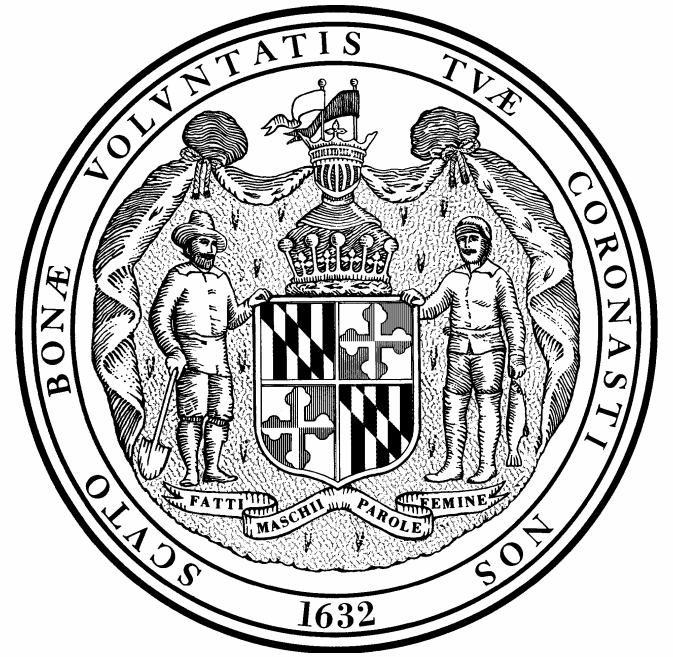
MARYLAND STATE TASK FORCE ON INDOOR AIR QUALITY

Final Report



July 1, 2002

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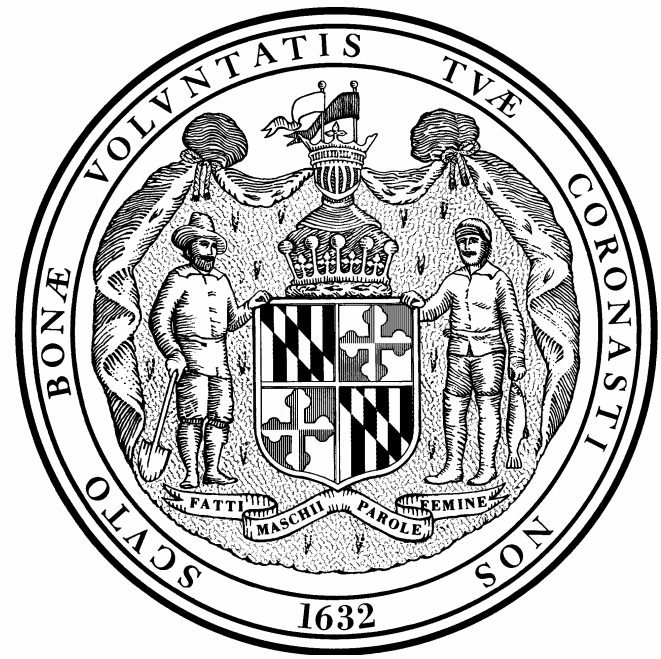

July 1, 2002

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Department of Environmental Health Sciences
Division of Occupational Health

June 28, 2002

Honorable Parris N. Glendening, Governor
State House
Annapolis, MD 21401

Dear Governor Glendening:

Pursuant to Chapter 591 of the 2001 General Assembly, I am pleased to submit the Final Report of the Maryland Indoor Air Quality Task Force. As required by law, I am forwarding copies to the Department of Legislative Reference so that the Report may be available to other interested parties.

I wish to acknowledge the members and staff of the Task Force for their hard work during the past year. The Task Force confronted a difficult challenge, and I believe its findings are well reasoned and appropriate. The Task Force strongly believes that by adopting these recommendations, Maryland will protect and improve the health and productivity of office workers, and reduce health care and liability costs in the State,

It was an honor to serve as Chairman of the Task Force, and I look forward to working with your office and the General Assembly to enact and implement these recommendations.

