the PEOSH Program develop an information bulletin

Other comments and suggestions:

Prevention

The Key to Mold Control is Moisture Control!

When water leaks or spills occur indoors - act promptly. Any initial water infiltration should be stopped and cleaned promptly. A prompt response (within 24–48 hours) and thorough clean-up, drying, and/or removal of water-damaged materials will prevent or limit mold growth.

Mold prevention tips include:

- Repair plumbing leaks and leaks in the building structure as soon as possible
- Look for condensation and wet spots. Fix source(s) of moisture intrusion problem(s) as soon as possible.
- Prevent moisture from condensing by increasing surface temperature or reducing the moisture level in the air (humidity). To increase surface temperature, insulate or increase air circulation. To reduce the moisture level in the air, repair leaks, increase ventilation (if outside air is cold and dry), or dehumidify (if outdoor air is warm and humid).
- Keep HVAC drip pans clean, flowing properly, and unobstructed.
- Perform regularly scheduled building/HVAC inspections and maintenance, including filter changes
- Maintain indoor relative humidity below 70%.
- Vent moisture-generating appliances, such as dryers, to the outside where possible.
- Vent kitchens (cooking areas) and bathrooms according to local code requirements.
- Clean and dry wet or damp spots as soon as possible, but no more than 48 hours after discovery.
- Provide adequate drainage around buildings and sloping the ground away from building foundations. Follow all local building codes.
- Pinpoint areas where leaks have occurred, identifying the causes, and take preventive action to ensure that they do not reoccur

Questions That May Assist in Determining Whether a Mold Problem Currently Exists

- Are building materials or furnishings visibly moisture damaged?
- Have building materials been wet more than 48 hours?
- Are there existing moisture problems in the building?
- Are building occupants reporting musty or moldy odors?
- Are building occupants reporting health symptoms that they think are related to mold in the indoor environment?
- Has the building been recently remodeled or has the building use changed?
- Has routine maintenance been delayed or the maintenance plan been altered?

Always consider consulting a health professional to address any employee health concerns.

Remediation Plan

Remediation includes both the identification and correction of the conditions that permit mold growth, as well as the steps to safely and effectively remove mold damaged materials.

Before planning the remediation, assess the extent of the mold or moisture problem and the type of damaged materials. If you choose to hire outside assistance to do the clean-up, make sure the contractor has experience with mold remediation. Check references and ask the contractor to follow the recommendations in EPA's publication, "Mold Remediation in Schools and Commercial Buildings," or other guidelines developed by professional or governmental organizations.

The remediation plan should include steps to permanently correct the water or moisture problem. The plan should cover the use of appropriate personal protective equipment (PPE). It also should include steps to carefully contain and remove moldy building materials in a manner that will prevent further contamination. Remediation plans may vary greatly depending on the size and complexity of the job, and may require revision if circumstances change or new facts are discovered.

If you suspect that the HVAC system is contaminated with mold, or if mold is present near the intake to the system, contact the National Air Duct Cleaners Association (NADCA), or consult EPA's guide, "Should You Have the Air Ducts in Your Home Cleaned?" before

taking further action. **Do not run the HVAC system if you know or suspect that it is contaminated with mold, as it could spread contamination throughout the building.** If the water or mold damage was caused by sewage or other contaminated water, consult a professional who has experience cleaning and repairing buildings damaged by contaminated water.

The remediation manager's highest priority must be to protect the health and safety of the building occupants and remediators. Remediators should avoid exposing themselves and others to mold-laden dusts as they conduct their clean-up activities. Caution should be used to prevent mold and mold spores from being dispersed throughout the air where they can be inhaled by building occupants. In some cases, especially those involving large areas of contamination, the remediation plan may include temporary relocation of some or all of the building occupants.

When deciding if relocating occupants is necessary, consideration should be given to the size and type of mold growth, the type and extent of health effects reported by the occupants, the potential health risks that could be associated with the remediation activity, and the amount of disruption this activity is likely to cause. In addition, before deciding to relocate occupants, one should also evaluate the remediator's ability to contain/minimize possible aerosolization of mold spores given their expertise and the physical parameters of the workplace. When possible, remediation activities should be scheduled during off-hours when building occupants are less likely to be affected.

Mold Remediation/Clean-up Methods

The purpose of mold remediation is to correct the moisture problem and to remove moldy and contaminated materials to prevent human exposure and further damage to building materials and furnishings. Porous materials that are wet and have mold growing on them may have to be discarded because molds can infiltrate porous substances and grow on or fill in empty spaces or crevices. This mold can be difficult or impossible to remove completely.

As a general rule, simply killing the mold, for example, with a biocide is not enough. The mold must be removed, since the chemicals and proteins, which can cause a reaction in humans, are present even in dead mold.

A variety of clean-up methods are available for remediating damage to building materials and furnishings caused by moisture control problems and mold growth. The specific method or group of methods used will depend on the type of material affected. Some methods that may be used include the following:

Wet Vacuum

Wet vacuums are vacuum cleaners designed to collect water. They can be used to remove water from floors, carpets, and hard surfaces where water has accumulated. They should not be used to vacuum porous materials, such as gypsum board. Wet vacuums should be used only on wet materials, as spores may be exhausted into the indoor environment if insufficient liquid is present. The tanks, hoses, and attachments of these vacuums should be thoroughly cleaned and dried after use since mold and mold spores may adhere to equipment surfaces.

Damp Wipe

Mold can generally be removed from nonporous surfaces by wiping or scrubbing with water and detergent. It is important to dry these surfaces quickly and thoroughly to discourage further mold growth. Instructions for cleaning surfaces, as listed on product labels, should always be read and followed.

HEPA Vacuum

HEPA (High-Efficiency Particulate Air) vacuums are recommended for final clean-up of remediation areas after materials have been thoroughly dried and contaminated materials removed. HEPA vacuums also are recommended for clean-up of dust that may have settled on surfaces outside the remediation area. Care must be taken to assure that the filter is properly seated in the vacuum so that all the air passes through the filter. When changing the vacuum filter, remediators should wear respirators, appropriate personal protective clothing, gloves, and eye protection to prevent exposure to any

captured mold and other contaminants. The filter and contents of the HEPA vacuum must be disposed of in impermeable bags or containers in such a way as to prevent release of the debris.

Disposal of Damaged Materials

Building materials and furnishings contaminated with mold growth that are not salvageable should be placed in sealed impermeable bags or closed containers while in the remediation area. These materials can usually be discarded as ordinary construction waste. It is important to package mold-contaminated materials in this fashion to minimize the dispersion of mold spores. Large items with heavy mold growth should be covered with polyethylene sheeting and sealed with duct tape before being removed from the remediation area. Some jobs may require the use of dust-tight chutes to move large quantities of debris to a dumpster strategically placed outside a window in the remediation area.

Use of Biocides

The use of a biocide, such as chlorine bleach, is not recommended as a routine practice during mold remediation, although there may be instances where professional judgment may indicate its use (for example, when immuno-compromised individuals are present). In most cases, it is not possible or desirable to sterilize an area, as a background level of mold spores consistent to the level in outside air will persist. However, the spores in the ambient air will not cause further problems if the moisture level in the building has been corrected.

Biocides are toxic to animals and humans, as well as to mold. If you choose to use disinfectants or biocides, always ventilate the area, using outside air if possible, and exhaust the air to the outdoors. When using fans, take care not to extend the zone of contamination by distributing mold spores to a previously unaffected area.

Never mix chlorine bleach solution with other cleaning solutions or detergents that contain ammonia because this may produce highly toxic vapors and create a hazard to workers.

Some biocides are considered pesticides, and some states require that only registered pesticide applicators apply these products in schools, commercial buildings, and homes. Make sure anyone applying a biocide is properly licensed where required. For further information, contact the New Jersey Department of Environmental Protection, Pesticide Control Program, at 609-984-6507.

Fungicides are commonly applied to outdoor plants, soil, and grains as a powder or spray. Examples of fungicides include hexachlorobenzene, organomercurials, pentachlorophenol, phthalimides, and dithiocarbamates.

Do not use fungicides developed for outdoor use in any indoor application, as they can be extremely toxic to animals and humans in an enclosed environment.

When you use biocides as a disinfectant or a pesticide, or as a fungicide, you should use appropriate PPE, including respirators. Always read and follow product label precautions. It is a violation of Federal (EPA) law to use a biocide in any manner inconsistent with its label instructions.

Mold Remediation Guidelines

This section presents remediation guidelines for building materials that have or are likely to have mold growth. The guidelines are designed to protect the health of clean-up personnel and other workers during remediation. These guidelines are based on the size of the area impacted by mold contamination. Please note that these are guidelines; some professionals may prefer other remediation methods, and certain circumstances may require different approaches or variations on the approaches described below. If possible, remediation activities should be scheduled during off-hours when building occupants are less likely to be affected.

Although the level of personal protection suggested in these guidelines is based on the total surface area contaminated and the potential for remediator or occupant exposure, professional judgment always should play a part in remediation decisions. These remediation guidelines are based on the size of the affected area to make it easier for remediators to select appropriate techniques, not on the basis of research showing there is a specific method appropriate at a certain number of square feet. The guidelines have been designed to help construct a remediation plan. The remediation manager

should rely on professional judgment and experience to adapt the guidelines to particular situations. When in doubt, caution is advised. Consult an experienced mold remediator for more information.

Level I: Small Isolated Areas (10 sq. ft. or less) - e.g., ceiling tiles, small areas on walls.

- Remediation can be conducted by the regular building maintenance staff as long as they are trained on proper clean-up methods, personal protection, and potential health hazards. This training can be performed as part of a program to comply with the requirements of the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7).
- Respiratory protection (e.g., N-95 disposable respirator) is recommended. Respirators must be used in accordance with the PEOSH adopted Respiratory Protection Standard (29 CFR 1910.134). Gloves and eye protection should be worn.
- The work area should be unoccupied. Removing people from spaces adjacent to the work area is not necessary, but is recommended for infants (less than 12 months old), persons recovering from recent surgery, immune-suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity pneumonitis, and severe allergies).
- Containment of the work area is not necessary. Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.
- Contaminated materials that cannot be cleaned should be removed from the building in a sealed impermeable plastic bag. These materials may be disposed of as ordinary waste.
- The work area and areas used by remediation workers for egress should be cleaned with a damp cloth or mop and a detergent solution.
- All areas should be left dry and visibly free from contamination and debris.

Level II: Mid-Sized Isolated Areas (10-30 sq. ft.) - e.g., individual wallboard panels.

- Remediation can be conducted by the regular building maintenance staff. Such persons should receive training on proper clean-up methods, personal protection, and potential health hazards. This training can be performed as part of a program to comply with the requirements of the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7).
- Respiratory protection (e.g., N-95 disposable respirator) is recommended. Respirators must be used in accordance with the PEOSH adopted Respiratory Protection Standard (29 CFR 1910.134). Gloves and eye protection should be worn.
- The work area should be unoccupied. Removing people from spaces adjacent to the work area is not necessary, but is recommended for infants (less than 12 months old), persons recovering from recent surgery, immune-suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity pneumonitis, and severe allergies).
- Surfaces in the work area that could become contaminated should be covered with a secured plastic sheet(s) before remediation to contain dust/debris and prevent further contamination.
- Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.
- Contaminated materials that cannot be cleaned should be removed from the building in a sealed impermeable plastic bag. These materials may be disposed of as ordinary waste.
- The work area and areas used by remediation workers for egress should be HEPA-vacuumed and cleaned with a damp cloth or mop and a detergent solution.
- All areas should be left dry and visibly free from contamination and debris.

Level III: Large Isolated Areas (30-100 sq. ft.) - e.g., several wallboard panels.

Industrial hygienists or other environmental health and safety professionals with experience performing microbial investigations and/or mold remediation should be consulted prior to remediation activities to provide oversight for the project.
The following procedures may be implemented depending upon the severity of the contamination.

- It is recommended that personnel be trained in the handling of hazardous materials and equipped with respiratory protection (e.g., N-95 disposable

respirators). Respirators must be used in accordance with the PEOSH adopted Respiratory Protection Standard (29 CFR 1910.134). Gloves and eye protection should be worn.

- Surfaces in the work area and areas directly adjacent that could become decontaminated should be covered with a secured plastic sheet(s) before remediation to contain dust/debris and prevent further contamination.
- Seal ventilation ducts/grills in the work area and areas directly adjacent with plastic sheeting.
- The work area and areas directly adjacent should be unoccupied. Removing people from spaces near the work area is recommended for infants, persons having undergone recent surgery, immune-suppressed people, or people with chronic inflammatory lung diseases, (e.g., asthma, hypersensitivity pneumonitis, and severe allergies)
- Dust suppression methods, such as misting (not soaking) surfaces prior to mediation, are recommended.
- Contaminated materials that cannot be cleaned should be removed from the building in sealed impermeable plastic bags. These materials may be disposed of as ordinary waste.
- The work area and surrounding areas should be HEPA-vacuumed and cleaned with a damp cloth or mop and a detergent solution.
- All areas should be left dry and visibly free from contamination and debris.

Note: If abatement procedures are expected to generate a lot of dust (e.g., abrasive cleaning of contaminated surfaces, demolition of plaster walls) or the visible concentration of the mold is heavy (blanket coverage as opposed to patchy), it is recommended that the remediation procedures for Level IV be followed.

Level IV: Extensive Contamination (greater than 100 contiguous sq. ft. in an area).

Industrial hygienists or other environmental health and safety professionals with experience performing microbial investigations and/or mold remediation should be consulted prior to remediation activities to provide oversight for the project.

The following procedures may be implemented depending upon the severity of the contamination:

- Personnel trained in the handling of hazardous materials and equipped with
  - full-face piece respirators with HEPA cartridges;
  - disposable protective clothing covering the entire body including both head and shoes; and
  - gloves.
- Containment of the affected area
  - complete isolation of the work area from occupied spaces using plastic sheeting sealed with duct tape (including ventilation ducts/grills, fixtures, and other openings);
  - the use of an exhaust fan with a HEPA filter to generate negative pressurization; and
  - airlocks and a decontamination room.
- If containment practices effectively prevent mold from migrating from affected areas, it may not be necessary to remove people from the surrounding work areas. However, removal is still recommended for infants, persons having undergone recent surgery, immune-suppressed people, or people with chronic inflammatory lung diseases, (e.g., asthma, hypersensitivity pneumonitis, and severe allergies).
- Contaminated materials that cannot be cleaned should be removed from the building in sealed impermeable plastic bags. The outside of the bags should be cleaned with a damp cloth and a detergent solution or HEPA-vacuumed in the decontamination chamber prior to their transport to uncontaminated areas of the building. These materials may be disposed of as ordinary waste.
- The contained area and decontamination room should be HEPA-vacuumed and cleaned with a damp cloth or mopped with a detergent solution and be visibly clean prior to the removal of isolation barriers.

Personal Protective Equipment (PPE)

Any remediation work that disturbs mold and causes mold spores to become airborne increases the degree of respiratory exposure. Actions that tend to disperse mold include breaking apart moldy porous materials such as wallboard, destructive invasive procedures to examine or remediate mold growth in a wall cavity; removal of contaminated wallpaper by stripping or peeling; using fans to dry items or ventilate areas.

The primary function of personal protective equipment is to prevent the inhalation and ingestion of mold and mold spores and to avoid mold contact with the skin or eyes. The following sections discuss the various types of PPE that may be used during remediation activities.

Skin and Eye Protection

Gloves protect the skin from contact with mold, as well as from potentially irritating cleaning solutions. Long gloves that extend to the middle of the forearm are recommended. The glove material should be selected based on the type of substance/chemical being handled. If you are using a biocide such as chlorine bleach, or a strong cleaning solution, you should select gloves made from natural rubber, neoprene, nitrile, polyurethane, or PVC. If you are using a mild detergent or plain water, ordinary household rubber gloves may be used.

To protect your eyes, use properly fitted goggles or a full face piece respirator. Goggles must be designed to prevent the entry of dust and small particles. Safety glasses or goggles with open vent-holes are not appropriate in mold remediation.

Respiratory Protection

Respirators protect clean-up workers from inhaling airborne mold, contaminated dust, and other particulates that are released during the remediation process. Either a half mask or full-face piece air-purifying respirator can be used. A full-face piece respirator provides both respiratory and eye protection. Please refer to the discussion of the different levels of remediation to ascertain the type of respiratory protection recommended. Respirators used to provide protection from mold and mold spores must be certified by the National Institute for Occupational Safety and Health (NIOSH). More protective respirators may have to be selected and used if toxic contaminants such as asbestos or lead are encountered during remediation.

As specified by PEOSH in 29 CFR 1910.134, individuals who use respirators must be properly trained, have medical clearance, and be properly fit-tested before they begin using a respirator. In addition, use of respirators requires the employer to develop and implement a written respiratory protection program, with worksite-specific procedures and elements.

Protective Clothing

While conducting building inspections and remediation work, individuals may encounter hazardous biological agents as well as chemical and physical hazards. Consequently, appropriate personal protective clothing (i.e., reusable or disposable) is recommended to minimize cross-contamination between work areas and clean areas, to prevent the transfer and spread of mold and other contaminants to street clothing, and to eliminate skin contact with mold and potential chemical exposures.

Disposable PPE should be discarded after it is used. They should be placed into impermeable bags, and usually can be discarded as ordinary construction waste.

Sampling for Mold

Is it necessary to sample for mold? In most cases, if visible mold growth is present, sampling is unnecessary. Air sampling for mold may not be part of a routine assessment because decisions about appropriate remediation strategies often can be made on the basis of visual inspection.

Your first step should be to inspect for any evidence of water damage and visible mold growth. Testing for mold is expensive, and there should be a clear reason for doing so. In many cases, it is not economically practical or useful to test for mold growth on surfaces or for airborne spores in the building. In addition, there are no standards for "acceptable" levels of mold in buildings, and the lack of a definitive correlation between exposure levels and health effects makes interpreting the data difficult, if not impossible.

Testing is usually done to compare the levels and types of mold spores found inside the building, with those found outside of the building or for comparison with another location in the building. In addition, air sampling may provide tangible evidence supporting a hypothesis that investigators have formulated. For example, air sampling may show a higher concentration of the same species of mold when the HVAC is operating than when it has been turned off. This finding may convince the investigators that the mold is growing within, and being disseminated by the HVAC system. Conversely, negative results may persuade investigators to abandon this hypothesis and to consider other sources of mold growth or dissemination.

If you know you have a mold problem, it is more important to spend time and resources removing the mold and solving the moisture problem that causes the moldy conditions than to undertake extensive testing for the type and quantity of mold.

If you are in doubt about sampling, consult an industrial hygienist or other environmental health or safety professional with experience in microbial investigations to help you decide if sampling for mold is necessary or useful, and to identify persons who can conduct any necessary sampling. Due to the wide difference in individual susceptibility to mold contamination, sampling results may have limited application. However, sampling results can be used as a guide to determine the extent of an infestation and the effectiveness of the clean-up. Their interpretation is best left to the industrial hygienist or other environmental health or safety professional.

Sampling for mold should be conducted by professionals with specific experience in designing mold-sampling protocols, sampling methods for microbial contaminants, and interpretation of results. For additional information on air sampling, refer to the American Conference of Governmental Industrial Hygienists' document, "Bioaerosols: Assessment and Control." In addition, sampling and analysis should follow any other methods recommended by either OSHA, NIOSH, EPA, the American Industrial Hygiene Association, or other recognized professional guidelines. Types of samples can include: air samples, surface samples, bulk samples, and water samples from condensate drain pans or cooling towers.

Microscopic identification of the spores/colonies requires considerable expertise. These services are not routinely available from commercial laboratories. Documented quality control in the laboratories used for analysis of the bulk, surface, and other samples is necessary. The American Industrial Hygiene Association offers accreditation to microbial laboratories (Environmental Microbiology Laboratory Accreditation Program (EMLAP)). Accredited laboratories must participate in quarterly proficiency testing (Environmental Microbiology Proficiency Analytical Testing Program (EMPAT)).

Remediation Equipment

There are various types of equipment useful in mold assessment and remediation. Some of the more common items include:

Moisture Meters

Moisture meters measure/monitor moisture levels in building materials, and may be helpful for measuring the moisture content in a variety of building materials following water damage. They also can be used to monitor the progress of drying damaged materials. These direct-reading devices have a thin probe that is inserted into the material to be tested or pressed directly against the surface of the material. Moisture meters can be used on materials such as carpet, wallboard, wood, brick, and concrete.

Humidity Gauges or Meters

Humidity meters can be used to monitor indoor humidity. Inexpensive (less than $50) models that monitor both temperature and humidity are available.

Humidistat

A humidistat is a control device that can be connected to an HVAC system and adjusted so that if the humidity level rises above a set point, the HVAC system will automatically turn on and reduce the humidity below the established point.

Borescope

A borescope is a hand-held tool that allows users to see potential mold problems inside walls, ceiling plenums, crawl spaces, and other tight areas. It consists of a video camera on the end of a flexible "snake." No major drilling or cutting of dry wall is required.

HVAC System Filter

High-quality filters must be used in a HVAC system during remediation because conventional HVAC filters are typically not effective in filtering particles the size of mold spores. Consult an engineer for the appropriate filter efficiency for your specific HVAC system, and consider upgrading your filters if necessary. A filter with a minimum efficiency of 50 to 60% or a rating of MERV 8, as determined by Test Standard 52.2 of the American Society of Heating, Refrigerating and Air-Conditioning Engineers, may be appropriate.

Remember to change filters as appropriate, especially following any remediation activities. Remove filters in a manner that minimizes the reentry of mold and other toxic substances into the workplace. Under certain circumstances, it may be necessary to wear appropriate PPE while performing this task.

How Do You Know When You Have Finished Remediation/Clean-up?

- You must have identified and completely corrected the source of the water or moisture problem.
- Mold removal should be complete. Visible mold, mold-damaged materials, and moldy odors should no longer be present.
- Sampling, if conducted, should show that the level and types of mold and mold spores inside the building are similar to those found outside.
- You should revisit the site(s) after remediation, and it should show no signs of moldy or musty odors, water damage, or mold growth and employee complains should be diminishing.

Conclusion

The primary response to mold contamination in buildings is to correct water or moisture infiltration; then promptly remove contaminated materials and perform structural repairs.

In all situations, the underlying cause of water accumulation must be rectified or the mold growth may reoccur.

Emphasis should be placed on preventing contamination through proper building and HVAC system maintenance and prompt repair of water damaged areas.

Effective communication with building occupants is an essential component of all large-scale remediation efforts. The building owner, management, and/or employer should notify occupants in the affected area(s) of the presence of mold. Notification should include a description of the remedial measures to be taken and a timetable for completion. Group meetings held before and after remediation with full disclosure of plans and results can be an effective communication mechanism. Individuals with persistent health problems that appear to be related to mold exposure should see their physicians for a referral to practitioners who are trained in occupational/environmental medicine or related specialists and are knowledgeable about these types of exposures.

A checklist on mold remediation can be found in Appendix A on page 11.

APPENDIX A
CHECKLIST FOR MOLD REMEDIATION*

Investigate and evaluate moisture and mold problems

- ☐ Assess size of moldy area (square feet)
- ☐ Consider the possibility of hidden mold
- ☐ Clean-up small mold problems and fix moisture problems before they become large problems
- ☐ Select remediation manager for medium or large-size mold problem
- ☐ Investigate areas associated with occupant complaints
- ☐ Identify source(s) or cause of water or moisture problem(s)
- ☐ Note type of water-damaged materials (wallboard, carpet, etc.)
- ☐ Check inside air ducts and air handling unit
- ☐ Throughout process, consult qualified professional if necessary or desired

Communicate with building occupants at all stages of process, as appropriate

- ☐ Designate contact person for questions and comments about medium or large-scale remediation as needed

Plan remediation

- ☐ Adapt or modify remediation guidelines to fit your situation; use professional judgment
- ☐ Plan to dry wet, non-moldy materials within 48 hours to prevent mold growth
- ☐ Select clean-up methods for moldy items
- ☐ Select Personal Protective Equipment - protect remediators
- ☐ Select containment equipment - protect building occupants
- ☐ Select remediation personnel who have the experience and training needed to implement the remediation plan and use Personal Protective Equipment and containment as appropriate

Remediate moisture and mold problems

- ☐ Fix moisture problem, implement repair plan and/or maintenance plan
- ☐ Dry wet, non-moldy materials within 48 hours to prevent mold growth
- ☐ Clean and dry moldy materials
- ☐ Discard moldy porous items that can't be cleaned

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* For details, see EPA's *Mold Remediation in Schools and Commercial Buildings*. Please note that this checklist was designed to highlight key parts of a school or commercial building remediation and does not list all potential steps or problems.

References

New Jersey Department of Health and Senior Services
Public Employees Occupational Safety
and Health Program
PO Box 360, 7th Floor
Trenton, NJ 08625-0360
e-mail: peosh@doh.state.nj.us
http://www.nj.gov/health/eoh/peoshweb

New Jersey Department of Labor and
Workforce Development
Division of Public Safety and Occupational
Safety and Health
PO Box 386
Trenton, NJ 08625-0386
(609) 292-7036
Fax: (609) 292-3749
http://www.nj.gov/labor/lwd/safetyposh.html

New Jersey Department of Health and Senior Services
Consumer and Environmental Health Services
Indoor Environments Program
PO Box 369
Trenton, NJ 08625
Fax: (609) 588-7818
http://www.nj.gov/health/eoh/hsrp/index.htm

U.S. Department of Labor, Occupational Safety and Health Administration. *A Brief Guide to Mold in the Workplace. http://www.osha.gov/dts/shib/shib101603.html*

U.S. Environmental Protection Agency, Office of Air and Radiation, Indoor Environments Division 2001. *Mold Remediation in Schools and Commercial Buildings*. EPA 402-K-01-001, *http://www.epa.gov/iaq/molds/graphics/moldremediation.pdf*

American Conference of Governmental Industrial Hygienists 1999.
Bioaerosols Assessment and Control
http://www.acgih.org
National Apartment Association,
http://www.naahq.org

National Institute for Occupational Safety and Health (NIOSH), *http://www.cdc.gov/niosh*

National Multi-Housing Council,
http://www.nmhc.org

The Building Owners and Managers Association International (BOMA), *http://www.boma.org*

New York City Department of Health & Mental Hygiene Bureau of Environmental & Occupational Disease Epidemiology 2002. *Guidelines on Assessment and Remediation of Fungi in Indoor Environments*
http://www.nyc.gov/html/doh/html/epi/moldrpt1.html

Mold Resources List

Contact the PEOSH Consultation Project at 609-984-1863 for free consultation service. The Consultation Program can help the employer evaluate and prevent hazardous conditions in the workplace that can cause injuries and illnesses, including mold problems.

The following list of resources includes information developed and maintained by public and private organizations. However, PEOSH does not control this information and cannot guarantee the accuracy, relevance, timeliness, or completeness of this outside information. Further, the inclusion of these resources is not intended to endorse any view expressed, or products or services offered, by the author of the reference or the organization operating the service identified by the reference.

Questions and Answers on Stachybotrys Chartarum and Other Molds
http://www.cdc.gov/nceh/ohp/pollution/molds/stachy.htm

An Office Building Occupant's Guide to IAQ
http://www.epa.gov/iaq/pubs/occupgd.html

Biological Contaminants
http://www.epa.gov/iaq/biologic.html

Building Air Quality Action Plan (For Commercial Buildings) *http://www.epa.gov/iaq/largebldgs/actionpl.html*

Floods/Flooding
http://www.epa.gov/iaq/pubs/floods.html

Indoor Air Quality (IAQ) Home Page
http://www.epa.gov/iaq

IAQ in Large Buildings/Commercial Buildings
http://www.epa.gov/iaq/largebldgs/

IAQ in Schools
http://www.epa.gov/iaq/schools/

Mold Resources
http://www.epa.gov/iaq/molds/moldresources.html

Mold Remediation in Schools and Commercial Buildings
http://www.epa.gov/iaq/molds/mold_remediation.html

U.S. EPA IAQ Information Clearinghouse (IAQINFO)
Phone: (800) 438-4318 or (703) 356-4020
Fax: (703) 356-5386
E-mail: iaqinfo@aol.com
Indoor air related documents, answers to Indoor Air Quality (IAQ) questions, maintains listing of State IAQ contacts, and regional EPA Contacts.

Air Conditioning Contractors of America (ACCA)
Phone: (703) 575-4477
http://www.acca.org/index.html
Information on indoor comfort products and services

American College of Occupational and Environmental Medicine (ACOEM)
Phone: (847) 818-1800
http://www.acoempriorpractice.com/
Referrals to physicians who have experience with environmental exposures.

American Conference of Governmental Industrial Hygienists, Inc. (ACGIH)
Phone: (513) 742-2020
http://www.acgih.org
Occupational and environmental health and safety information.

American Industrial Hygiene Association (AIHA)
Phone: (703) 849-8888
http://www.aiha.org
Information on industrial hygiene and indoor air quality issues including mold hazards and legal issues.

American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE)
Phone: (800) 527-4723
http://www.ashrae.org
Information on engineering issues and indoor air quality

Association of Occupational and Environmental Clinics (AOEC)
Phone: (202) 347-4976
http://www.aoec.org
Referrals to clinics with physicians, who have experience with environmental exposures, include exposure to mold, maintains a database of occupational and environmental cases.

Association of Specialists in Cleaning and Restoration (ASCR)
Phone: (800) 272-7012 or (410) 739-3603
http://www.ascr.org/institutes
Carpet and Upholstery Cleaning Institute, Mechanical System Hygiene Institute, National Institute of Disaster Restoration, National Institute Rug Cleaning, Water Loss Institute referrals to professionals

American Academy of Allergy, Asthma & Immunology (AAAAI)
Phone: (800) 822-2762
http://www.aaaai.org/
Physician referral directory, information on allergies and asthma.

Asthma and Allergy Foundation of America (AAFA)
Phone: (800) 7ASTHMA (800) 727-8462
http://www.aafa.org
Information on allergies and asthma.

American Lung Association (ALA)
Phone: (800) LUNGUSA (800) 586-4872
http://www.lungusa.org
Information on allergies and asthma

Allergy and Asthma Network Mothers of Asthmatics (AANMA)
Phone: (800) 878-4403 or (703) 641-9595)
http://www.aanma.org
Information on allergies and asthma

National Institute of Allergy and Infectious Diseases (NIAID)
Phone: (301) 496-5717
http://www.niaid.nih.gov
Information on allergies and asthma.

National Jewish Medical and Research Center
Phone: (800) 222-LUNG (800) 222-5864)
http://www.njc.org
Information on allergies and asthma.

Carpet and Rug Institute (CRI)
Phone: (800) 882-8846
http://www.carpet-rug.com
Carpet maintenance, restoration guidelines for water-damaged carpet, other carpet-related issues.

Centers for Disease Control and Prevention (CDC)
Phone: (800) 311-3435
http://www.cdc.gov
Information on health-related topics including asthma, molds in the environment, and occupational health. CDC is recognized as the lead federal agency for protecting the health and safety of the American people at home and abroad. It serves as the national focus for developing and applying disease prevention and control, environmental health, and health promotion and education activities.

Floods/Flooding
Federal Emergency Management Agency (FEMA)
Phone: (800) 480-2520
http://www.fema.gov/mit
Publications on floods, flood-proofing, etc.

University of Minnesota, Department of Environmental Health and Safety
Phone: (612) 626-5804
http://www.dehs.umn.edu/iaq/flood.html
Management water infiltration into buildings.

Indoor Environmental Remediation Board (IERB)
Phone: (215) 387-4097
http://www.ierb.org
Information on best practices in building remediation

Institute of Inspection, Cleaning and Restoration Certification (IICRC)
Phone: (360) 693-5575
http://www.iicrc.org
Information on and standards for the inspection, cleaning, and restoration industry.

International Sanitary Supply Association (ISSA)
Phone: (800) 225-4772
http://www.issa.com
Education and training on cleaning and maintenance

MidAtlantic Environmental Hygiene Resource Center (MEHRC)
Phone: (215) 387-4096
http://www.mehrc.org
Indoor environmental quality training center giving courses in building moisture and biocontamination, and managing and operating facilities for good IAQ. Extensive courses given in IAQ

National Air Duct Cleaners Association (NADCA)
Phone: (202) 737-2926
http://www.nadca.com
Duct cleaning information.

National Institute of Building Sciences (NIBS)
Phone: (202) 289-7800
http://www.nibs.org
Information on building regulations, science, and technology.

National Institute for Occupational Safety and Health (NIOSH)
Phone: (800) 35NIOSH (800) 356-4674
http://www.cdc.gov/niosh
Health and safety information with a workplace orientation.

National Pesticide Information Center (NPIC)
Phone: (800) 858-7378
http://npic.orst.edu/
Information on pesticides/antimicrobial chemicals, including safety and disposal information

New York Department of Health, Bureau of Environmental and Occupational Disease Epidemiology, Guidelines on Assessment and Remediation of Fungi in Indoor Environments
Phone: (212) 788-4290
http://www.ci.nyc.ny.us/html/doh/html/epi/moldrpt1.html

Occupational Safety and Health Administration (OSHA)
Phone: (800) 321-OSHA (800) 321-6742)
http://www.osha.gov
Information on worker safety and health, compliance assistance, laws and regulations, cooperative programs, state programs, statistics, and newsroom.

Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
Phone: (703) 803-2980
http://www.smacna.org
Technical information on topics such as air conditioning and air ducts

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Occupational Health Service
Public Employees Occupational Safety and Health Program

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Essex County Schools of Technology

Indoor Air Quality Program Update **2022-2023 School Year**

Public Employees Occupational Safety and Health

Appendix E

INDOOR BIOAEROSOLS

INDOOR BIOAEROSOLS

NEW JERSEY DEPARTMENT OF HEALTH AND SENIOR SERVICES

Heather Howard, J.D.
Commissioner

Public Employees Occupational Safety and Health Program

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Commissioner

Prepared by NJDHSS May 2003

INTRODUCTION

This information bulletin was prepared because of the increasing awareness of bioaerosols in the indoor environment. It is intended to provide general information on indoor bioaerosols, how to identify bioaerosol contamination and its sources, and the control of bioaerosols in the indoor environment. The information bulletin focuses on bioaerosols that get into buildings from the outside environment.

WHAT ARE BIOAEROSOLS?

Bioaerosols are microorganisms or particles, gases, vapors, or fragments of biological origin (i.e., alive or released from a living organism) that are in the air. Bioaerosols are everywhere in the environment.

Some examples of bioaerosols are:

Living Source Microorganisms (microbes):	Examples of Bioaerosols
Bacteria	*Legionella, Actinomycetes*
Fungi	*Histoplasma, Alternaria, Penicillium, Aspergillus, Stachybotrys*, aflatoxins, aldehydes, alcohol
Protozoa	*Naegleria, Acanthamoeba*
Viruses	*Influenza* (flu)
Algae	*Chlorococcus*
Green plants	*Ambrosia* (ragweed) pollen
Arthropods	*Dermatophagoides* (dust mites) feces
Mammals	Horse or cat dander

Bioaerosols are always present in our environment and pose no problems in most cases when the quantity of them and the various types are kept within reasonable limits. However, some bioaerosols, when breathed in, can cause diseases including pneumonia, asthma, rhinitis (e.g., cold, hay fever), and respiratory infection.

In order for microorganisms to release indoor bioaerosols, they must get indoors, grow and multiply on some material and then get into the air. Microorganisms can get indoors through the heating, ventilation, and air conditioning system, doors, windows, cracks in the walls, the potable drinking water system, or be brought in on the shoes and clothes of people working or visiting in the building. Water, humidity, temperature, nutrient sources (e.g., sheetrock, wood paneling, cellulose ceiling tiles, carpets, upholstered furniture, and fiberglass-lined air ducts) and oxygen determine whether micro-organisms will grow in the indoor environment. The most common microorganisms found indoors are fungi and bacteria. Fungi produce spores that become airborne; some also produce mycotoxins (poisonous substances) or volatile organic compounds. Some fungi found indoors that can cause health problems are *Penicillium, Aspergillus*, and *Stachybotrys chartarum*. Some bacteria produce endotoxins (poisonous substances) and volatile organic compounds. Bioaerosols other than those from microorganisms (e.g., pollen, cat dander) get indoors in the same way as the microorganisms. These do not multiply but may become a problem if they accumulate.

WHAT ARE THE DISEASES CAUSED BY INDOOR BIOAEROSOLS?

Bioaerosols enter the human body mostly through being breathed in. So, the diseases they cause usually affect the respiratory system.

The diseases caused by indoor bioaerosols fall into two categories: hypersensitivity diseases and infectious diseases.

Hypersensitivity Diseases

Hypersensitivity diseases (allergic diseases) result from exposure to materials in the environment called antigens (in this case, certain indoor bioaerosols) that stimulate an allergic response by the body's immune system. Some people are more susceptible than others. In other words, some of the people exposed may become ill and others may not. These diseases usually are diagnosed by a physician. Once an individual has developed a hypersensitivity disease, a very small amount of the antigen may cause a severe reaction. Hypersensitivity diseases account for most of the health problems due to indoor bioaerosols.

- $ Building-related asthma may result in complaints of chest tightness, wheezing, coughing, and shortness of breath. These symptoms may occur within an hour of exposure or 4–12 hours after exposure. Building-related asthma can be caused by airborne fungi such as *Alternaria*, glycoproteins from fungi, proteases (digestive enzymes that cause the breakdown of proteins) from bacteria, the algae *Clorococcus*, ragweed pollen, dust mites, and dander from cats.

- $ Allergic rhinitis involves stuffiness of the nose, clear discharge from the nose, itchy nose, and sneezing. Itching and puffy eyes may also occur. All the indoor bioaerosols listed under building-related asthma except the bacteria proteases also cause rhinitis.

- $ Hypersensitivity pneumonitis (extrinsic allergic alveolitis) can be an acute, recurrent pneumonia with fever, cough, chest tightness, and fluids entering the lungs. Or, it can be a cough that progresses to shortness of breath, fatigue, weight loss and thickening and scarring of the lungs. The microorganisms associated with hypersensitivity pneumonitis are fungi such as *Penicillium* and *Sporobolomyces*, bacteria such as *Thermoactinomyces*, and protozoa such as *Acanthamoeba*.

- $ Humidifier fever results in fever, chills, muscle aches, and malaise (general feeling of being unwell), but no lung symptoms. The symptoms usually start within 4–8 hours of exposure and end within 24 hours without long-term effects.

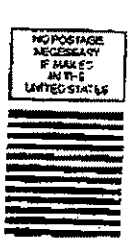
Infectious Diseases

Infectious diseases are caused by the invasion of the body by a harmful organism. Some examples of infectious diseases caused by indoor bioaerosols follow.