Sincerely,

Clifford S. Mitchell, MS, MD, MPH
Chairman, Task Force on Indoor Air Quality

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June 28, 2002

Honorable Thomas v. Mike Miller, Jr.
President of the Senate State House, H-1 07
Annapolis, MD 21401-1991

Honorable Casper R. Taylor, Jr.
Speaker of the House of Delegates 101 State House,
Annapolis, MD 21401-1991

Dear Mr. President and Mr. Speaker:

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Clifford S. Mitchell, MS, MD, MPH
Chairman, Task Force on Indoor Air Quality

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Executive Summary

The Maryland State Task Force on Indoor Air Quality was established to make recommendations to the Legislature and the Governor regarding:

> "(i) The prevention of workers' HVAC-related illnesses, including a monitoring program to identify the probable onset of HVAC-related illnesses and their underlying causes;
>
> (ii) The institution of appropriate remedies and controls in office building that, because of the dangers of indoor air quality, expose workers to unwarranted health risks, including the best available treatment technology and the feasibility of voluntary prevention and pollution reduction programs;
>
> (iii) A plan to provide educational information and, as may be necessary, warnings to affected workers regarding health and environmental risks associated with the indoor air quality of their office building sites; and
>
> (iv) Legislative or regulatory measures that are necessary and appropriate to address current gaps in federal, State, and local protection of office workers from HVAC-borne toxins…"

The Task Force reviewed current science and knowledge regarding indoor air quality (IAQ)-related health problems in the State, as well as the economic and social costs of those problems. The findings of the Task Force include the following:

- There is no clear State authority for IAQ, with governmental responsibility historically allocated partly to the Departments of Environment (MDE), Health and Mental Hygiene (DHMH), and Labor, Licensing and Regulation (DLLR). In addition, due to the decentralized nature of many functions in DHMH and MDE, authority for IAQ is often vested at the local level, primarily with the local Health Officer. This has led to a diffusion of responsibility, and frustration on the part of office workers, building owners and operators, and others involved in management of IAQ-related problems. In many cases, even when building owners and operators wish to deal with IAQ-related problems, there is no State agency that can offer comprehensive technical assistance.

- There are no regulatory standards in Maryland or nationally for what constitutes acceptable or unacceptable IAQ in office buildings. The Task Force found that at present, there is inadequate scientific knowledge to establish health-based standards for individual substances, including molds. However, the Task Force found that there are guidelines for the operation and maintenance of heating, ventilating, and air conditioning (HVAC) systems in office buildings, that in combination with a building management program of adequate housekeeping, preventive maintenance, and response to occupant complaints, would prevent many if not most IAQ-related problems in office buildings.

- There is a need to collect and analyze data on IAQ-related problems when considering any new regulations or technical assistance programs. There is currently no such mechanism in the State. Without this, it is difficult to know whether the burden of IAQ-related problems is growing or decreasing, and it is impossible to know how best to allocate technical assistance efforts.

Based on these findings, the Task Force is issuing four recommendations for the State of Maryland. The Task Force focused on developing evidence-based recommendations that would improve public health as well as the effectiveness of HVAC operation and maintenance, while ensuring flexibility for building owners, operators, and others involved in managing office building environments. The principal recommendations of the Task Force are:

Recommendation 1: Primary statutory authority for regulating indoor air quality should be granted to the Maryland Department of the Environment (MDE), along with the resources required to execute this authority. An Office of Indoor Air Quality should be established within MDE, which would, among other responsibilities, enforce new indoor air quality regulations for building owners.

The Task Force believes that there is a need for one lead agency that has familiarity with IAQ problems and management to take responsibility for enforcement of any new IAQ initiative in the State. The Maryland Department of the Environment (MDE) has familiarity with IAQ problems and the Task Force believes that MDE is best able to provide the combination of technical expertise, interaction with other agencies, and experience with IAQ management necessary for this new authority. The agency's responsibilities would include:

- Enforcement of new IAQ requirements (described in Recommendation 2);
- Provision of technical assistance and outreach to building owners and operators interested in IAQ management; and
- Other such activities as are recommended by the new State Indoor Air Advisory Council (defined below).

Recommendation 2: Building owners should be required to comply with standards for operation and maintenance of an office building that will prevent the development of most IAQ problems.

Owners of buildings greater than 2,500 square feet where office activities comprise at least 50% of the activity would be required to develop Operation and Maintenance (O & M) plans for the building consistent with current guidelines of the American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE). At a minimum, these plans would describe procedures for regular inspection and maintenance of the HVAC system and other building systems where water leaks or intrusion can occur. The procedures would contain a description of how the building owner responds to occupant concerns about IAQ problems.