- $ Legionnaire's disease, a bacterial pneumonia, is caused by *Legionella pneumophila*. It is a type of pneumonia that affects the lungs and may also affect the stomach and intestines, kidneys, and central nervous system. It can take 2–10 days after exposure to develop and frequently requires hospitalization. The source of the disease has been traced to aerosols from contaminated cooling towers, evaporative condensers, whirlpools, shower heads, faucets, and hot water tanks.

- $ Pontiac fever is also caused by *Legionella*. Pontiac fever is a "flu-like" illness with fever, chills, headache, myalgia (pain in the muscles), cough, nausea, and breathlessness. Pneumonia does not occur. It usually lasts 2–5 days. The sources are the same as for Legionnaire's disease.

- $ Histoplasmosis and Cryptococcosis, both fungal infections, may occur when contaminated bird droppings enter the indoor environment. Infection with *Histoplasma* often results in no symptoms or there may be mild respiratory illness (cough, fever, malaise). Rarely, a life threatening illness involving many parts of the body occurs. Infection with *Cryptococcus* results in inflammation of the brain and the membranes covering it and also can involve the lungs, kidneys, prostate gland, bones, or liver. The skin may also be affected with acne-like lesions, ulcers, or tumor-like masses.



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NEW JERSEY DEPARTMENT OF HEALTH
AND SENIOR SERVICES
PEOSH PROGRAM
PO Box 360
TRENTON, NEW JERSEY 08625-9985

HOW IS IT DETERMINED THAT AN INDOOR BIOAEROSOL IS THE CAUSE OF A BUILDING-RELATED ILLNESS?

Health complaints related to indoor air quality usually have a real basis, though it may sometimes be difficult to find the cause. Sometimes, bioaerosols are suspected of causing symptoms that are really caused by other agents. For example, detergent residues left in carpets after cleaning can cause cough and dry throat symptoms. Carbon monoxide poisoning can cause headache, fatigue, and nausea. These, and similar agents, should be ruled out before investigating for bioaerosols. For more information, see the Public Employees Occupational Safety and Health Program's information bulletin entitled "Indoor Air Quality."

Several steps can be taken to make the determination that an indoor bioaerosol is the cause of a building-related illness. These steps include epidemiologic investigation and on-site investigation. Each of these steps is discussed below.

Epidemiologic Investigation

An epidemiologic investigation sometimes can clarify whether or not there is a building related illness, if it is due to an indoor bioaerosol(s), and, if so, how to deal with it. An epidemiologic investigation includes:

- $ definition of a case of disease;
- $ review of possible other non-building diseases that may be causing the problem;
- $ selection of controls (people without the disease) to compare to the cases;
- $ questionnaires for the cases and controls which include questions about the disease (e.g., symptoms, date started); and
- $ ordering of diagnostic tests, obtaining the results of physician evaluations, or arranging for one physician or clinic to evaluate all the employees with serious health complaints.

Sometimes the epidemiologic investigation is not necessary because it is obvious that a bioaerosol is causing the problem. For example, if mold is growing on a carpet or wall, an on-site investigation can begin without the epidemiologic investigation.

On-site Investigation

If it is believed that an indoor bioaerosol is the cause of the health complaints, an assessment of the bioaerosol status of the building should be undertaken. The investigators should study the structure, maintenance, and occupancy patterns of the building, look for possible sources of the indoor bioaerosol, and make recommendations about additional investigation or how to control the indoor bioaerosol. Sometimes bulk, wipe, or air sampling is part of the on-site investigation. The sampling strategy, laboratory analysis, and interpretation of the sampling results are complicated and require a high level of training and expertise. Industrial hygienists and/or other trained personnel (e.g., mycologist, engineer), building management, and maintenance personnel should be involved in the investigation. Areas that should be included in the on-site investigation are listed below.

- $ Outdoor investigation—Any disturbance that has recently occurred such as agricultural activity or construction work should be noted. Outdoor sources of bioaerosols can be stirred up during these activities. A sample of the outdoor air should be taken for comparison with the indoor air samples only if indoor air sampling is done (see the section on "Recommendations for Control"). The outdoor air sampling should be done at the same time and in the same way as the indoor air sampling. In general, the types of bioaerosols indoors should be similar to those outdoors and the amounts should be lower. If not, this indicates a potential problem.
- $ Heating, ventilation, and air conditioning (HVAC) system investigation—Generally a building's HVAC system mixes outdoor air with recirculated air, filters the air mixture, heats or cools the air mixture, and distributes it via ductwork throughout the building. Places to look within the HVAC system are the outdoor air intakes, filters, heat exchanger, air supply plenum and ductwork (including insulation), fan-coil and induction units, and return air. These parts of the system and the potential bioaerosol sources are described in more detail below.

- Outdoor air intakes – excessively contaminated outdoor air can be brought indoors through the intakes. Potential bioaerosol sources are cooling towers and evaporative condensers located close to or directly upwind from the outdoor air intakes, especially for Legionnaire's disease. Slime, foam, standing water, and other indicators of poor maintenance suggest microbial growth. Water samples and slime scrapings can be collected and analyzed in the laboratory. This is most helpful when a specific building-related disease such as Legionnaire's disease or Pontiac fever has been identified in the epidemiologic investigation. Sanitary vents located near the outdoor air intakes can contaminate the indoors with intestinal bacteria. Stagnant water, leaves, soil, or vegetable material near or in the intake can allow growth of bacteria and fungi which then enter the building. Birds may use the intakes to roost and nest. Their droppings can harbor fungi such as *Histoplasma* and *Cryptococcus* and bacteria.

- Filters – most buildings' filters are not efficient enough to remove small (1-2 microns) fungal and bacterial spores. Filters that contain organic dusts may become moist during the air conditioning season, allowing microbial growth on the filter itself. Filters are usually changed when there is a noticeable pressure drop in the HVAC system. By this time, many microorganisms can be growing on the filter. The dirt that has accumulated on the filters can be collected and analyzed to see if microorganisms are growing on the filter.

- Heat exchanger – the heat exchanger, with heating and cooling coils, adds or removes heat and moisture. Potential bioaerosol sources include stagnant water from drain pans that do not drain properly. The presence of slime or foam in standing water is an indicator of microbial growth. Water samples can be taken for analysis. Fungi and bacteria may grow in the porous insulation next to the cooling coils and drain pan. Microbial growth may be seen and/or bulk samples of insulation can be taken for analysis. Air washers and humidification devices are almost always contaminated with microorganisms. Bulk samples can be taken to confirm contamination.

- Air supply plenum and ductwork – this moves the filtered, conditioned air to the occupied rooms of the building. The reservoirs (the water supply) of humidification devices in the ductwork may be contaminated, and the ductwork next to these devices can become contaminated if water condenses on it. Reservoir water samples can be taken, the ductwork can be looked at for microbial growth, or bulk samples of the duct liner or accumulated debris can be collected. Ductwork usually has some dirt, but it should not contain a thick layer of deposited material. If dirt and debris collect in the ductwork and moisture becomes excessive, microbial growth can occur. If microbial growth can be seen, swab or bulk samples can be taken to confirm their identity.

- Fan-coil and induction units – heating and cooling for the building may also take place in these units which are located in enclosures. These units can become contaminated with microorganisms in the same way other parts of the ventilation system can become contaminated.

- Return air – air exits from the occupied space of the building in various ways. Bioaerosols from the occupied space can enter the return air system and settle on duct or plenum surfaces. Back-flow through the return air system could cause the settled microorganisms to get in the air again.

- Occupied space – the most important potential microbial source in occupied space is water from leaks, high relative humidity, humidifiers, floods, and spills. Microbes can multiply within a short time after water has gotten inside the building. Water-damaged ceiling tiles, sheetrock, wall coverings, wickerware, and wood are good places for microorganisms to grow. They also can grow on water-damaged chair fabric, modular furniture, and in carpets. Usually water damage and microbial growth are obvious, but water-damaged materials can support microbial growth long after they appear dry.

If the relative humidity in the occupied space is over 70 percent, materials containing carbon may absorb enough moisture to support microbial growth. Musty or moldy odors are associated with excess relative humidity and indicate that contamination exists. Condensation can occur on exterior walls and the building envelope (the area between the exterior and interior walls), especially in humidified buildings during the cold, winter months. Visible microbial growth is an indication of contamination, and swab or bulk samples can be taken to confirm the identity of the organisms. Microorganisms are abundant in portable cool mist and ultrasonic humidifiers unless they are cleaned and disinfected daily. People are sources of viruses such as influenza and measles, and bacteria such as *Staphylococcus*, *Streptococcus*, and *Mycobacterium tuberculosis*. People can also bring in contaminants on their clothes, such as cat dander, that become airborne. The number of people occupying the building affects the potential for transmission of diseases, as does inappropriate use of occupied space.

Recommendations for Control

As a result of the epidemiologic and/or on-site investigations, one or more potential bioaerosol sources may be identified, and there may be enough information to make recommendations for the control of the bioaerosols. Additional information may be needed to identify the bioaerosols and to determine if they are causing the problem. The results of the wipe and bulk samples collected during the on-site investigation may provide the additional needed information. Air sampling may be appropriate. If no apparent sources for bioaerosol contamination are found during the investigation, nonbioaerosol causes for building-related complaints should be investigated. Sometimes, it is not possible to determine for sure what is causing the building-related complaints. Control recommendations still may be made based on the findings of the on-site investigation.

WHAT ARE THE POSSIBLE CONTROLS FOR BIOAEROSOLS?

Actions to control indoor bioaerosols are of three types:

- $ design buildings and HVAC systems so that indoor contamination does not occur;
- $ maintain indoor conditions so that contamination does not occur and reoccur; and
- $ clean-up existing contamination.

Each of these actions is discussed in more detail below.

Building and HVAC System Design

Buildings and HVAC systems can be designed to prevent the entry of outdoor bioaerosols and to maintain conditions within the building that do not help microbial growth. Preventing the entry of bioaerosols from outdoors involves the appropriate location of air intakes and good air filtration. Design factors that help to prevent microbial growth are:

- $ Dilution – Adequate fresh air is needed to dilute human-source bioaerosols. For example, outdoor air should be provided at a rate of 20 cubic feet per minute (cfm) per person working in an office building.

- $ Maintenance – Good maintenance is necessary to eliminate areas where microorganisms can grow and multiply. Air handling units and ductwork should allow easy access for inspection and cleaning. The drain pan below the cooling coils should be designed and placed so that the collected water can drain easily, preventing the water from accumulating and becoming stagnant.

- $ Minimize and Protect Substrates – Substrates are any materials that trap dirt and moisture, thus providing a good place for microorganisms to grow. Acoustical/thermal fibrous glass insulation on the inside surface of the housing of the air handling, fan-coil, and induction units should be smooth-surfaced, or insulation should be placed on the outside. Fibrous glass lining should not be used in ductwork where there is high relative humidity or within ten feet of either side of the cooling coils. Carpeting should not be used where there is persistent moisture (e.g., buildings built on a slab with no basement).

- $ Humidification – Humidifiers provide moisture to the air, usually in the dry, winter months. Humidifiers should, if possible, use clean steam. Cold water humidifiers should use potable (drinkable) water that should be run to a drain line after passing through the humidifying device. Humidifiers using recirculated water are not recommended because they can become good sites for microbial growth.

The use of console humidifiers or vaporizers should be discouraged in the building. The use of water spray humidifiers or air washers as components of HVAC systems is not recommended because these units almost always provide a good place for microorganisms to grow. They have been associated with outbreaks of humidifier fever and hypersensitivity pneumonitis.

- Dehumidification – Moisture in the interior building must be controlled. Relative humidity in the occupied space should be maintained below 60 percent throughout the year. To accomplish this, most HVAC systems remove moisture or heat from the air through the use of a cooling coil section. Another approach to control humidity is to have reheat coils or desiccant dehumidification immediately after the heat exchanger. It is difficult and expensive to do this in an HVAC system already in place.

- Filtration – The location of the filters in the HVAC system is very important in protecting building occupants from bioaerosols. In order to remove fungal and bacterial spores, filters should have a 50-70 percent efficiency rating. In most air handling units, filters are located before the heat exchanger section. Consequently, building occupants will not be protected from bioaerosols produced in areas beyond the heat exchanger section, such as cooling deck coils, humidifiers, and water spray systems.

Maintenance

Preventive maintenance is probably the single most important method to control bioaerosols in existing buildings. Maintenance involves keeping the indoor environment clean by removing dirt and water and maintaining equipment so that conditions that help microbial growth do not occur. Cleaning includes the routine prevention of the build-up of dirt and moisture and immediate attention to unusual situations that could result in bioaerosol problems.

- Routine cleaning – A maintenance schedule must be established to remove dirt and debris from the internal components of air handling units, fan-coil units, and induction units. Carpeting should be maintained dry and free of accumulated dirt. Steam or other water-based carpet cleaning adds moisture to the environment and must be used with extreme care. The carpet should be dried with heat and fans within 24 hours. Duct cleaning (vacuuming) is necessary only when so much dirt has collected that the duct surfaces are no longer visible. Careful attention to proper filter selection and maintenance can reduce the need for duct cleaning.

- Heat exchange systems – Stagnant water should not be allowed to collect in drain pans or air handling and fan-coil units.

- Humidifiers – Cold water humidifiers should have a fastidious preventive maintenance program, including regular inspection of mechanical components and removal of stagnant water and slime.

- Dehumidification – Moisture levels in the air must be low enough so that condensation on cold interior surfaces such as cold water pipes does not occur. Protection of filters against moisture damage and scheduled replacement of filters is required for acceptable filter maintenance.

- Emergency situations – Prompt repair and prevention of leaks that cause floods are essential. If a flood is due to potable water, wet vacuums should be used to remove as much water as soon as possible, preferably within 24 hours. Water-damaged materials such as ceiling tiles, and insulation should be removed and replaced. Water-soaked carpeting and carpet padding should be replaced if it is not completely dried within 48 hours. Water-damaged papers should be discarded unless they are essential, in which case they should be spread out to dry as soon as possible. If microbial growth becomes visible, the papers should be discarded. Contaminated items can be frozen to stop microbial growth until drying can occur. A diluted bleach solution (1 part bleach to 10-50 parts water) may be used to disinfect hard surfaces when necessary. If the flood is due to dirty water such as sewage, the clean-up procedures are different. All contaminated porous materials, including carpets, should be removed. Other floor covering, such as tiles, can be disinfected with a diluted bleach solution, rinsed with clean water, and allowed to dry. Dehumidifiers can be used to dry water-damaged areas. All clean-up personnel should be protected using appropriate personal protective equipment such as respirators, gloves, and protective suits. Only trained individuals should perform the clean-up. If respirators are used, the Occupational Safety and Health Administration's (OSHA) or Public Employees Occupational Safety and Health (PEOSH) Program's Respiratory Protection Standard (29 CFR 1910.134) must be followed.

Clean-up of Existing Contamination

Potential sources of bioaerosols found during the on-site investigation, or following a more intensive investigation, should be removed and/or cleaned. Contaminated cooling towers should be cleaned and decontaminated to prevent the microorganisms from returning. Air intakes and/or cooling towers should be moved so that contaminants from the cooling towers or other places cannot enter the air intakes. Within the HVAC system, mechanical or detergent cleaning may be required to remove dirt and debris, and microorganisms before decontamination. Steam can be used for cleaning if that treatment does not damage the heat exchanger. Chlorine-generating materials or hydrogen peroxide may be used for disinfection. It is not clear that biocides (substances that kill living cells) are effective over the long term. HVAC system mechanical components should be turned off during cleaning and people should not be in the building. Cleaning chemicals and disinfectants should be removed from the HVAC system prior to its being restarted. Otherwise, the chemicals from the cleaning could become airborne and cause health problems for the people in the building.

Microbial contamination on hard surfaces may be removed with a vacuum cleaner that has a high-efficiency particulate air (HEPA) filter. Any porous material in a building that is contaminated with microorganisms should be discarded. Contaminated ceiling plenums are almost impossible to clean and contaminated insulation must be removed.

If the problem is due to bird droppings, the best approach is to isolate the affected area, and treat and remove the bird droppings. The bird droppings must be wet down and treated with a bleach solution before removal. The surrounding area should also be disinfected with a bleach solution. Personnel doing the removal should use personal protective equipment such as respirators, gloves, and protective clothing. All clean-up should be performed by trained individuals. If respirators are used, the OSHA or PEOSH Program's Respiratory Protection Standard (29 CFR 1910.134) must be followed.

REFERENCES

Public Employees Occupational Safety and Health Program, New Jersey Department of Health and Senior Services, "Indoor Air Quality," January 2001. This information bulletin and other information on indoor air quality can be obtained by calling (609) 984-1863 or by writing to the PEOSH Program, New Jersey Department of Health and Senior Services, PO Box 360, Trenton, NJ 08625-0360. The information may also be obtained from the PEOSH Web Site at www.state.nj.us/health/eoh/peoshweb.

American Conference of Governmental Industrial Hygienists, *Bioaerosols: Assessment and Control*, Cincinnati, Ohio, 1999. The *Guidelines* can be obtained from the American Conference of Governmental Industrial Hygienists (ACGIH) by calling (513) 742-6163 or by writing to ACGIH, Kemper Woods Center, 1330 Kemper Meadow Drive, Cincinnati, OH 45240.

Morey PR, "Statement on Biocontaminant Control for Occupational Safety and Health Administration Public Hearings on the Agency's Indoor Air Quality Proposal," Clayton Environmental Consultants, Inc. October 13, 1994.

Office of Air and Radiation, United States Environmental Protection Agency, *Introduction to Indoor Air Quality—A Reference Manual*, EPA/400/3-91/003, July 1991. This and other information on indoor air quality can be obtained from the United States Environmental Protection Agency by calling (800) 438-4318 or by writing to USEPA, Indoor Air Quality Information Clearinghouse, P.O. Box 37133, Washington, DC 20013-7133.

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PEOSH PROGRAM
READER RESPONSE CARD

Indoor Bioaerosols

Dear Reader:

Please take a few minutes to help us evaluate this publication. Please check the following:

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Which section did you find most useful?

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Other occupational health topics you would like to see the PEOSH Program develop an information bulletin on:

Other comments and suggestions:

Essex County Schools of Technology

Indoor Air Quality Program Update **2022-2023 School Year**

Public Employees Occupational Safety and Health

Appendix F

RENOVATION & CONSTRUCTION - IAQ COMPLIANCE CHECKLIST

Renovation/Construction Project
IAQ Compliance Checklist

Employer Name: _____
Facility Name: _____
Project Name: _____
Estimated Time Period: _____
Area(s) Affected _____
General Contractor Name/Phone #: _____

Pre-Construction/Planning Phase:	**Complete**	**N/A**
Notified the Designated Person of the project.	☐	☐
Considered performing work during periods of minimal or non-occupancy and included requirements in bid specification (if applicable).	☐	☐
Reviewed hazard information (labels, MSDS) with contractor(s) and approved selected products.*	☐	☐
In buildings constructed prior to 1981: Reviewed Asbestos Survey. Ensured that all Asbestos-containing materials (ACM)/and Presumed Asbestos-containing materials (PACM) are labeled, Employees and Contractors notified of presence of ACM/PACM.	☐	☐
Notified affected employees at least 24 hours in advance, or promptly in emergency situations, of work to be performed on the building that may introduce air contaminants into their work area.*	☐	☐
Reviewed hazard information (labels, MSDS) to determine necessary measures to be taken.*	☐	☐
Reviewed product labels and MSDS sheets to determine whether the use of paints, adhesives, sealants, solvents or installation of insulation, particle board, plywood, floor coverings, carpet backing, textiles or other materials contain volatile organic compounds that could be emitted during regular use.*	☐	☐
Construction Phase:		
Local ventilation or other protective devices used to safeguard employees and students from dust, stone and other small particles, toxic gases or other harmful substances in quantities hazardous to health are in place.	☐	☐
Renovation/Construction areas in occupied buildings are isolated so that air contaminants, dust, and debris are confined to the renovation or construction area by use of measures such as physical barriers and pressure differentials.	☐	☐
Re-occupancy Phase:		
Inspected that the work areas are cleaned and aired out as necessary prior to re-occupancy.*	☐	☐
Re-occupancy authorized by: (Name/Title) Name: _____ Title: _____ Signature: _____ Date: _____		

** N.J.A.C. 12:100-13.5 requires that documentation of this action be maintained in accordance with recordkeeping requirements.*

Essex County Schools of Technology

Indoor Air Quality Program Update **2022-2023 School Year**

Public Employees Occupational Safety and Health

Appendix G

RENOVATION & CONSTRUCTION IN SCHOOLS - CONTROLLING HEALTH AND SAFETY HAZARDS

Renovation & Construction in Schools Controlling Health and Safety Hazards

Clifton R. Lacy, M.D.
Commissioner

James E. McGreevey
Governor

Albert G. Krell
Commissioner

Public Employees Occupational Safety and Health Program

March, 2004

Background

New Jersey's ***Educational Facilities Construction and Financing Act***, which was enacted on July 18, 2000, provides extensive funding to restore and rebuild schools that are old and deteriorating in the State. Because of this legislation, New Jersey will experience an unprecedented amount of school construction and renovation in the next decade. The increased activity, often conducted while a building is occupied, may create safety and health risks for school employees. This document provides information on potential health and safety hazards associated with school renovation and construction and what precautions to take in order to prevent or control them.

What are some of the potential health hazards associated with school renovation and construction?

- Dust and debris
- Asbestos
- Lead
- Air pollutants from paints, sealers, glues, varnishes, urethanes and roofing materials
- Air pollutants from new furnishings and equipment (copiers, carpeting, new particleboard or plywood)
- Diesel exhaust, carbon monoxide
- Mold
- Accumulated bird droppings
- Noise

What are some of the health symptoms associated with these hazards?

- Eye, nose and throat irritation
- Nasal congestion, sneezing and coughing
- Rashes and skin irritation
- Asthma-like symptoms such as wheezing, tightness in the chest, shortness of breath
- Nausea
- Dizziness
- Headaches
- Irritability
- Stress

What are some of the main areas of concern associated with school renovation/construction?

Construction and Demolition Work

Construction and demolition work usually creates nuisance dust. The greatest amount of dust may be generated during dry dusting and sweeping. These practices should be avoided because they may lead to excessive dust in the work area, which may cause health-related complaints from building occupants.

Demolition and construction can cause excessive noise. There may also be airborne exposure to welding fumes as well as carbon monoxide and fuel exhaust.

Safety-related problems may include: dangerous traffic patterns; open construction areas; falling objects; unattended construction equipment; blocked exits; and disabled fire alarms, detection systems and emergency lights.

Asbestos

Asbestos is present in many schools in building materials such as pipe and boiler insulation, sprayed-on or troweled-on fire-resistant surfacing materials, roofing products and siding, acoustical products, and floor and ceiling tiles. Asbestos-containing materials (ACM) are considered relatively safe if the fibers within the building material are firmly bonded or compacted. When asbestos becomes loose or crumbles (called "friable"), microscopic fibers can be released into the air and cause a health risk when breathed in or swallowed. Potential health problems, which take years to develop, include scarring of the lung (asbestosis) and cancer. Exposures to asbestos are most likely to occur during removal of ACM or disturbing ACM during renovation activities.

All New Jersey schools must have an ***Asbestos Hazard Emergency Response Act (AHERA) Management Plan*** that should be made available to employees upon request. The location of asbestos and its condition (e.g., intact or friable) must be identified in the Plan.

PEOSH standards regulating asbestos include:

- ***General Asbestos Standard, 29 CFR 1910.1001*** - covers routine custodial/housekeeping operations in facilities where ACM are present;

- ***Asbestos Standard for Construction, 29 CFR 1926.1101*** - applies to demolition and renovation of buildings where asbestos is present. It also includes removal and encapsulation of ACM, emergency clean up of asbestos spills, as well as transporting, disposing, storing, containing, and housekeeping activities involving ACM on a construction site.

Both asbestos standards set a maximum exposure limit and include provisions for engineering controls such as isolation, enclosure, local exhaust ventilation and dust collection. The standards mandate respirator training, protective clothing, exposure monitoring, hygiene facilities and practices, warning signs, labeling, recordkeeping and medical exams for workers in areas in excess of the Permissible Exposure Limit (PEL) and the Excursion Limit (EL) for airborne asbestos.

The regulations prohibit the following work practices:

- Dry sweeping, shoveling or other dry clean-up of dust and debris;
- Using compressed air for dust clean-up;
- Sanding of asbestos-containing flooring.

For more information on asbestos, contact the PEOSH Program. (See Resource List on page 8.) Copies of the asbestos standards, 29 CFR 1910.1001, and 29 CFR 1926.1101, can be accessed from www.osha.gov.

For information on asbestos removal procedures and contractors, contact the NJDHSS Consumer and Environmental Health Services, Indoor Environments Program, at (609) 588-3120.

Lead

Lead exposures occur when lead-containing coatings or paint are disturbed or removed from surfaces during building renovation and demolition. As with asbestos, lead-based paint that is in good repair and is not flaking poses a minimal risk. The paint becomes a threat when it is damaged due to abrasion (e.g., sanding), poor maintenance, water damage, or during renovation and construction.

Lead can be absorbed into the body by inhalation or ingestion. Adverse health effects associated with lead dust include damage to the nervous system and kidneys. Low-level exposure can cause a range of physical and mental problems including loss of appetite, nausea, vomiting, fatigue, moodiness, headaches, anxiety, insomnia, and high blood pressure.

The PEOSH standard that regulates lead is:

> ***Lead in Construction, 29 CFR 1926.62.*** This standard requires employers to use, when feasible, engineering, work practice and administrative controls to reduce and maintain employee lead exposure to or below the Permissible Exposure Limit (PEL).

For more information on lead, contact the PEOSH Program. (See Resource List on page 8.) A copy of the Lead Standard, ***29 CFR 1926.62***, can be accessed from www.osha.gov.

For information on training and certification requirements for lead abatement contractors, contact the NJDHSS Lead Abatement Program at (609) 588-7456.

Mold

There is a potential for exposure to mold spores and other biological materials from existing contaminated building materials during renovation and construction activities. This can happen when workers have to repair or remove water-damaged building materials, such as sheet rock, ceiling tiles and carpeting that have become contaminated. Mold spores can become airborne when work is being done on a heating, ventilation and air conditioning (HVAC) system that has areas of microbial growth (e.g., contaminated insulation inside the ductwork). Mold spores can also be pulled into the school via the ventilation system from outside sources (e.g., excavation).

Airborne microorganisms or particles (e.g., mold spores) are present in our environment and usually pose no problems. Some mold spores however, when breathed in, can cause asthma, rhinitis, sinus infections, pneumonia and other respiratory infections. It is important to note that dead mold can still cause allergic reactions and other health effects in sensitive individuals.

For more information on mold, contact the PEOSH Program. (See the Resource List on page 8.)

Bird Droppings

There are health risks associated with airborne exposure to contaminated dust from accumulated bird droppings. Fresh bird droppings on surfaces have not been shown to present a health risk. However, there is a health risk associated with accumulated bird droppings (e.g., several inches of pigeon manure from roosting pigeons in an undisturbed location, i.e., attics, roofs and stairwells). Among the fungal diseases associated with bird droppings, the two most common are histoplasmosis and cryptococcosis. For more information, see the Resource List on page 8.

Roofing

Roofing work often involves the use of tar or other pollutant-producing chemicals that cause indoor air problems if airborne contaminants enter the building. Therefore, it is important to identify, and close off when appropriate, outside air intakes located on the roof prior to beginning roof repairs. If the building is occupied, an alternative source of outside air should be provided to the affected areas.

There are many different types of roofing operations. While older methods include applying coal-tar pitch and asphalt, newer roofing technologies use rubber or other synthetic membranes as roofing materials. Roof removal operations may release coal-tar pitch dust that is a confirmed human carcinogen. Rubber or synthetic applications use organic solvents in adhesives, primers, sealants and hardening agents that may be toxic. Short-term exposure to solvents can affect the central nervous system in the body and prolonged exposure can cause a range of chronic health effects. During the application of polyurethane roofing, isocyanates and organic vapors may be released which can cause adverse health symptoms.

Flooring

Installation of flooring materials has the potential to impact indoor air quality (IAQ); therefore, selection of flooring materials is an important consideration during the renovation process. Potential pollutants from flooring materials include volatile organic compounds (VOC's) that may be emitted into the air (called "off-gassing"). Floor adhesives, varnish and sealers contain VOC's that can cause adverse health effects usually through inhalation.

Painting

Chemicals may be introduced into the indoor environment during painting operations. In addition to paints, other products such as strippers, primers and thinners may also be used in painting operations. When solvents evaporate or aerosolize, air quality in the school can be affected. Although water-based paint is often used, most paint still contains some measure of VOC's that can produce health effects that include respiratory irritation, dizziness, nausea and asthma-like symptoms.

New Furnishings

Formaldehyde and other chemicals are found in furniture, new carpeting, particleboard, plywood and many other products associated with renovation. After installation, low levels of these chemicals can be emitted into the air, which can cause irritation of the eyes and respiratory tract.

What can be done to prevent or reduce safety and health hazards?

The key to preventing or controlling health and safety problems during and after renovation and construction in schools is in the planning phase of the operation. In the words of Benjamin Franklin, "An ounce of prevention is worth a pound of cure".

General Planning Activities

Inspect the designated areas in the school

Areas to be renovated should be inspected long before the work begins. This provides time to identify and evaluate potential problems, and incorporate the appropriate language into the contract specification when indicated. Express concerns to the architect and builder and enlist their help in taking measures to assure a safer environment both during and after the project.

Asbestos, lead-based paint, mold-contaminated building materials, and accumulated bird droppings should be identified and removed by trained personnel prior to any renovation and construction that will disturb them.

Check the regulations!

Review the applicable regulations (such as the Asbestos and Lead standards) and find out what is required. Consult your school's AHERA Asbestos Management Plan (AMP). If renovation will disturb any asbestos, hire a competent person to assist with the project.

Do an initial screening of the building using a trained lead paint inspector/risk assessor. Special care should be taken when sanding surfaces to prepare for painting, due to the dust released into the air. The dust may contain lead particles. Use appropriate personnel and precautions when removing and disposing of lead-based paint.

Check with New Jersey Department of Environmental Protection (NJDEP) Hazardous Waste Technical Assistance Hotline at (609) 292-8341 regarding appropriate waste disposal methods for lead and asbestos.

The PEOSH Program enforces the ***PEOSH Indoor Air Quality Standard (NJAC 12:100-13)*** for public employees in New Jersey. Key provisions of the law include:

- Use local ventilation or other protective devices to ensure the safety of employees when renovation work and/or new construction results in the dispersion of dust, stone, and other small particles, toxic gases or other harmful substances in quantities hazardous to health.
- Isolate renovation in occupied buildings so that dust and debris will be confined to the renovation/ construction area.
- Check product labels, or seek and obtain information from manufacturers to determine if the product contains volatile organic compounds such as solvents, formaldehyde or isocyanates that could be emitted during regular use. This is especially important before using paints, adhesives, sealants, or installation of insulation, particleboard, plywood, floor coverings, carpet backing, textiles, or other materials used in the course of renovation/ construction.

- Notify employees at least 24 hours in advance, or promptly in emergency situations, of work to be performed in the school that may introduce air contaminants into their work area.

The PEOSH Indoor Air Quality Standard also requires that visible mold growth be remediated. If there is a problem with mold in the school, contact the PEOSH Program for guidance on adequate protective measures to ensure both worker and occupant safety. Contact the PEOSH Program for a copy of the PEOSH Indoor Air Quality Standard (see the Resource List on page 8).

Contract Specifications

Contract specifications should state that all applicable regulations must be satisfied. Possible contract specification topics include:

- Notification and communication
- Scheduling to minimize occupant exposure
- Selection of building materials
- Protection of building systems and furnishings, including the ventilation system
- Use of isolation techniques, including barriers and negative pressure
- Ventilation and filtration requirements
- Work practices and housekeeping
- Material storage
- Close-out and commissioning criteria

Notification and Communication

Good communication will help foster an atmosphere of trust and confidence in which people are more willing to work together on solutions to problems that may occur. Avoid withholding information - it usually is counterproductive and affects trust.

Designate a person knowledgeable about indoor air quality issues to oversee the work and answer any questions. Notify employees before planned changes in the building. They should be kept up to date periodically as the work progresses. If the building is to be occupied during the summer months, notify the occupants prior to renovation and construction activities. Staff should report complaints, concerns, and observations, including health symptoms, to the designated person. The designated person should keep a log of this information including corrective actions that were taken.

If not already established, a Health and Safety Committee should be created. The Committee should meet regularly with the designated person, construction manager, contractor and project architect and should be involved in the investigation and response to complaints. For more information on Health and Safety Committees, contact the PEOSH Program (see the Resource List on page 8). Providing accurate information will help people understand that steps are being taken to protect their health during a renovation project and allow individuals with special health concerns to prepare for the event.

Changes in the school's evacuation plan should be addressed. Exits that were used pre-renovation may have been eliminated or no longer provide a safe exit from the building. When evaluating the evacuation plan, check both sides of the exit door. An exit may look unchanged from the inside of the building, but on the outside they may exit directly into a construction area or be limited in other ways. Meeting points should also be reviewed to determine if they are still safe. Frequent walk-through inspections should also be done to insure that evacuation routes have not been blocked or altered.

Scheduling to Minimize Occupant Exposure

If possible, begin and end the renovation activity during the summer months or while staff and students are not in school. Even during unoccupied times, ventilation and containment strategies discussed below should be used to prevent the spread of contaminants throughout the school.

It is recommended that employees be relocated if they are sensitive to materials used during renovation activities.

Selection of Building Materials

Before renovation begins, employees should be informed how they can obtain material safety data sheets (MSDSs) and *New Jersey Right to Know Hazardous Substance*

Fact Sheets (HSFSs) for information on products that will be used during the renovation process. The employer can request MSDSs from the contractor or the manufacturer of the product. The HSFS can be obtained by contacting the New Jersey Department of Health and Senior Services, Right to Know Program at (609) 984-2202.

Select low-or-no VOC-emitting paint (e.g., water-based paints instead of oil-based), finishes, glues and adhesives. Schools should avoid using carpets, especially on concrete slabs in contact with the ground, in favor of hard and smooth cleanable flooring such as textured (skid-free) tile. Vapors (including VOC's) given off by carpet components and carpet adhesives, can contribute to indoor air pollution. Carpets can also harbor a variety of biological contaminants such as dust mites, bacteria and mold that can grow in carpets that have been exposed to moisture. Carpeting is also likely to be more difficult to maintain than other flooring alternatives.

However, if a decision is made to use carpeting, the Carpet and Rug Institute (CRI) has a carpet testing and labeling program. If your carpet supplier cannot provide information on any carpets you are considering, contact CRI (800-882-8846) to obtain data on emissions from these carpets. If practical, unwrap and unroll flooring products in a well-ventilated location other than the school, such as a ventilated warehouse, prior to installation.

Protection of building systems and furnishings, including the ventilation system

Construction workers should use work practices that minimize dust creation. They should be discouraged from walking through the occupied areas and tracking dust and dirt through the school. Walk-off mats, the use of removable coveralls, and wiping down equipment before exiting the work area are all effective practices.

In addition, new construction materials should be protected from water and high humidity to guard against mold growth.

Use of isolation techniques, including barriers and negative pressure

The best method to avoid student/staff injuries is to maintain strict control of access to the construction site when appropriate. Items such as fencing posts anchored in the ground, strong fencing materials, limited openings in the fence and securing of the site during non-work hours should be included in the initial contracts.

Plan to isolate students, staff, and other areas of the school from any dust or fumes generated during renovation work. This may include temporarily relocating people away from potential problem areas. Use plastic sheeting, portable fans, and a mechanical ventilation strategy (where applicable) to prevent dust and fumes from reaching school occupants through hallways, doors, windows, and the ventilation system.

On small jobs (e.g., painting a classroom), use local exhaust (e.g., fans facing outwards in windows) to remove pollutants and help ensure that air does not move from the renovation work area to the rest of the school. Air from the work area should be exhausted directly to the outdoors and the room maintained under negative pressure relative to the surrounding rooms and hallways.

Ventilation and filtration controls

Don't allow the ventilation system to carry construction-related pollutants throughout the building. Whenever possible, exhaust pollutants from work areas directly to the outside. Avoid cutting off an occupied room from its supply of outdoor air. If a room is subdivided, the newly created rooms should have an air supply and exhaust.

Use the ventilation system to dilute odors or pollutants that may inadvertently migrate to occupied staff and student areas. Operate supply fans continuously (24 hours/day, 7 days/week), at the highest possible outdoor air supply setting. (This assumes that measures have been taken to protect the ventilation system itself from construction emissions. See the previous section on isolation techniques.)

It may be necessary to temporarily block ventilation grills in work areas to avoid having the ventilation system serve as either a reservoir or pathway for pollutants. This is especially important where the return (exhaust) air is recirculated throughout the building.

Use filters with the highest recommended efficiency. They should be checked frequently during the renovation activities and changed as needed. (Consult the ventilation system manufacturer for their recommendations.)

Work practices and housekeeping

During periods of renovation, increased housekeeping may be necessary, not only in the renovation area, but also in the rest of the school.

The school's cleaning schedule should be increased to address the extra dust and dirt created by the renovation work. The following should be done on a daily basis:

- Clean all horizontal surfaces (desks, chair seats, windowsills, etc.) to minimize exposure to dust. Dusting should be done with a damp cloth.
- Damp-mop vinyl, tile and other hard surface flooring.
- Vacuum carpets with a high efficiency particulate air (HEPA) filter vacuum.

This work should ideally be done after construction activities have finished for the evening, or before students arrive in the morning.

Material storage

Seal containers carefully after use. Keep paint containers and other related products in designated storage areas equipped with exhaust ventilation, never in HVAC equipment rooms.

Closeout and commissioning criteria

- Ensure that after the work is completed that all hard surfaces are wet-wiped and vacuumed (high efficiency vacuuming for fine or potentially toxic dusts, such as asbestos, lead or mold).
- Clean building system components, including those in the ventilation system which have been contaminated during the work. This includes the disposal and replacement of filters.
- If the ventilation system were modified, or if areas served by the ventilation system have been altered (e.g., if a partition wall was installed or removed), have the system balanced and tested.
- Ventilate the school before occupancy.
- Investigate on-going employee and student health symptoms.
- Correct remaining problems.