The Task Force believes there is a need to establish baseline IAQ standards that office workers, building owners and operators, and public officials can turn to and cite when evaluating IAQ conditions within an office building. The Task Force considered adopting standards based on specific pollutants or agents and their health effects. However, the Task Force concluded that there is currently an inadequate scientific base of knowledge to justify adopting health-based standards for most substances, and therefore elected to base standards on the evidence presented to it, that most IAQ problems can be prevented by regular preventive maintenance, and early identification and correction of the problems that invariably occur in buildings. However, the Task Force heard from many witnesses that many if not most IAQ problems stem from a few basic causes: (1) a failure to perform routine preventive maintenance on HVAC systems; (2) inappropriate balancing and reassessment of HVAC systems when buildings are renovated or modified; (3) inadequate housekeeping and maintenance of buildings, particularly with respect to moisture control; and (4) failure to respond to employee IAQ complaints and communicate the findings and corrective actions back to the employees.

Recommendation 3: A permanent Maryland Advisory Council on Indoor Air Quality should be established to advise the Secretary of the Environment on IAQ issues.

The Task Force recognizes that there are great many unanswered questions regarding the appropriate management of IAQ in office buildings. The proposed Office of Indoor Air Quality within MDE will need guidance from technical experts as more knowledge of IAQ problems develops, and how this knowledge can best be applied by stakeholders concerned with IAQ issues. The Task Force recommends that a permanent advisory council on IAQ be established to advise the Secretary of the Environment on new scientific findings and technical developments that could affect IAQ policy. The Advisory Council would have responsibility for several areas:

1. Recommendations for adoption or modification of IAQ standards for building owners and operators.
2. How best to provide additional technical assistance and training to promote recognition and resolution of IAQ problems in the private and public sectors.
3. Recommendations on the collection of data regarding the impacts of state IAQ activities on the health and well-being of Maryland workers.
4. Evaluation of the economic impacts of IAQ management.
5. Recommendations concerning integration of IAQ activities in MDE with other State agencies such as DLLR, DHMH, Department of Education, DGS, and other appropriate governmental agencies.
6. Measures to improve IAQ management in State owned and leased buildings.
7. Guidelines for construction or renovation in occupied facilities to maintain acceptable IAQ conditions.
8. Design guidelines for achieving optimal IAQ in new buildings.
9. Guidelines for the balancing and commissioning of HVAC systems.

10. How best to implement operational standards for HVAC systems, such as applicable ASHRAE standards.
11. Adoption of best practices or standards for housekeeping that will assure good building IAQ, such as ASTM Standard E1971-1998, "Standard Guide for Stewardship for the Cleaning of Commercial and Institutional Buildings".

Recommendation 4. As one of its first tasks, the new Maryland Advisory Council on Indoor Air Quality should consider how to implement an effective IAQ surveillance program.

The Task Force feels the IAQ Advisory Council should, as one of its first tasks, study whether and what kind of surveillance system should be established by the State in order to better understand the scope of IAQ problems within the State. The Task Force repeatedly confronted an absence of information needed to tailor recommendations to the most significant IAQ problems. However, the Task Force felt that the precise design of such a surveillance program – what criteria should be used for reporting, whether the reporting system should rely on voluntary reporting or use some kind of active outreach, whether it should use representative sampling or be universally applied, whether it should be located in the new Office of IAQ or another agency such as DHMH – should be left to the IAQ Advisory Council, in consultation with the Secretary of MDE and other officials.

Background

In April 2001 Governor Glendening signed SB 283 (Appendix 1), an Act establishing the Maryland State Task Force on Indoor Air. The charge to the Task Force, as described in the legislation, was to:

> "(1) Study the nature, location, and extent of health environmental risks posed to workers as a result of molds, spores, and other toxic organisms located in the HVAC systems of office buildings, including:
>
> (i) The relative risks associated with the manufacture, maintenance, and repair of HVAC systems;
>
> (ii) Actual and projected costs for the medical treatment of HVAC-related illnesses; and
>
> (iii) Actual and projected costs in loss of worker productivity because of HVAC-related illnesses;
>
> (2) Make recommendations regarding:
>
> (i) The prevention of workers' HVAC-related illnesses, including a monitoring program to identify the probable onset of HVAC-related illnesses and their underlying causes;
>
> (ii) The institution of appropriate remedies and controls in office building that, because of the dangers of indoor air quality, expose workers to unwarranted health risks, including the best available treatment technology and the feasibility of voluntary prevention and pollution reduction programs;
>
> (iii) A plan to provide educational information and, as may be necessary, warnings to affected workers regarding health and environmental risks associated with the indoor air quality of their office building sites; and
>
> (iv) Legislative or regulatory measures that are necessary and appropriate to address current gaps in federal, State, and local protection of office workers from HVAC-borne toxins…"

The Task Force was subsequently appointed and had its first meeting on October 9, 2001. The Task Force established an action plan to develop recommendations that included the following elements:

1. Review existing state and federal guidelines on indoor air quality.
2. Review existing Maryland policies on indoor air quality.

3. Solicit testimony from citizens, experts, state agencies, interest groups, and other stakeholders on indoor air quality.
4. Develop preliminary recommendations.
5. Solicit feedback on preliminary recommendations.
6. Review feedback and adopt final recommendations.

Determinants of Indoor Air Quality

The Task Force first reviewed various factors that affect IAQ. These include:

- Ventilation rate, temperature, and humidity – factors directly determined by the heating, ventilation and air conditioning (HVAC) system
- Bioaerosols – which include molds, fungi, pollens, viruses, bacteria, animal dander, and other agents that are either living organisms or products derived from living organisms
- Particulates – dusts, fibers, and other solid materials
- Volatile organic chemicals (VOCs) – a large number of diverse chemicals with indoor and outdoor sources
- Chemicals produced by combustion that include carbon monoxide, nitrous oxides, sulfur oxides, and ozone

Contaminants may be produced either within the building, or brought into the building through the HVAC system and/or the building envelope. The HVAC system is one key component of maintaining acceptable IAQ, although it is not the only component that affects the health and comfort of building occupants. The HVAC system helps remove particulates from the outside, dilutes and removes contaminants in the occupied space, and brings in "fresh" outside air and distributes it to the occupied space. Although it is important to note that even the best designed and operated HVAC system cannot, by itself, completely ensure acceptable IAQ, an HVAC system that is improperly designed, maintained, or updated when building conditions change will inevitably exacerbate IAQ problems.

Structure and Function of HVAC Systems

Ventilation air plays an important role in removing or diluting contaminants, whether those contaminants originate inside the building or outside. Buildings are ventilated both mechanically (e.g., by fans) and naturally (e.g., through windows or other openings. Minimum ventilation rates for the control of odors and other common contaminants in buildings with no unusual sources of pollutants, are prescribed by Standard 62-2001, *Ventilation for Acceptable Indoor Air Quality*, of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE). The standard for new office buildings is currently 20 cubic feet per minute of outside air per person. In addition, measured carbon dioxide levels under approximately 1100 parts per million may suggest that this ventilation standard is being met. The carbon dioxide concentration is a good surrogate measure of a building's ability to achieve acceptable IAQ. However, additional investigation may be necessary, depending on the complexity of the building systems and how the interior space is configured. For example, buildings with Variable Air Volume (VAV) units need to be checked to ensure that acceptable quantities of air are being

provided under each cooling load that the unit may encounter with a given space. Likewise, the distribution of outside air within the building also has a major impact on IAQ. Older buildings will not necessarily meet current standards for the amount of stipulated outdoor air per person. These older building, particularly those build in the 1970's and 1980's may have been designed under an ASHRAE Standard edition which required by code less outdoor air, in order to save energy. Since existing buildings are only required to meet ventilation requirements at the time they were constructed or renovated, they may have to be evaluated by the Indoor Air Quality Method specified in ASHRAE 62-2001in order to provide acceptable IAQ. This method measures the levels of contaminants within the building.

The HVAC system also plays a major role in controlling moisture within the building. The HVAC system controls moisture through two mechanisms: (1) dehumidification of the indoor air; and (2) by maintaining positive pressure within the structure relative to outdoors, so as to minimize infiltration of moist outside air through the building envelope.