RESOURCE LIST

New Jersey Department of Health
and Senior Services
Public Employees Occupational Safety
and Health Program
PO Box 360, 7th Floor
Trenton, NJ 08625-0360
(609) 984-1863
Fax: (609) 984-2779
e-mail: peosh@doh.state.nj.us
http://www.state.nj.us/health/eoh/peoshweb

New Jersey Department of Health
and Senior Services
Consumer and Environmental Health Services
Indoor Environments Program
PO Box 369
Trenton, NJ 08625-0369
(609) 588-3120
http://www.state.nj.us/health/eoh/tsrp

U.S. Environmental Protection Agency (EPA).
Indoor Air Quality, Design Tools for Schools,
Draft, July 2002
www.epa.gov/iaq/schooldesign/construction.html
www.epa.gov/iaq/schooldesign/renovation.html
www.epa.gov/iaq/schools/tfs/renovate.html

New Jersey Department of Labor
Division of Public Safety and Occupational
Safety and Health
PO Box 386
Trenton, NJ 08625-0386
(609) 292-7036
Fax: (609) 292-3749
http://www.state.nj.us/labor/lsse/lspeosh.html

New Jersey Department of Environmental Protection
Bureau of Resource Recovery and
Technical Programs
(609) 984-6985
Hazardous Waste Technical Assistance Hotline
(609) 292-8341

Federal OSHA: www.osha.gov

U.S. Environmental Protection Agency (EPA).
Mold Remediation in Schools and Commercial
Buildings
www.epa.gov/iaq/mold

PEOSH Information Bulletins:

Policy on Building Renovations
Asbestos in Construction
Facts About Lead Paint Hazards for Public Employees
Indoor Air Quality Standard
Bioaerosols
Control of Health Hazards Associated with Bird and Bat Droppings

Also Available:

PEOSH Indoor Air Quality Model Program

Document prepared by:
Carol Lamond, R.N., M.S.
NJDHSS PEOSH Program
Education and Training Project

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PEOSH PROGRAM
READER RESPONSE CARD

Renovation & Construction in Schools
Controlling Health and Safety Hazards

Dear Reader:

Please take a few minutes to help us evaluate this publication. Please check the following:

Check the category that best describes your position:

- ☐ manager
- ☐ safety professional
- ☐ researcher
- ☐ employee
- ☐ occupational health professional
- ☐ health care worker
- ☐ educator
- ☐ other (specify) _____

Check the category that best describes your workplace:

- ☐ academia
- ☐ state government
- ☐ county government
- ☐ municipal government
- ☐ municipal utilities authority
- ☐ labor organization
- ☐ other (specify) _____

Describe how thoroughly you read this publication:

- ☐ cover-to-cover
- ☐ sections of interest only (specify) _____
- ☐ other (specify) _____

How will you use this information (check all that apply):

- ☐ change the work environment
- ☐ change a procedure
- ☐ assist in research
- ☐ change training curriculum
- ☐ provide information
- ☐ copy and distribute
- ☐ in training
- ☐ not used
- ☐ other (specify) _____

Which section did you find most useful?

The least useful and why?

Other occupational health topics on which you would like to see the PEOSH Program develop an information bulletin:

Other comments and suggestions:

BUSINESS REPLY MAIL
256

360

086259985

Essex County Schools of Technology

Indoor Air Quality Program Update **2022-2023 School Year**

Public Employees Occupational Safety and Health

Appendix H

PEOSH POLICY ON BUILDING RENOVATION

POLICY ON
BUILDING RENOVATION

Public Employees Occupational Safety and Health Program

Clifton R. Lacy, M.D.
Commissioner

James E. McGreevey
Governor

Albert G. Kroll
Commissioner

Revised March 1997

This educational bulletin contains information on potential renovation health hazards and how to minimize or avoid such hazards. Topics include: roof renovation, painting, construction and demolition work, lead abatement, asbestos and carpeting.

ROOF RENOVATION, PAINTING, CONSTRUCTION AND DEMOLITION

The Public Employees Occupational Safety and Health (PEOSH) Program has received numerous complaints from building occupants who have stated that they experienced health symptoms from renovation activity. Health effects associated with vapors and dusts generated by these activities include eye irritation, upper respiratory irritation, nausea, dizziness, lightheadedness, headache and irritability.

Roof Renovation: Several different types of roofing applications are available. While older methods include applying coal-tar pitch and asphalt, newer roofing technologies use rubber or other synthetic membranes as roofing materials. Each type of roofing application should be evaluated for the potential for releasing chemical contaminants.

Studies by the National Institute for Occupational Safety and Health (NIOSH) have documented that health problems can occur from exposure to coal-tar pitch products during roofing operations. Roof removal operations may release coal-tar pitch dust that contains polynuclear aromatic hydrocarbons (PAHs).

Rubber or synthetic membrane applications use organic solvents in adhesives, primers, sealants and hardening agents. During the applications of polyurethane roofing, methylene-bisphenyl-isocyanate and organic solvent vapors may be released which can cause adverse health symptoms.

Painting: Painting may introduce many chemicals into the indoor environment. In addition to paints, other products such as strippers, primers, and thinners may also be used. The solvents and additives found in paints, strippers, primers, and thinners may cause indoor air quality problems, due to the evaporation and aerosolization of the solvents and additives found during and after application.

Paints are usually described by the solvent systems utilized in their formulations. The two common types of paints are:

- alkyd—hydrocarbon solvent based and usually a higher volatile organic compound (VOC) content
- latex—water based and usually a lower VOC content.

The amount of VOCs present in paints and released into the indoor environment may contribute to indoor air quality problems during painting operations. Paint manufacturers have formulated paints that have lower VOCs, but these paints tend to be thicker and more difficult to apply. Some companies are producing paints from "natural" products. These paints are not considered to be hazard free, but they are developed from substances which are less harmful.

Construction and Demolition Work: Construction and demolition work usually creates nuisance dust. The greatest amount of dust may be generated during sweeping. If good housekeeping practices are not used, this may lead to excessive dust in the work area, which may cause adverse health effects for building occupants.

What can be done to reduce potential health hazards?

The PEOSH Indoor Air Quality Standard contains requirements for building renovation. The regulation requires renovation or new construction that results in the diffusion of dust, stone, and other small particles, toxic gases or other harmful substances in quantities hazardous to health, be safeguarded by local ventilation or other protective devices to ensure the safety of employees.

Renovation areas in occupied buildings must be isolated and dust and debris must be confined to the renovation or construction area. Examples of isolation measures may include:

- sealing off the work area;
- shutting down ventilation system and sealing the supply and return grilles;
- maintaining the work area under negative pressure in relation to adjacent areas;
- practicing good housekeeping in the work area.

Before using paints, adhesives, sealants, solvents, or installing insulation, particle board, plywood, floor coverings, carpet backing, textiles, or other materials, the employer must check product labels or obtain information from the manufacturers of those products on whether or not they contain volatile organic compounds such as solvents, formaldehyde, or isocyanates that could be emitted during regular use. This information must be used to select products and to determine necessary measures to be taken.

The employer must notify employees at least 24 hours in advance, or promptly in emergency situations, of work to be performed on the building that may introduce air contaminants into the work area.

Although not part of the regulation, the following actions may be necessary:

- employees should be relocated if they are sensitized to products or materials being used in renovation or construction;
- employees should be informed of the location and how to obtain material safety data sheets (MSDS) and New Jersey Right to Know Hazardous Substance Fact Sheets (HSFS) for products being used during construction and renovation. The MSDS can be obtained from the contractor or the manufacturer of the product. The HSFS can be obtained by contacting the New Jersey Department of Health and Senior Services, Right to Know Program, at (609) 984-2202;
- the name of the individual(s) who is responsible for building related issues.

In addition, if the above control measures are not adequate, then work may need to be performed when the building is not occupied.

For more information on the PEOSH Indoor Air Quality standard (N.J.A.C. 12:100-13), obtain the PEOSH information bulletin PEOSH Indoor Air Quality Standard

LEAD ABATEMENT

As a general rule, buildings built before 1978 may contain lead-based paint. Lead can damage a number of systems in the body. Lead exposures occur when lead-based paint is removed from surfaces during building renovation and demolition. Building occupants may get lead poisoning by breathing in airborne lead dust or fumes or accidentally eating lead dust.

For more information on this subject, obtain the PEOSH information bulletin on Facts About Lead Paint Hazards for Public Employees.

ASBESTOS ABATEMENT

Asbestos can be found in installed products such as shingles, floor tiles, cement pipe and sheet, roofing felts, insulation, ceiling tile, fire-resistant drywall, and acoustical products. Very few asbestos-containing products are currently being installed. Consequently, most worker exposures occur during the removal of asbestos and the renovation and maintenance of buildings and structures containing asbestos.

Asbestos fibers enter the body by being breathed in or by being swallowed and can become lodged in the respiratory or digestive systems. Exposure to asbestos can cause many disabling or fatal diseases, such as asbestosis and mesothelioma, that take years to develop.

For more information on this subject, obtain the PEOSH information bulletin on PEOSH Asbestos Standard 29 CFR 1910.1001 and PEOSH Asbestos Standard for Construction 29 CFR 1926.1101.

CARPETING

The PEOSH Program has received numerous complaints from building occupants who have stated that they have experienced health symptoms related to the installation or maintenance of carpeting. Carpeting, and the adhesives used to glue it down, may contain many chemicals, some of which may cause adverse health effects. These chemicals can be found in carpet fiber bonding materials, backing glues, solvents, anti-static and anti-stain treatments, fire retardants, pesticides and fungicides. Most commercial carpeting comes with a styrene-butadiene latex rubber backing. Commercial carpeting is used wall-to-wall and is glued rather than tacked down so that it doesn't move when heavy office furniture and file cabinets are moved.

Carpeting may be shipped from the factory in plastic-covered rolls. When it is unrolled for installation, certain chemicals (called volatile and semi-volatile chemicals) may be released into the air. These chemicals may continue to off-gas from days to several months. Potential adverse health effects depend on the type of carpeting installed, how much adhesive is used, and how much fresh air is being circulated in the building by the ventilation system. Health complaints have also been associated with cleaning products used to shampoo carpets, mold growth on carpets, and allergic reactions to mites and their dander in carpeting.

What can be done to reduce potential health hazards?

- limit the use of carpeting in the workplace;
- never use carpeting where persistent moisture may be present;
- before carpeting is installed, make certain that it is aired out;
- when removing old carpeting, first vacuum it thoroughly;
- relocate workers during installation;
- isolate and ventilate the work area;
- keep the carpet clean and dry;
- use the least volatile adhesive.

To obtain more information, contact the Public Employees Occupational Safety and Health (PEOSH) Program at (609) 984-1863 or visit our website at *www.state.nj.us/health/eoh/peoshweb/*.

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PEOSH PROGRAM
READER RESPONSE CARD

PEOSH Policy on Building Renovations

Dear Reader:

Please take a few minutes to help us evaluate this publication. Please check the following:

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Other comments and suggestions.

Essex County Schools of Technology

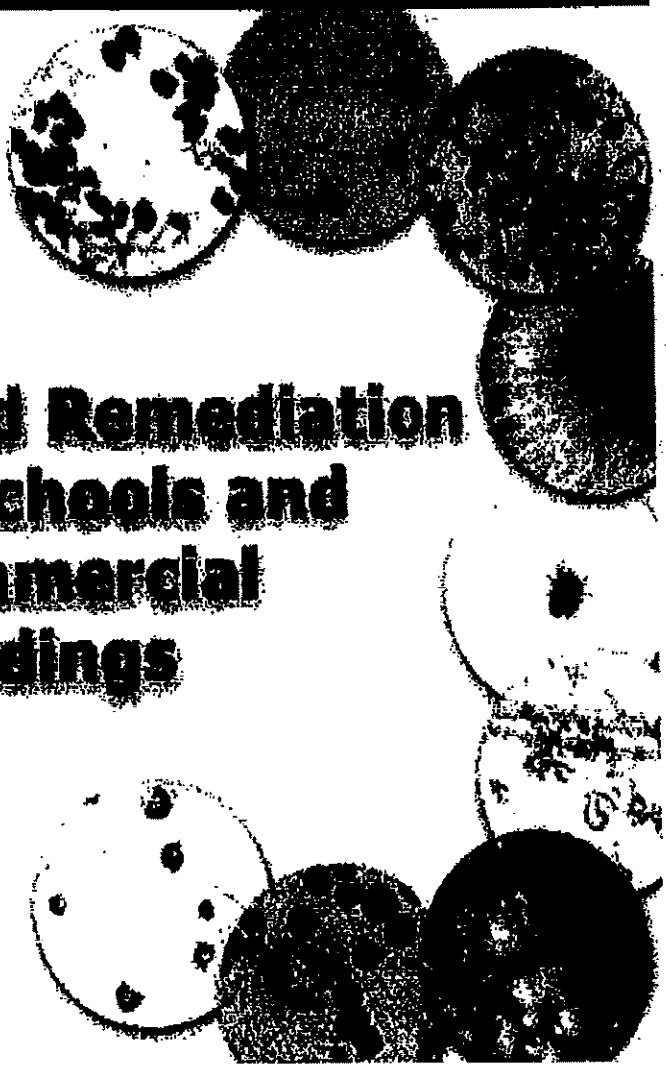
Indoor Air Quality Program Update **2022-2023 School Year**

Public Employees Occupational Safety and Health

Appendix I

EPA - MOLD REMEDIATION IN SCHOOLS & COMMERCIAL BUILDINGS

EPA



Mold Remediation in Schools and Commercial Buildings

Acknowledgements

This document was prepared by the Indoor Environments Division (IED) of the U.S. Environmental Protection Agency. IED would like to thank the reviewers of this document who provided many valuable and insightful comments, and the contractors who provided support during the development of this document. EPA would also like to thank those who provided photos: Terry Brennan (Photo #2, Photo #3A, Photo #4A, Photo #6, Photo #8, Photo #9); Paul Ellringer (Photo #4C); Stephen Vesper, Ph.D. (Photo #3B); and Chin Yang, Ph.D. (cover photos, Photo #4B, Photo #5, Photo #7).

Please note that this document presents recommendations on mold remediation. EPA does not regulate mold or mold spores in indoor air.

This document is available as a text-searchable HTML document on EPA's web server at:
www.epa.gov/iaq/molds (last updated - June 25, 2001).
You can download an Adobe Acrobat version of this document at:
www.epa.gov/iaq/molds/graphics/moldremediation.pdf

EPA 402-K-01-001
March 2001

Mold Remediation in Schools and Commercial Buildings

U.S. Environmental Protection Agency
Office of Air and Radiation
Indoor Environments Division
1200 Pennsylvania Avenue, NW
Mailcode: 6609J
Washington, DC 20460
www.epa.gov/iaq/molds
(last updated - June 25, 2001)
Adobe Acrobat PDF file
www.epa.gov/iaq/molds/graphics/moldremediation.pdf

CONTENTS

INTRODUCTION

Concern about indoor exposure to mold has been increasing as the public becomes aware that exposure to mold can cause a variety of health effects and symptoms, including allergic reactions. This document presents guidelines for the remediation/cleanup of mold and moisture problems in schools and commercial buildings; these guidelines include measures designed to protect the health of building occupants and remediators. It has been designed primarily for building managers, custodians, and others who are responsible for commercial building and school maintenance. It should serve as a reference for potential mold and moisture remediators. Using this document, individuals with little or no experience with mold remediation should be able to make a reasonable judgment as to whether the situation can be handled in-house. It will help those in charge of maintenance to evaluate an in-house remediation plan or a remediation plan submitted by an outside contractor.[1] Contractors and other professionals who respond to mold and moisture situations in commercial buildings and schools may also want to refer to these guidelines.

Molds gradually destroy the things they grow on. Prevent damage to building materials and furnishings, save money, and avoid potential health risks by controlling moisture and eliminating mold growth.

Photo 2: Extensive mold contamination of ceiling and walls

[1] If you choose to use outside contractors or professionals, make sure they have experience cleaning up mold, check their references, and have them follow the recommendations presented in this document, the guidelines of the American Conference of Government Industrial Hygienists (ACGIH) (see Resources List), and/or guidelines from other professional organizations.

Molds can be found almost anywhere; they can grow on virtually any organic substance, as long as moisture and oxygen are present. There are molds that can grow on wood, paper, carpet, foods, and insulation. When excessive moisture accumulates in buildings or on building materials, mold growth will often occur, particularly if the moisture problem remains undiscovered or unaddressed. It is impossible to eliminate all mold and mold spores in the indoor environment. However, mold growth can be controlled indoors by controlling moisture indoors.

Molds reproduce by making spores that usually cannot be seen without magnification. Mold spores waft through the indoor and outdoor air continually. When mold spores land on a damp spot indoors, they may begin growing and digesting whatever they are growing on in order to survive. Molds gradually destroy the things they grow on.

Many types of molds exist. All molds have the potential to cause health effects. Molds can produce allergens that can trigger allergic reactions or even asthma attacks in people allergic to mold. Others are known to produce potent toxins and/or irritants. Potential health concerns are an important reason to prevent mold growth and to remediate/clean up any existing indoor mold growth.

Since mold requires water to grow, it is important to prevent moisture problems in buildings. Moisture problems can have many causes, including uncontrolled humidity. Some moisture problems in buildings have been linked to changes in building construction practices during the 1970s, 80s, and 90s. Some of these changes have resulted in buildings that are tightly sealed, but may lack adequate ventilation, potentially leading to moisture buildup. Building materials, such as drywall, may not allow moisture to escape easily. Moisture problems may include roof leaks, landscaping or gutters that direct water into or under the building, and unvented combustion appliances. Delayed maintenance or insufficient maintenance are also associated with moisture problems in schools and large buildings. Moisture problems in portable classrooms and other temporary structures have frequently been associated with mold problems.

When mold growth occurs in buildings, adverse health problems may be reported by some building occupants, particularly those with allergies or respiratory problems. Remediators should avoid exposing themselves and others to mold-laden dusts as they conduct their cleanup activities. Caution should be used to prevent mold and mold spores from being dispersed throughout the air where they can be inhaled by building occupants.

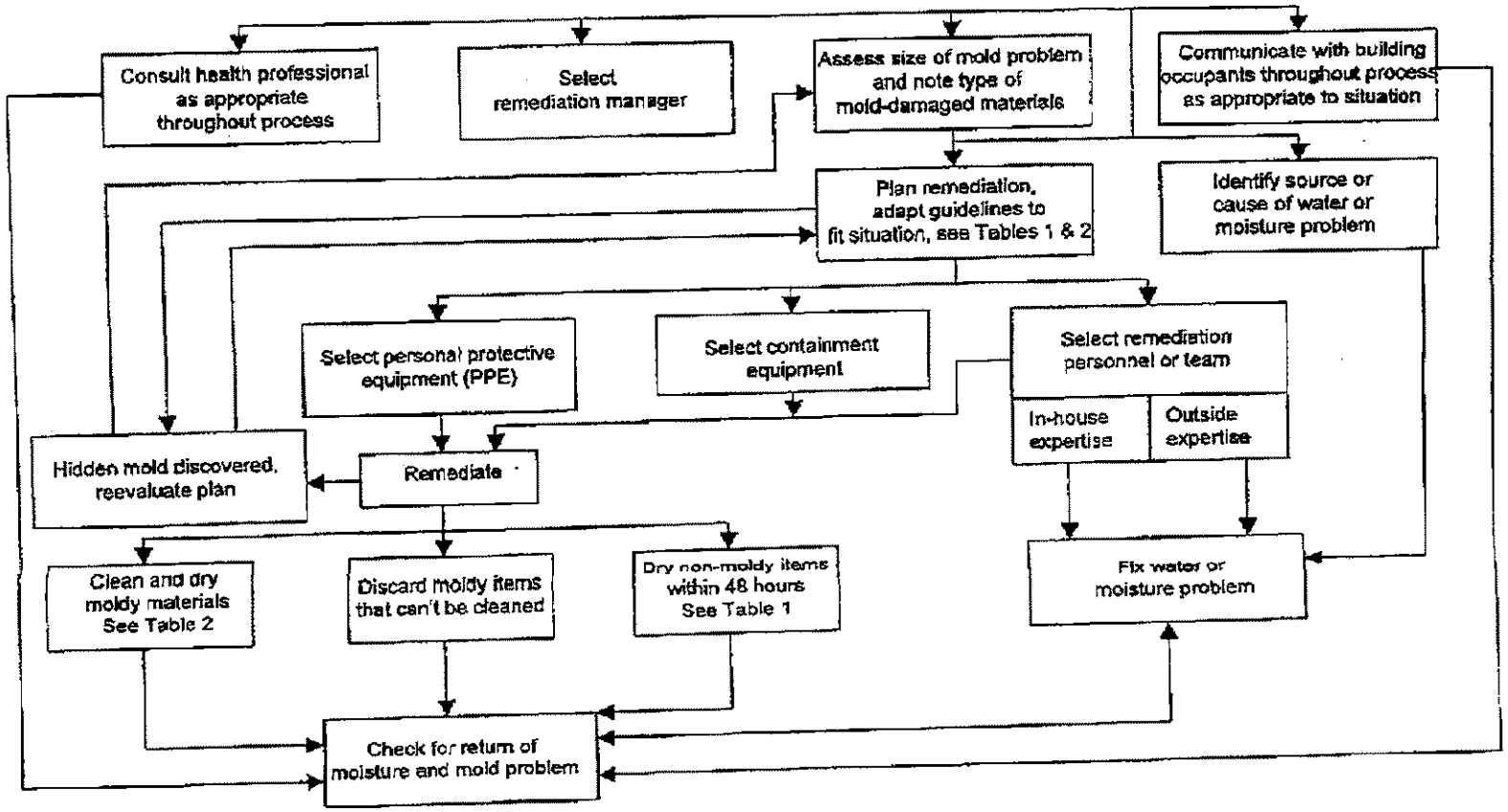
PREVENTION

The key to mold control is moisture control. Solve moisture problems before they become mold problems!

Mold Prevention Tips

- Fix leaky plumbing and leaks in the building envelope as soon as possible.
- Watch for condensation and wet spots. Fix source(s) of moisture problem(s) as soon as possible.
- Prevent moisture due to condensation by increasing surface temperature or reducing the moisture level in air (humidity). To increase surface temperature, insulate or increase air circulation. To reduce the moisture level in air, repair leaks, increase ventilation (if outside air is cold and dry), or dehumidify (if outdoor air is warm and humid).
- Keep heating, ventilation, and air conditioning (HVAC) drip pans clean, flowing properly, and unobstructed.
- Vent moisture-generating appliances, such as dryers, to the outside where possible.
- Maintain low indoor humidity, below 60% relativehumidity (RH), ideally 30-50%, if possible.
- Perform regular building/HVAC inspections and maintenance as scheduled.
- Clean and dry wet or damp spots within 48 hours.
- Don't let foundations stay wet. Provide drainage and slope the ground away from the foundation.

Mold Remediation – Key Steps



INVESTIGATING, EVALUATING, AND REMEDIATING MOISTURE AND MOLD PROBLEMS

Safety Tips While Investigating and Evaluating Mold and Moisture Problems

- Do not touch mold or moldy items with bare hands.
- Do not get mold or mold spores in your eyes.
- Do not breathe in mold or mold spores.
- Consult Table 2 and text for Personal Protective Equipment (PPE) and containment guidelines.
- Consider using PPE when disturbing mold. The minimum PPE is an N-95 respirator, gloves, and eye protection.

Moldy Areas Encountered During an Investigation

Photo 3A: Mold growing in closet as a result of condensation from room air

Photo 3B: Front side of wall-board looks fine, but the back side is covered with mold

PLAN THE REMEDIATION BEFORE STARTING WORK

Questions to Consider Before Remediating

- Are there existing moisture problems in the building?
- Have building materials been wet more than 48 hours? (See Table 2 and text)
- Are there hidden sources of water or is the humidity too high (high enough to cause condensation)?
- Are building occupants reporting musty or moldy odors?
- Are building occupants reporting health problems?
- Are building materials or furnishings visibly damaged?
- Has maintenance been delayed or the maintenance plan been altered?
- Has the building been recently remodeled or has building use changed?
- Is consultation with medical or health professionals indicated?

Remediation Plan

Assess the size of the mold and/or moisture problem and the type of damaged materials before planning the remediation work. Select a remediation manager for medium or large jobs (or small jobs requiring more than one person). The remediation plan should include steps to fix the water or moisture problem, or the problem may reoccur. The plan should cover the use of appropriate Personal Protective Equipment (PPE) and include steps to carefully contain and remove moldy building materials to avoid spreading the mold.[2] A remediation plan may vary greatly depending on the size and complexity of the job, and may require revision if circumstances change or new facts are discovered.

The remediation manager's highest priority must be to protect the health and safety of the building occupants and remediators. It is also important to communicate with building occupants when mold problems are identified.[3] In some cases,

[2] Molds are known allergens and may be toxic. You may wish to use Personal Protective Equipment (PPE) while investigating a mold problem, as well as during remediation/clean-up situations. The minimum PPE includes an N-95 respirator, gloves, and eye protection.

[3] See Appendix C.

especially those involving large areas of contamination, the remediation plan may include temporary relocation of some or all of the building occupants. The decision to relocate occupants should consider the size and type of the area affected by mold growth, the type and extent of health effects reported by the occupants, the potential health risks that could be associated with debris, and the amount of disruption likely to be caused by remediation activities. If possible, remediation activities should be scheduled during off-hours when building occupants are less likely to be affected.

Remediators, particularly those with health-related concerns, may wish to check with their doctors or health care professionals before working on mold remediation or investigating potentially moldy areas. If you have any doubts or questions, you should consult a health professional before beginning a remediation project.

HVAC System

Do not run the HVAC system if you know or suspect that it is contaminated with mold. If you suspect that it may be contaminated (it is part of an identified moisture problem, for instance, or there is mold growth near the intake to the system), consult EPA's guide *Should You Have the Air Ducts in Your Home Cleaned?*[4] before taking further action (see Resources List).

Photo 4A: Contaminated fibrous insulation inside air handler cover

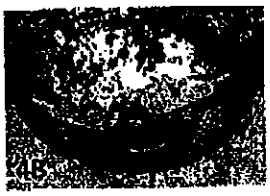


Photo 4B: Mold growth on air diffuser in ceiling

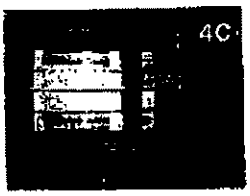


Photo 4C: Moldy air duct

[4] Although this document has a residential focus, it is applicable to other building types.

Hidden Mold Growth

Photo 5: Mold growth behind wallpaper

Hidden Mold

In some cases, indoor mold growth may not be obvious. It is possible that mold may be growing on hidden surfaces, such as the back side of dry wall, wallpaper, or paneling, the top of ceiling tiles, the underside of carpets and pads, etc. Possible locations of hidden mold can include pipe chases and utility tunnels (with leaking or condensing pipes), walls behind furniture (where condensation forms), condensate drain pans inside air handling units, porous thermal or acoustic liners inside ductwork, or roof materials above ceiling tiles (due to roof leaks or insufficient insulation). Some building materials, such as dry wall with vinyl wallpaper over it or wood paneling, may act as vapor barriers,[4] trapping moisture underneath their surfaces and thereby providing a moist environment where mold can grow. You may suspect hidden mold if a building smells moldy, but you cannot see the source, or if you know there has been water damage and building occupants are reporting health problems. Investigating hidden mold problems may be difficult and will require caution when the investigation involves disturbing potential sites of mold growth—make sure to use PPE. For example, removal of wallpaper can lead to a massive release of spores from mold growing on the underside of the paper. If you believe that you may have a hidden mold problem, you may want to consider hiring an experienced professional. If you discover hidden mold, you should revise your remediation plan to account for the total area affected by mold growth.

[4] For more information on vapor barriers and building construction, see Resources List. It is important that building materials be able to dry; moisture should not be trapped between two vapor barriers or mold may result.

REMEDIATION

1. Fix the water or humidity problem. Complete and carry out repair plan if appropriate. Revise and/or carry out maintenance plan if necessary. Revise remediation plan as necessary, if more damage is discovered during remediation. See Mold Remediation – Key Steps (page 5) and Resources List (page 29) for additional information.

2. Continue to communicate with building occupants, as appropriate to the situation. Be sure to address all concerns.

3. Completely clean up mold and dry water-damaged areas. Select appropriate cleaning and drying methods for damaged/contaminated materials. Carefully contain and remove moldy building materials. Use appropriate Personal Protective Equipment (PPE). Arrange for outside professional support if necessary.

The Key to Mold Control is Moisture Control

- When addressing mold problems, don't forget to address the source of the moisture problem, or the mold problem may simply reappear!
- Remember to check for high humidity and condensation problems as well as actual water leaks, maintenance issues, and HVAC system problems.
- Protect the health and safety of the building occupants and remediators. Consult a health professional as needed. Use PPE and containment as appropriate when working with mold.

Table 1: Water Damage Cleanup and Mold Prevention[8]

Table 1 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 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.

[8] Please note that Tables 1 and 2 contain general guidelines. Their purpose is to provide basic information for remediation managers to first assess the extent of the damage and then to determine whether the remediation should be managed by in-house personnel or outside professionals. The remediation manager can then use the guidelines to help design a remediation plan or to assess a plan submitted by outside professionals.

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	* 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‡	* Remove water with water extraction vacuum. * Reduce ambient humidity levels with dehumidifier. * Accelerate drying process with fans.
Ceiling tiles	* Discard and replace.
Cellulose insulation	* Discard and replace.
Concrete or cinder block surfaces	* Remove water with water extraction vacuum. * Accelerate drying process with dehumidifiers, fans, and/or heaters.
Fiberglass insulation	* Discard and replace.
Hard surface, porous flooring‡ (Linoleum, ceramic tile, vinyl)	* 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)	* Vacuum or damp wipe with water and mild detergent and allow to dry; scrub if necessary.
Upholstered furniture	* 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.
Wallboard (Drywall and gypsum board)	* May be dried in place if there is no obvious swelling and the seams are intact. If not, remove, discard, and replace. * Ventilate the wall cavity, if possible.
Window drapes	* Follow laundering or cleaning instructions recommended by the manufacturer.
Wood surfaces	* 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 experience 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.

Table 2: Mold Remediation Guidelines[7]

Mold and Indoor Air Regulations and Standards

Standards or Threshold Limit Values (TLVs) for airborne concentrations of mold, or mold spores, have not been set. As of December 2000, there are no EPA regulations or standards for airborne mold contaminants.

Table 2 presents remediation guidelines for building materials that have or are likely to have mold growth. The guidelines in Table 2 are designed to protect the health of occupants and cleanup personnel during remediation. These guidelines are based on the area and type of material affected by water damage and/or mold growth. Please note that these are guidelines; some professionals may prefer other cleaning methods. If you are considering cleaning your ducts as part of your remediation plan, you should consult EPA's publication entitled, *Should You Have the Air Ducts In Your Home Cleaned?*[8] (see Resources List). If possible, remediation activities should be scheduled during off-hours when building occupants are less likely to be affected.

Although the level of personal protection suggested in these guidelines is based on the total surface area contaminated and the potential for remediator and/or occupant exposure, professional judgment should always play a part in remediation decisions. These remediation guidelines are based on the size of the affected area to make it easier for remediators to select appropriate techniques, not on the basis of health effects or research showing there is a specific method appropriate at a certain number of square feet. The guidelines have been designed to help construct a remediation plan. The remediation manager will then use professional judgment and experience to adapt the guidelines to particular situations. When in doubt, caution is advised. Consult an experienced mold remediator for more information.

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[7] Please note that Tables 1 and 2 contain general guidelines. Their purpose is to provide basic information for remediation managers to first assess the extent of the damage and then to determine whether the remediation should be managed by in-house personnel or outside professionals. The remediation manager can then use the guidelines to help design a remediation plan or to assess a plan submitted by outside professionals.

[8] Although this document has a residential focus, it is applicable to other building types.

In cases in which a particularly toxic mold species has been identified or is suspected, when extensive hidden mold is expected (such as behind vinyl wallpaper or in the HVAC system), when the chances of the mold becoming airborne are estimated to be high, or sensitive individuals (e.g., those with severe allergies or asthma) are present, a more cautious or conservative approach to remediation is indicated. Always make sure to protect remediators and building occupants from exposure to mold.

Health Concerns

If building occupants are reporting serious health concerns, you should consult a health professional.

Table 2. Guidelines for Remediating Building Materials with Mold Growth Caused by Clean Water[1]

Material or Furnishing Affected	Cleanup Methods[1]	Personal Protective Equipment	Containment
SMALL – Total Surface Area Affected Less Than 10 square feet (ft^2)			
Books and papers	3	Minimum N-95 respirator, gloves, and goggles	None required
Carpet and backing	1, 3		
Concrete or cinder block	1, 3		
Hard surface, porous flooring (linoleum, ceramic tile, vinyl)	1, 2, 3		
Non-porous, hard surfaces (plastics, metals)	1, 2, 3		
Upholstered furniture & drapes	1, 3		
Wallboard (drywall and gypsum board)	3		
Wood surfaces	1, 2, 3		
MEDIUM – Total Surface Area Affected Between 10 and 100 (ft^2)			
Books and papers	3	Limited or Full Use professional judgment, consider potential for remediator exposure and size of contaminated area	Limited Use professional judgment, consider potential for remediator/occupant exposure and size of contaminated area
Carpet and backing	1, 3, 4		
Concrete or cinder block	1, 3		
Hard surface, porous flooring (linoleum, ceramic tile, vinyl)	1, 2, 3		
Non-porous, hard surfaces (plastics, metals)	1, 2, 3		
Upholstered furniture & drapes	1, 3, 4		
Wallboard (drywall and gypsum board)	3, 4		
Wood surfaces	1, 2, 3		
LARGE – Total Surface Area Affected Greater Than 100 (ft^2) or Potential for Increased Occupant or Remediator Exposure During Remediation Estimated to be Significant			
Books and papers	3	Full Use professional judgment, consider potential for remediator exposure and size of contaminated area	Full Use professional judgment, consider potential for remediator/occupant exposure and size of contaminated area
Carpet and backing	1, 3, 4		
Concrete or cinder block	1, 3		
Hard surface, porous flooring (linoleum, ceramic tile, vinyl)	1, 2, 3, 4		
Non-porous, hard surfaces (plastics, metals)	1, 2, 3		
Upholstered furniture & drapes	1, 3, 4		
Wallboard (drywall and gypsum board)	3, 4		
Wood surfaces	1, 2, 3, 4		

Table 2 continued

*Use professional judgment to determine prudent levels of Personal Protective Equipment and containment for each situation, particularly as the remediation site size increases and the potential for exposure and health effects rises. Assess the need for increased Personal Protective Equipment, if, during the remediation, more extensive contamination is encountered than was expected. Consult Table 1 if materials have been wet for less than 48 hours, and mold growth is not apparent.

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 the Occupational Safety and Health Administration (OSHA) requires PPE and containment. An experienced professional should be consulted if you and/or your remediators do not have expertise in remediating contaminated water situations.

†Select method most appropriate to situation. Since molds gradually destroy the things they grow on, if mold growth is not addressed promptly, some items may be damaged such that cleaning will not restore their original appearance. If mold growth is heavy and items are valuable or important, you may wish to consult a restoration/water damage/remediation expert. Please note that these are guidelines; other cleaning methods may be preferred by some professionals.

CLEANUP METHODS

Method 1: Wet vacuum (in the case of porous materials, some mold spores/fragments will remain in the material but will not grow if the material is completely dried). Steam cleaning may be an alternative for carpets and some upholstered furniture.
Method 2: Damp-wipe surfaces with plain water or with water and detergent solution (except wood—use wood floor cleaner); scrub as needed.
Method 3: High-efficiency particulate air (HEPA) vacuum after the material has been thoroughly dried. Dispose of the contents of the HEPA vacuum in well-sealed plastic bags.
Method 4: Discard – remove water-damaged materials and seal in plastic bags while inside of containment, if present. Dispose of as normal waste. HEPA vacuum area after it is dried.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Minimum: Gloves, N-95 respirator, goggles/eye protection
Limited: Gloves, N-95 respirator or half-face respirator with HEPA filter, disposable overalls, goggles/eye protection
Full: Gloves, disposable full body clothing, head gear, foot coverings, full-face respirator with HEPA filter

CONTAINMENT

Limited: Use polyethylene sheeting ceiling to floor around affected area with a slit entry and covering flap; maintain area under negative pressure with HEPA filtered fan unit. Block supply and return air vents within containment area.
Full: Use two layers of fire-retardant polyethylene sheeting with one airlock chamber. Maintain area under negative pressure with HEPA filtered fan exhausted outside of building. Block supply and return air vents within containment area.

Table developed from literature and remediation documents including *Bioaerosols: Assessment and Control* (American Conference of Governmental Industrial Hygienists, 1999) and *IICRC S500, Standard and Reference Guide for Professional Water Damage Restoration* (Institute of Inspection, Cleaning and Restoration, 1999); see Resources List for more information.

Cleanup Methods

A variety of mold cleanup methods are available for remediating damage to building materials and furnishings caused by moisture control problems and mold growth. The specific method or group of methods used will depend on the type of material affected, as presented in Table 2. Please note that professional remediators may use some methods not covered in these guidelines; absence of a method in the guidelines does not necessarily mean that it is not useful.[9]

Molds Can Damage Building Materials and Furnishings

Mold growth can eventually cause structural damage to a school or large building, if a mold/moisture problem remains unaddressed for a long time. In the case of a long-term roof leak, for example, molds can weaken floors and walls as the molds feed on wet wood. If you suspect that mold has damaged building integrity, you should consult a structural engineer or other professional with expertise in this area.

Photo 6: Heavy mold growth on underside of spruce floorboards

Method 1: Wet Vacuum

Wet vacuums are vacuum cleaners designed to collect water. They can be used to remove water from floors, carpets, and hard surfaces where water has accumulated. They should not be used to vacuum porous materials, such as gypsum board. They

[9] If you are unsure what to do, or if the item is expensive or of sentimental value, you may wish to consult a specialist. Specialists in furniture repair/restoration, painting, art restoration and conservation, carpet and rug cleaning, water damage, and fire/water restoration are commonly listed in phone books. Be sure to ask for and check references; look for affiliation with professional organizations. See Resources List.

should be used only when materials are still wet—wet vacuums may spread spores if sufficient liquid is not present. The tanks, hoses, and attachments of these vacuums should be thoroughly cleaned and dried after use since mold and mold spores may stick to the surfaces.

Method 2: Damp Wipe

Whether dead or alive, mold is allergenic, and some molds may be toxic. Mold can generally be removed from nonporous (hard) surfaces by wiping or scrubbing with water, or water and detergent. It is important to dry these surfaces quickly and thoroughly to discourage further mold growth. Instructions for cleaning surfaces, as listed on product labels, should always be read and followed. Porous materials that are wet and have mold growing on them may have to be discarded. Since molds will infiltrate porous substances and grow on or fill in empty spaces or crevices, the mold can be difficult or impossible to remove completely.

Mold and Paint

Don't paint or caulk moldy surfaces; clean and dry surfaces before painting. Paint applied over moldy surfaces is likely to peel.

Method 3: HEPA Vacuum

HEPA (High-Efficiency Particulate Air) vacuums are recommended for final cleanup of remediation areas after materials have been thoroughly dried and contaminated materials removed. HEPA vacuums are also recommended for cleanup of dust that may have settled on surfaces outside the remediation area. Care must be taken to assure that the filter is properly seated in the vacuum so that all the air must pass through the filter. When changing the vacuum filter, remediators should wear PPE to prevent exposure to the mold that has been captured. The filter and contents of the HEPA vacuum must be disposed of in well-sealed plastic bags.

Mold Remediation/Cleanup and Biocides

The purpose of mold remediation is to remove the mold to prevent human exposure and damage to building materials and furnishings. It is necessary to clean up mold contamination, not just to kill the mold. Dead mold is still allergenic, and some dead molds are potentially toxic. The use of a biocide, such as chlorine bleach, is not recommended as a routine practice during mold remediation, although there may be instances where professional judgment may indicate its use (for example, when immune-compromised individuals are present). In most cases, it is not possible or desirable to sterilize an area; a background level of mold spores will remain in the air (roughly equivalent to or lower than the level in outside air). These spores will not grow if the moisture problem in the building has been resolved.

If you choose to use disinfectants or biocides, always ventilate the area. Outdoor air may need to be brought in with fans. When using fans, take care not to distribute mold spores throughout an unaffected area. Biocides are toxic to humans, as well as to mold. You should also use appropriate PPE and read and follow label precautions. Never mix chlorine bleach solution with cleaning solutions or detergents that contain ammonia; toxic fumes could be produced.

Some biocides are considered pesticides, and some States require that only registered pesticide applicators apply these products in schools. Make sure anyone applying a biocide is properly licensed, if necessary. Fungicides are commonly applied to outdoor plants, soil, and grains as a dust or spray—examples include hexachlorobenzene, organomercurials, pentachlorophenol, phthalimides, and dithiocarbamates. Do not use fungicides developed for use outdoors for mold remediation or for any other indoor situation.

Method 4: Discard — Remove Damaged Materials and Seal in Plastic Bags

Building materials and furnishings that are contaminated with mold growth and are not salvageable should be double-bagged using 6-mil polyethylene sheeting. These materials can then usually be discarded as ordinary construction waste. It is important to package mold-contaminated materials in sealed bags before removal from the containment area to minimize the dispersion of mold spores throughout the building. Large items that have heavy mold growth

should be covered with polyethylene sheeting and sealed with duct tape before they are removed from the containment area.

Personal Protective Equipment (PPE)

Always use gloves and eye protection when cleaning up mold!

If the remediation job disturbs mold and mold spores become airborne, then the risk of respiratory exposure goes up. Actions that are likely to stir up mold include: breakup of moldy porous materials such as wallboard; invasive procedures used to examine or remediate mold growth in a wall cavity; actively stripping or peeling wallpaper to remove it; and using fans to dry items.

The primary function of Personal Protective Equipment (PPE) is to avoid inhaling mold and mold spores and to avoid mold contact with the skin or eyes. The following sections discuss the different types of PPE that can be used during remediation activities. Please note that all individuals using certain PPE equipment, such as half-face or full-face respirators, must be trained, must have medical clearance, and must be fit-tested by a trained professional. In addition, the use of respirators must follow a complete respiratory protection program as specified by the Occupational Safety and Health Administration (see Resources List for more information).

Personal Protective Equipment

Photo 7: Remediation worker with limited PPE

Skin and Eye Protection

Gloves are required to protect the skin from contact with mold allergens (and in some cases mold toxins) and from potentially irritating cleaning solutions. Long gloves that extend to the middle of the forearm are recommended. The glove material should

be selected based on the type of materials being handled. If you are using a biocide (such as chlorine bleach) or a strong cleaning solution, you should select gloves made from natural rubber, neoprene, nitrile, polyurethane, or PVC. If you are using a mild detergent or plain water, ordinary household rubber gloves may be used.

To protect your eyes, use properly fitted goggles or a full-face respirator with HEPA filter. Goggles must be designed to prevent the entry of dust and small particles. Safety glasses or goggles with open vent holes are not acceptable.

Respiratory Protection

Respirators protect cleanup workers from inhaling airborne mold, mold spores, and dust.

Minimum: When cleaning up a small area affected by mold, you should use an N-95 respirator. This device covers the nose and mouth, will filter out 95% of the particulates in the air, and is available in most hardware stores.

Limited: Limited PPE includes use of a half-face or full-face air purifying respirator (APR) equipped with a HEPA filter cartridge. These respirators contain both inhalation and exhalation valves that filter the air and ensure that it is free of mold particles. Note that half-face APRs do not provide eye protection. In addition, the HEPA filters do not remove vapors or gases. You should always use respirators approved by the National Institute for Occupational Safety and Health (see Resources List).

Full: In situations in which high levels of airborne dust or mold spores are likely or when intense or long-term exposures are expected (e.g., the cleanup of large areas of contamination), a full-face, powered air purifying respirator (PAPR) is recommended. Full-face PAPRs use a blower to force air through a HEPA filter. The HEPA-filtered air is supplied to a mask that covers the entire face or a hood that covers the entire head. The positive pressure within the hood prevents unfiltered air from entering through penetrations or gaps. Individuals must be trained to use their respirators before they begin remediation. The use of these respirators must be in compliance with OSHA regulations (see Resources List).

Disposable Protective Clothing

Disposable clothing is recommended during a medium or large remediation project to prevent the transfer and spread of mold to clothing and to eliminate skin contact with mold.

Limited: Disposable paper overalls can be used.

Full: Mold-impervious disposable head and foot coverings, and a body suit made of a breathable material, such as TYVEK®, should be used. All gaps, such as those around ankles and wrists, should be sealed (many remediators use duct tape to seal clothing).

Containment

The purpose of containment during remediation activities is to limit release of mold into the air and surroundings, in order to minimize the exposure of remediators and building occupants to mold. Mold and moldy debris should not be allowed to spread to areas in the building beyond the contaminated site.

Containment Tips

- Always maintain the containment area under negative pressure.
- Exhaust fans to outdoors and ensure that adequate makeup air is provided.
- If the containment is working, the polyethylene sheeting should billow inwards on all surfaces. If it flutters or billows outward, containment has been lost, and you should find and correct the problem before continuing your remediation activities.

The two types of containment recommended in Table 2 are limited and full. The larger the area of moldy material, the greater the possibility of human exposure and the greater the need for containment. In general, the size of the area helps determine the level of containment. However, a heavy growth of mold in a relatively small area could release more spores than a lighter growth of mold in a relatively large area. Choice of containment should be based on professional judgment.[18] The primary object of containment should be to prevent occupant and remediator exposure to mold.

[18] For example, a remediator may decide that a small area that is extensively contaminated and has the potential to distribute mold to occupied areas during cleanup should have full containment, whereas a large wall surface that is lightly contaminated and easily cleaned would require only limited containment.

Limited Containment

Limited containment is generally recommended for areas involving between 10 and 100 square feet (ft^2) of mold contamination. The enclosure around the moldy area should consist of a single layer of 6-mil, fire-retardant polyethylene sheeting. The containment should have a slit entry and covering flap on the outside of the containment area. For small areas, the polyethylene sheeting can be affixed to floors and ceilings with duct tape. For larger areas, a steel or wooden stud frame can be erected and polyethylene sheeting attached to it. All supply and air vents, doors, chases, and risers within the containment area must be sealed with polyethylene sheeting to minimize the migration of contaminants to other parts of the building. Heavy mold growth on ceiling tiles may impact HVAC systems if the space above the ceiling is used as a return air plenum. In this case, containment should be installed from the floor to the ceiling deck, and the filters in the air handling units serving the affected area may have to be replaced once remediation is finished.

Photo 8: Full containment on large job

The containment area must be maintained under negative pressure relative to surrounding areas. This will ensure that contaminated air does not flow into adjacent areas. This can be done with a HEPA-filtered fan unit exhausted outside of the building. For small, easily contained areas, an exhaust fan ducted to the outdoors can also be used. The surfaces of all objects removed from the containment area should be remediated/cleaned prior to removal. The remediation guidelines outlined in Table 2 can be implemented when the containment is completely sealed and is under negative pressure relative to the surrounding area.

Full Containment

Full containment is recommended for the cleanup of mold-contaminated surface areas greater than 100 ft^2 or in any situation in which it appears likely that the occupant space would be further contaminated without full containment. Double layers of polyethylene should be used to create a barrier between the moldy area and other parts of the building. A decontamination chamber or airlock should be constructed for entry into and exit from the remediation area. The entryways to the airlock from the outside and from the airlock to the main containment area should consist of a slit entry with covering flaps on the outside surface of each slit entry. The chamber should be large enough to hold a waste container and allow a person to put on and remove PPE. All contaminated PPE, except respirators, should be placed in a sealed bag while in this chamber. Respirators should be worn until remediators are outside the decontamination chamber. PPE must be worn throughout the final stages of HEPA vacuuming and damp-wiping of the contained area. PPE must also be worn during HEPA vacuum filter changes or cleanup of the HEPA vacuum.

Equipment

Moisture Meters: Measure/ Monitor Moisture Levels in Building Materials

Moisture meters may be helpful for measuring the moisture content in a variety of building materials following water damage. They can also be used to monitor the process of drying damaged materials. These direct reading devices have a thin probe which can be inserted into the material to be tested or can be pressed directly against the surface of the material. Moisture meters can be used on materials such as carpet, wallboard, wood, brick, and concrete.

Moisture Meter

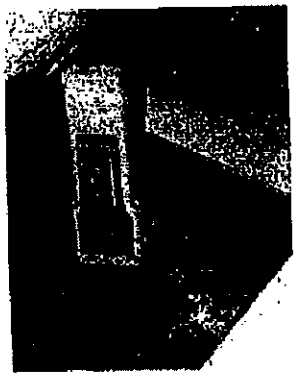

Photo 9: Moisture meter measuring moisture content of plywood subfloor

Humidity Gauges or Meters: Monitor Moisture Levels in the Air

Humidity meters can be used to monitor humidity indoors. Inexpensive (<$50) models are available that monitor both temperature and humidity.

Humidistat: Turns on HVAC System at Specific Relative Humidity (RH)

A humidistat is a control device that can be connected to the HVAC system and adjusted so that, if the humidity level rises above a set point, the HVAC system will automatically come on.

HVAC System Filter: Filters Outdoor Air

Use high-quality filters in your HVAC system during remediation. Consult an engineer for the appropriate efficiency for your specific HVAC system and consider upgrading your filters if appropriate. Conventional HVAC filters are typically not effective in filtering particles the size of mold spores. Consider upgrading to a filter with a minimum efficiency of 50 to 60% or a rating of MERV 8, as determined by Test Standard 52.2 of the American Society of Heating, Refrigerating, and Air Conditioning Engineers. Remember to change filters regularly and change them following any remediation activities.

Sampling

Is sampling for mold needed? In most cases, if visible mold growth is present, sampling is unnecessary. In specific instances, such as cases where litigation is involved, the source(s) of the mold contamination is unclear, or health concerns are a problem, you may consider sampling as part of your site evaluation. Surface sampling may also be useful in order to determine if an area has been adequately cleaned or remediated. Sampling should be done only after developing a sampling plan that includes a confirmable theory regarding suspected mold sources and routes of exposure. Figure out what you think is happening and how to prove or disprove it before you sample!

If you do not have extensive experience and/or are in doubt about sampling, consult an experienced professional. This individual can help you decide if sampling for mold is useful and/or needed, and will be able to carry out any necessary sampling. It is important to remember that the results of sampling may have limited use or application. Sampling may help locate the source of mold contamination, identify some of the mold species present, and differentiate between mold and soot or dirt. Pre- and post-remediation sampling may also be useful in determining whether remediation efforts have been effective. After remediation, the types and concentrations of mold in indoor air samples should be similar to what is found in the local outdoor air. Since no EPA or other Federal threshold limits have been set for mold or mold spores, sampling cannot be used to check a building's compliance with Federal mold standards.

Sampling for mold should be conducted by professionals with specific experience in designing mold sampling protocols, sampling methods, and interpretation of results. Sample analysis should follow analytical methods recommended by the American Industrial Hygiene Association (AIHA), the American Conference of Governmental Industrial Hygienists (ACGIH), or other professional guidelines (see Resources List). Types of samples include air samples, surface samples, bulk samples (chunks of carpet, insulation, wall board, etc.), and water samples from condensate drain pans or cooling towers.

A number of pitfalls may be encountered when inexperienced personnel conduct sampling. They may take an inadequate number of samples, there may be inconsistency in sampling protocols, the samples may become contaminated, outdoor control samples may be omitted, and you may incur costs for unneeded or inappropriate samples. Budget constraints will often be a consideration when sampling; professional advice may be necessary to determine if it is possible to take sufficient samples to characterize a problem on a given budget. If it is not possible to sample properly, with a sufficient number of samples to answer the question(s) posed, it would be preferable not to sample. Inadequate sample plans may generate misleading, confusing, and useless results.

Keep in mind that air sampling for mold provides information only for the moment in time in which the sampling occurred, much like a snapshot. Air sampling will reveal, when properly done, what was in the air at the moment when the sample was taken. For someone without experience, sampling results will be difficult to interpret. Experience in interpretation of results is essential.

How Do You Know When You Have Finished Remediation/Cleanup?

1. You must have completely fixed the water or moisture problem.
2. You should complete mold removal. Use professional judgment to determine if the cleanup is sufficient. Visible mold, mold-damaged materials, and moldy odors should not be present.
3. If you have sampled, the kinds and concentrations of mold and mold spores in the building should be similar to those found outside, once cleanup activities have been completed.
4. You should revisit the site(s) shortly after remediation, and it should show no signs of water damage or mold growth.
5. People should be able to occupy or re-occupy the space without health complaints or physical symptoms.
6. Ultimately, this is a judgment call; there is no easy answer.

CHECKLIST FOR MOLD REMEDIATION*

Investigate and evaluate moisture and mold problems

- ☐ Assess size of moldy area (square feet)
- ☐ Consider the possibility of hidden mold
- ☐ Clean up small mold problems and fix moisture problems before they become large problems
- ☐ Select remediation manager for medium or large size mold problem
- ☐ Investigate areas associated with occupant complaints
- ☐ Identify source(s) or cause of water or moisture problem(s)
- ☐ Note type of water-damaged materials (wallboard, carpet, etc.)
- ☐ Check inside air ducts and air handling unit
- ☐ Throughout process, consult qualified professional if necessary or desired

Communicate with building occupants at all stages of process, as appropriate

- ☐ Designate contact person for questions and comments about medium or large scale remediation as needed

Plan remediation

- ☐ Adapt or modify remediation guidelines to fit your situation; use professional judgment
- ☐ Plan to dry wet, non-moldy materials within 48 hours to prevent mold growth (see Table 1 and text)
- ☐ Select cleanup methods for moldy items (see Table 2 and text)
- ☐ Select Personal Protection Equipment - protect remediators (see Table 2 and text)
- ☐ Select containment equipment - protect building occupants (see Table 2 and text)
- ☐ Select remediation personnel who have the experience and training needed to implement the remediation plan and use Personal Protection Equipment and containment as appropriate

Remediate moisture and mold problems

- ☐ Fix moisture problem, implement repair plan and/or maintenance plan
- ☐ Dry wet, non-moldy materials within 48 hours to prevent mold growth
- ☐ Clean and dry moldy materials (see Table 2 and text)
- ☐ Discard moldy porous items that can't be cleaned (see Table 2 and text)

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* For details, see main text of this publication. Please note that this checklist was designed to highlight key parts of a school or commercial building remediation and does not list all potential steps or problems.

* See pocket on inside back cover for an additional copy of this checklist.

RESOURCES LIST – EPA

U.S. Environmental Protection Agency (EPA), Indoor Environments Division (IED)

An Office Building Occupant's Guide to IAQ
www.epa.gov/iaq/pubs/occupgd.html

Biological Contaminants
www.epa.gov/iaq/pubs/bio_1.html

Building Air Quality Action Plan (for Commercial Buildings)
www.epa.gov/iaq/base/actionpl.html

Floods / Flooding
www.epa.gov/iaq/pubs/flood.html

Indoor Air Quality (IAQ) Home Page
www.epa.gov/iaq

IAQ in Large Buildings / Commercial Buildings
www.epa.gov/iaq/base/index.html

IAQ in Schools
www.epa.gov/iaq/schools/index.html

Mold Remediation in Schools and Commercial Buildings
www.epa.gov/iaq/pubs/molds.html

Mold Resources
www.epa.gov/iaq/pubs/moldresources.html

U.S. EPA IAQ Information Clearinghouse

Phone: (800) 438-4318 or (703) 356-4020
Fax: (703) 821-8236
Email: iaqinfo@aol.com

Indoor air-related documents, answers to Indoor Air Quality (IAQ) questions, maintains listing of state IAQ contacts, and regional EPA contacts

RESOURCES LIST – OTHER

The following list of resources includes information created and maintained by other public and private organizations. The U.S. EPA does not control or guarantee the accuracy, relevance, timeliness, or completeness of this outside information. Further, the inclusion of such resources is not intended to endorse any views expressed or products or services offered by the author of the reference or the organization operating the service on which the reference is maintained.

American College of Occupational and Environmental Medicine (ACOEM)
(847) 818-1800 www.siouxland.com/acoem/
Referrals to physicians who have experience with environmental exposures

American Conference of Governmental Industrial Hygienists, Inc. (ACGIH)
(513) 742-2020 www.acgih.org
Occupational and environmental health and safety information

American Industrial Hygiene Association (AIHA)
(703) 849-8888 www.aiha.org
Information on industrial hygiene and indoor air quality issues including mold hazards and legal issues

American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE)
(800) 527-4723 www.ashrae.org
Information on engineering issues and indoor air quality

Association of Occupational and Environmental Clinics (AOEC)
(202) 347-4976 www.aoec.org
Referrals to clinics with physicians who have experience with environmental exposures, including exposures to mold; maintains a database of occupational and environmental cases

Association of Specialists in Cleaning and Restoration (ASCR)
(800) 272-7012 www.ascr.org
Disaster recovery, water and fire damage, emergency tips, referrals to professionals

Asthma and Allergic Diseases:

American Academy of Allergy, Asthma & Immunology (AAAAI)
(800) 822-2762 www.aaaai.org
Physician referral directory, information on allergies and asthma

Asthma and Allergy Foundation of America (AAFA)
(800) 7-ASTHMA (800-727-8462) www.aafa.org
Information on allergies and asthma

American Lung Association (ALA)
(800) LUNG-USA (800-586-4872) www.lungusa.org
Information on allergies and asthma

Asthma and Allergy Network/Mothers of Asthmatics, Inc. (AAN-MA)
(800) 878-4403 or (703) 641-9595 www.aanma.org
Information on allergies and asthma

National Institute of Allergy and Infectious Diseases (NIAID)
(301) 496-5717 www.niaid.nih.gov
Information on allergies and asthma

National Jewish Medical and Research Center
(800) 222-LUNG (800-222-5864) www.njc.org
Information on allergies and asthma

Canada Mortgage and Housing Corporation (CMHC)
(613) 748-2003 [International] www.cmhc-schl.gc.ca/cmhc.html
Several documents on mold-related topics available

Carpet and Rug Institute (CRI)
(800) 882-8846 www.carpet-rug.com
Carpet maintenance, restoration guidelines for water-damaged carpet, other carpet-related issues.

Centers for Disease Control and Prevention (CDC)
(800) 311-3435 www.cdc.gov
Information on health-related topics including asthma, molds in the environment, and occupational health

CDC's National Center for Environmental Health (NCEH)
(888) 232-6789 www.cdc.gov/nceh/asthma/factsheets/molds/default.htm
"Questions and answers on *Stachybotrys chartarum* and other molds"

Energy and Environmental Building Association
(952) 881-1098 www.eeba.org
Information on energy-efficient and environmentally responsible buildings. humidity/moisture control/vapor barriers

Floods/Flooding:

Federal Emergency Management Agency (FEMA)
(800) 480-2520 www.fema.gov/mit
Publications on floods, flood proofing, etc.

University of Minnesota, Department of Environmental Health & Safety
(612) 626-6804 www.dehs.umn.edu/remanagi.html
Managing water infiltration into buildings

University of Wisconsin-Extension, The Disaster Handbook
(608) 262-3980 www.uwex.edu/ces/news/handbook.html
Information on floods and other natural disasters

Health Canada, Health Protection Branch, Laboratory Centre for Disease Control, Office of Biosafety
(613) 957-1779 www.hc-sc.gc.ca/main/lcdc/web/biosafty/msds/index.html
Material Safety Data Sheets with health and safety information on infectious microorganisms, including *Aspergillus* and other molds and airborne biologicals

Indoor Environmental Remediation Board (IERB)
(215) 387-4097 www.ierb.org
Information on best practices in building remediation

Institute of Inspection, Cleaning and Restoration Certification (IICRC)
(360) 693-5675 www.iicrc.org
Information on and standards for the inspection, cleaning, and restoration industry

International Sanitary Supply Association (ISSA)
(800) 225-4772 www.issa.com
Education and training on cleaning and maintenance

International Society of Cleaning Technicians (ISCT)
(800) WHY-ISCT (800-949-4728) www.isct.com
Information on cleaning such as stain removal guide for carpets

Material Safety Data Sheets (MSDSs) - Cornell University
http://msds.pdc.cornell.edu/msdssrch.asp
MSDSs contain information on chemicals or compounds including topics such as health effects, first aid, and protective equipment for people who work with or handle these chemicals

MidAtlantic Environmental Hygiene Resource Center (MEHRC)
(215) 387-4096 www.mehrc.org
Indoor environmental quality training on including topics such as mold remediation

National Air Duct Cleaners Association (NADCA)
(202) 737-2926 www.nadca.com
Duct cleaning information

National Antimicrobial Information Network (NAIN)
(800) 447-6349 http://ace.orst.edu/info/nain/
Regulatory information, safety information, and product information on antimicrobials

National Association of the Remodeling Industry (NARI)
(847) 298-9200 www.nari.org
Consumer information on remodeling, including help finding a professional remodeling contractor

National Institute of Building Sciences (NIBS)
(202) 289-7800 http://nibs.org
Information on building regulations, science, and technology

National Institute for Occupational Safety and Health (NIOSH)
(800) 35-NIOSH (800-356-4674) www.cdc.gov/niosh
Health and safety information with a workplace orientation

National Pesticide Telecommunications Network (NPTN)
(800) 858-7378 http://ace.orst.edu/info/nptn
Information on pesticides/antimicrobial chemicals, including safety and disposal information

New York City Department of Health,
Bureau of Environmental & Occupational Disease Epidemiology
(212) 788-4290 www.ci.nyc.ny.us/html/doh/html/epi/moldrpt1.html
"Guidelines on Assessment and Remediation of Fungi in Indoor Environments"

Occupational Safety & Health Administration (OSHA)
(800) 321-OSHA (800-321-6742) www.osha.gov
Information on worker safety, includes topics such as respirator use and safety in the workplace

Sheet Metal & Air Conditioning Contractors' National Association (SMACNA)
(703) 803-2980 www.smacna.org
Technical information on topics such as air conditioning and air ducts

Smithsonian Center for Materials Research and Education (SCMRE)
(301) 238-3700 www.si.edu/scmre
Guidelines for caring for and preserving furniture and wooden objects, paper-based materials; preservation studies

University of Michigan Herbarium
(734) 764-2407 www.herb.lsa.umich.edu
Specimen-based information on fungi; information on fungal ecology

University of Tulsa Indoor Air Program
(918) 631-5246 www.utulsa.edu/iaqprogram
Courses, classes, and continuing education on indoor air quality

Water Loss Institute, Association of Specialists in Cleaning and Restoration
(800) 272-7012 or (410) 729-9900 www.ascr.org/wli.asp
Information on water and sewage damage restoration

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Occupational Safety & Health Administration. *Respiratory Protection Standard, 29 CFR 1910.134*. 63 FR 1152. January 8, 1998.

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APPENDIX A – GLOSSARY

Allergen ..... Substance (such as mold) that can cause an allergic reaction.

APR ..... Air purifying respirator

Biocide ..... Substance or chemical that kills organisms such as molds.

EPA ..... Environmental Protection Agency

Fungi ..... Fungi are neither animals nor plants and are classified in a kingdom of their own. Fungi include molds, yeasts, mushrooms, and puffballs. In this document, the terms fungi and mold are used interchangeably. Molds reproduce by making spores. Mold spores waft through the indoor and outdoor air continually. When mold spores land on a damp spot indoors, they may begin growing and digesting whatever they are growing on. Molds can grow on virtually any organic substance, providing moisture and oxygen are present. It is estimated that more than 1.5 million species of fungi exist.

Fungicide ..... Substance or chemical that kills fungi.

HEPA ..... High-Efficiency Particulate Air

Hypersensitivity ..... Great or excessive sensitivity

IAQ ..... Indoor Air Quality

Mold ..... Molds are a group of organisms that belong to the kingdom Fungi. In this document, the terms fungi and mold are used interchangeably. There are over 20,000 species of mold.

mVOC.....Microbial volatile organic compound, a chemical made by a mold which may have a moldy or musty odor.

OSHA.....Occupational Safety and Health Administration

PAPR.....Powered air purifying respirator

PPE.....Personal Protective Equipment

Remediate.....Fix

Sensitization.....Repeated or single exposure to an allergen that results in the exposed individual becoming hypersensitive to the allergen.

Spore.....Molds reproduce by means of spores. Spores are microscopic; they vary in shape and size (2-100 micrometers). Spores may travel in several ways—they may be passively moved (by a breeze or waterdrop), mechanically disturbed (by a person or animal passing by), or actively discharged by the mold (usually under moist conditions or high humidity).

APPENDIX B - INTRODUCTION TO MOLDS

Molds in the Environment

Molds live in the soil, on plants, and on dead or decaying matter. Outdoors, molds play a key role in the breakdown of leaves, wood, and other plant debris. Molds belong to the kingdom Fungi, and unlike plants, they lack chlorophyll and must survive by digesting plant materials, using plant and other organic materials for food. Without molds, our environment would be overwhelmed with large amounts of dead plant matter.

Molds produce tiny spores to reproduce, just as some plants produce seeds. These mold spores can be found in both indoor and outdoor air, and settled on indoor and outdoor surfaces. When mold spores land on a damp spot, they may begin growing and digesting whatever they are growing on in order to survive. Since molds gradually destroy the things they grow on, you can prevent damage to building materials and furnishings and save money by eliminating mold growth.

Moisture control is the key to mold control. Molds need both food and water to survive; since molds can digest most things, water is the factor that limits mold growth. Molds will often grow in damp or wet areas indoors. Common sites for indoor mold growth include bathroom tile, basement walls, areas around windows where moisture condenses, and near leaky water fountains or sinks. Common sources or causes of water or moisture problems include roof leaks, deferred maintenance, condensation associated with high humidity or cold spots in the building, localized flooding due to plumbing failures or heavy rains, slow leaks in plumbing fixtures, and malfunction or poor design of humidification systems. Uncontrolled humidity can also be a source of moisture leading to mold growth, particularly in hot, humid climates.

Health Effects and Symptoms Associated with Mold Exposure

When moisture problems occur and mold growth results, building occupants may begin to report odors and a variety of health problems, such as headaches, breathing difficulties, skin irritation, allergic reactions, and aggravation of asthma symptoms; all of these symptoms could potentially be associated with mold exposure.

Potential Health Effects Associated with Inhalation Exposure to Molds and Mycotoxins

- Allergic Reactions (e.g., rhinitis and dermatitis or skin rash)
- Asthma
- Hypersensitivity Pneumonitis
- Other Immunologic Effects

Research on mold and health effects is ongoing. This list is not intended to be all-inclusive.

The health effects listed above are well documented in humans. Evidence for other health effects in humans is less substantial and is primarily based on case reports or occupational studies.

All molds have the potential to cause health effects. Molds produce allergens, irritants, and in some cases, toxins that may cause reactions in humans. The types and severity of symptoms depend, in part, on the types of mold present, the extent of an individual's exposure, the ages of the individuals, and their existing sensitivities or allergies. Specific reactions to mold growth can include the following:

Allergic Reactions: Inhaling or touching mold or mold spores may cause allergic reactions in sensitive individuals. Allergic reactions to mold are common – these reactions can be immediate or delayed. Allergic responses include hay fever-type symptoms, such as sneezing, runny nose, red eyes, and skin rash (dermatitis). Mold spores and fragments can produce allergic reactions in sensitive individuals regardless of whether the mold is dead or alive. Repeated or single exposure to mold or mold spores may cause previously non-sensitive individuals to become sensitive. Repeated exposure has the potential to increase sensitivity.

Asthma: Molds can trigger asthma attacks in persons who are allergic (sensitized) to molds. The irritants produced by molds may also worsen asthma in non-allergic (non-sensitized) people.

Hypersensitivity Pneumonitis: Hypersensitivity pneumonitis may develop following either short-term (acute) or long-term (chronic) exposure to molds. The disease resembles bacterial pneumonia and is uncommon.

Irritant Effects: Mold exposure can cause irritation of the eyes, skin, nose, throat, and lungs, and sometimes can create a burning sensation in these areas.

Opportunistic Infections: People with weakened immune systems (i.e., immune-compromised or immune-suppressed individuals) may be more vulnerable to infections by molds (as well as more vulnerable than healthy persons to mold toxins). *Aspergillus fumigatus*, for example, has been known to infect the lungs of immune-compromised individuals. These individuals inhale the mold spores which then start growing in their lungs. *Trichoderma* has also been known to infect immune-compromised children.

Healthy individuals are usually not vulnerable to opportunistic infections from airborne mold exposure. However, molds can cause common skin diseases, such as athlete's foot, as well as other infections such as yeast infections.

Mold Toxins (Mycotoxins)

Molds can produce toxic substances called mycotoxins. Some mycotoxins cling to the surface of mold spores; others may be found within spores. More than 200 mycotoxins have been identified from common molds, and many more remain to be identified. Some of the molds that are known to produce mycotoxins are commonly found in moisture-damaged buildings. Exposure pathways for mycotoxins can include inhalation, ingestion, or skin contact. Although some mycotoxins are well known to affect humans and have been shown to be responsible for human health effects, for many mycotoxins, little information is available.

Aflatoxin B_1 is perhaps the most well known and studied mycotoxin. It can be produced by the molds *Aspergillus flavus* and *Aspergillus parasiticus* and is one of the most potent carcinogens known. Ingestion of aflatoxin B_1 can cause liver cancer. There is also some evidence that inhalation of aflatoxin B_1 can cause lung cancer. Aflatoxin B_1 has been found on contaminated grains, peanuts, and other human and animal foodstuffs. However, *Aspergillus flavus* and *Aspergillus parasiticus* are *not* commonly found on building materials or in indoor environments.

Toxic Molds

Some molds, such as *Aspergillus versicolor* and *Stachybotrys atra (charterum)*, are known to produce potent toxins under certain circumstances. Although some mycotoxins are well known to affect humans and have been shown to be responsible for human health effects, for many mycotoxins, little information is available, and in some cases research is ongoing. For example, some strains of *Stachybotrys atra* can produce one or more potent toxins. In addition, preliminary reports from an investigation of an outbreak of pulomonary hemorrhage in infants suggested an association between pulmonary hemorrhage and exposure to *Stachybotrys charterum*. Review of the evidence of this association at CDC resulted in a published clarification stating that such an association was not established. Research on the possible causes of pulumonary hemorrhage in infants continues. Consult the Centers for Disease Control and Prevention (CDC) for more information on pulmonary hemorrhage in infants (see Resources List, page 31, for CDC contact and other information).

Much of the information on the human health effects of inhalation exposure to mycotoxins comes from studies done in the workplace and some case studies or case reports.* Many symptoms and human health effects attributed to inhalation of mycotoxins have been reported including: mucous membrane irritation, skin rash, nausea, immune system suppression, acute or chronic liver damage, acute or chronic central nervous system damage, endocrine effects, and cancer. More studies are needed to get a clear picture of the health effects related to most mycotoxins. However, it is clearly prudent to avoid exposure to molds and mycotoxins.

Some molds can produce several toxins, and some molds produce mycotoxins only under certain environmental conditions. The presence of mold in a building does not necessarily mean that mycotoxins are present or that they are present in large quantities.

* Information on ingestion exposure, for both humans and animals, is more abundant—a wide range of health effects has been reported following ingestion of moldy foods including liver damage, nervous system damage, and immunological effects.

Microbial Volatile Organic Compounds (mVOCs)

Some compounds produced by molds are volatile and are released directly into the air. These are known as microbial volatile organic compounds (mVOCs). Because these compounds often have strong and/or unpleasant odors, they can be the source of odors associated with molds. Exposure to mVOCs from molds has been linked to symptoms such as headaches, nasal irritation, dizziness, fatigue, and nausea. Research on MVOCs is still in the early phase.

Glucans or Fungal Cell Wall Components (also known as ß-(1 3)-D-Glucans)

Glucans are small pieces of the cell walls of molds which may cause inflammatory lung and airway reactions. These glucans can affect the immune system when inhaled. Exposure to very high levels of glucans or dust mixtures including glucans may cause a flu-like illness known as Organic Dust Toxic Syndrome (ODTS). This illness has been primarily noted in agricultural and manufacturing settings.

Spores

Mold spores are microscopic (2-10 um) and are naturally present in both indoor and outdoor air. Molds reproduce by means of spores. Some molds have spores that are easily disturbed and waft into the air and settle repeatedly with each disturbance. Other molds have sticky spores that will cling to surfaces and are dislodged by brushing against them or by other direct contact. Spores may remain able to grow for years after they are produced. In addition, whether or not the spores are alive, the allergens in and on them may remain allergenic for years.

APPENDIX C – COMMUNICATION WITH BUILDING OCCUPANTS

Communication with building occupants is essential for successful mold remediation. Some occupants will naturally be concerned about mold growth in their building and the potential health impacts. Occupants' perceptions of the health risk may rise if they perceive that information is being withheld from them. The status of the building investigation and remediation should be openly communicated including information on any known or suspected health risks.

Small remediation efforts will usually not require a formal communication process, but do be sure to take individual concerns seriously and use common sense when deciding whether formal communications are required. Individuals managing medium or large remediation efforts should make sure they understand and address the concerns of building occupants and communicate clearly what has to be done as well as possible health concerns.

Mold in Schools

Special communication strategies may be desirable if you are treating a mold problem in a school. Teachers, parents, and other locally affected groups should be notified of significant issues as soon as they are identified. Consider holding a special meeting to provide parents with an opportunity to learn about the problem and ask questions of school authorities, particularly if it is necessary/ advisable to ensure that the school is vacated during remediation. For more information on investigating and remediating molds in schools, refer to the U.S. EPA's *IAQ Tools for Schools* kit and the asthma companion piece for the IAQ Tools for Schools kit, entitled *Managing Asthma in the School Environment*.

Communication approaches include regular memos and/or meetings with occupants (with time allotted for questions and answers), depending on the scope of the remediation and the level of occupant interest. Tell the occupants about the size of the project, planned activities, and remediation timetable. Send or post regular updates on the remediation progress, and send or post a final memo when the project is completed or hold a final meeting. Try and resolve

Communicate When You Remediate

- Establish that the health and safety of building occupants are top priorities.
- Demonstrate that the occupants' concerns are understood and taken seriously.
- Present clearly the current status of the investigation or remediation efforts.
- Identify a person whom building occupants can contact directly to discuss questions and comments about the remediation activities.

issues and occupant concerns as they come up. When building-wide communications are frequent and open, those managing the remediation can direct more time toward resolving the problem and less time to responding to occupant concerns.

If possible, remediation activities should be scheduled during off-hours when building occupants are less likely to be affected. Communication is important if occupants are relocated during remediation. The decision to relocate occupants should consider the size of the area affected, the extent and types of health effects exhibited by the occupants, and the potential health risks associated with debris and activities during the remediation project. When considering the issue of relocation, be sure to inquire about, accommodate, and plan for individuals with asthma, allergies, compromised immune systems, and other health-related concerns. Smooth the relocation process and give occupants an opportunity to participate in resolution of the problem by clearly explaining the disruption of the workplace and work schedules. Notify individuals of relocation efforts in advance, if possible.

INDEX

NOTES

CHECKLIST FOR MOLD REMEDIATION*

Investigate and evaluate moisture and mold problems

- ❑ Assess size of moldy area (square feet)
- ❑ Consider the possibility of hidden mold
- ❑ Clean up small mold problems and fix moisture problems before they become large problems
- ❑ Select remediation manager for medium or large size mold problem
- ❑ Investigate areas associated with occupant complaints
- ❑ Identify source(s) or cause of water or moisture problem(s)
- ❑ Note type of water-damaged materials (wallboard, carpet, etc.)
- ❑ Check inside air ducts and air handling unit
- ❑ Throughout process, consult qualified professional if necessary or desired

Communicate with building occupants at all stages of process, as appropriate

- ❑ Designate contact person for questions and comments about medium or large scale remediation as needed

Plan remediation

- ❑ Adapt or modify remediation guidelines to fit your situation; use professional judgment
- ❑ Plan to dry wet, non-moldy materials within 48 hours to prevent mold growth (see Table 1 and text)
- ❑ Select cleanup methods for moldy items (see Table 2 and text)
- ❑ Select Personal Protective Equipment - protect remediators (see Table 2 and text)
- ❑ Select containment equipment - protect building occupants (see Table 2 and text)
- ❑ Select remediation personnel who have the experience and training needed to implement the remediation plan and use Personal Protective Equipment and containment as appropriate

Remediate moisture and mold problems

- ❑ Fix moisture problem, implement repair plan and/or maintenance plan
- ❑ Dry wet, non-moldy materials within 48 hours to prevent mold growth
- ❑ Clean and dry moldy materials (see Table 2 and text)
- ❑ Discard moldy porous items that can't be cleaned (see Table 2 and text)

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* For details, see text (of *Mold Remediation in Schools and Commercial Buildings*). Please note that this checklist was designed to highlight key parts of a school or commercial building remediation and does not list all potential steps or problems.

Questions to Consider Before Remediating

- Are there existing moisture problems in the building?
- Have building materials been wet more than 48 hours? (See Table 2 & text.)
- Are there hidden sources of water or is the humidity too high (high enough to cause condensation)?
- Are building occupants reporting musty or moldy odors?
- Are building occupants reporting health problems?
- Are building materials or furnishings visibly damaged?
- Has maintenance been delayed or the maintenance plan been altered?
- Has the building been recently remodeled or has building use changed?
- Is consultation with medical or health professionals indicated?

Avoid Exposure to and Contact with Mold

- Use Personal Protective Equipment (PPE)

U.S. Environmental Protection Agency (EPA)

- Indoor Air Quality Information Clearinghouse
  (800) 438-4318 www.epa.gov/iaq