The Task Force reviewed current knowledge regarding how HVAC systems may cause exposure to mold, and how potentially harmful exposures can be prevented or controlled. The Task Force identified four basic ways that HVAC operation may increase airborne mold in buildings above normally occurring background levels. In each case, there are procedures that will prevent or correct these potential exposure problems:

Problem 1: Outside Mold

> Mold levels in the outside air are generally higher than inside the building. This can be a particular problem where bird droppings or other local sources of mold and fungi (*e.g.*, mulch piles) may be located on or adjacent to the building. Occupant exposure to these outdoor sources will increase if the HVAC filtration is inadequate or the building operates with excessive exhaust (leading to negative pressure of the building interior related to the exterior, and consequently drawing in contaminants from the outside). This situation can be avoided by attention to filters (type, fit and changing frequency), building pressurization and the cleanliness of surfaces around air intakes.

Problem 2: Equipment Sanitation

> Inside the HVAC system, damp surfaces or stagnant water can promote local mold growth. This can be avoided by periodic inspection and equipment maintenance or modification. Proper design, installation, and maintenance of HVAC equipment are essential. Conditions often considered not acceptable include visible mold growth, stagnant water, excessive dust and musty odors. Specific components of the HVAC systems that can become the site of mold growth include cooling coils, drain pans, interior insulation (including pipe insulation and duct lining), and humidifiers.

Problem 3: Humidity Control

> Where HVAC systems are operated to allow excessive relative humidity in building areas for extended periods of time, mold may grow, particularly on colder surfaces.

Introduction of more fresh air than the system is capable of conditioning may also promote this problem during hot, humid weather. This can generally be avoided by attention to HVAC settings and operating schedules. During the heating season, HVAC systems with humidifiers may cause mold growth where they cause excessive dampness. Such systems must be frequently checked and maintained. Humidifiers also need to be properly installed and periodically cleaned and sanitized.

Problem 4: Chilled Water Pipe Surfaces

Piping that serves the HVAC system can become a source of mold growth when deficient insulation allows sweating (humidity condenses on cold surface). This can be avoided by proper insulating of chilled water pipes (including proper installation of vapor retarders) and attention to the chilled water set point. Where mold growth occurs around such piping, insulation can be treated or replaced, depending on the severity of the damage.

Building occupant comfort is determined by a combination of factors including: temperature, relative humidity, air velocity, the mean radiant temperature of surrounding surfaces, clothing, activity level and personal preference. Areas outside the general comfort range are the source of many IAQ complaints (see ASHRAE Standard 55-1992, *Thermal Environmental Conditions for Human Occupancy*). Thermal comfort complaints can occur when the outside temperature changes rapidly, and building operators have to scramble to change the HVAC system from heating to cooling mode (or *vice versa*), in order to compensate. Defects in the mechanical system can also contribute to conditions leading to comfort ventilation complaints.

Although elevated temperature levels can present a feeling of physical discomfort, humidity levels in the occupied space have the most potential to impact health. Areas with very low humidity can dry the membranes in the eyes and upper respiratory tract, potentially leading to eye and throat irritation. However, it is primarily when humidity levels are elevated that serious health concerns arise. Higher humidity can contribute to the growth of molds, which can adversely affect the health of some individuals as described in the section on health effects.

Another important role of HVAC systems is to maintain pressure differences between source areas (e.g., those that generate odors) and occupants. Understanding building air pathways and the driving forces moving the air between spaces, can be critical to the control of IAQ problems. Maintaining the proper pressure differential within the building also helps prevent the infiltration of moist air through the building envelope.

Other Sources of Indoor Air Pollutants

Combustion equipment such as boilers and gas/oil fired furnaces and hot water heaters are a potential source of indoor contaminants, particularly carbon monoxide, carbon dioxide, oxides of nitrogen, sulfur oxides, particulates, and water vapor. The impact of these devices depends on the burning efficiency, the draft on exhaust stacks, and the integrity of the containment at the heat exchanger junction of the unit. Proper design and maintenance will usually resolve these problems. Although there are monitors for carbon monoxide exposure that can be placed in the

occupied space, it is just as important to ensure that carbon monoxide and other combustion gases are eliminated at the source, through an aggressive maintenance program.

Airborne contaminants commonly originate from the following:

- Activities of occupants and their equipment;
- Building surfaces including contamination from mold growth or chemical spills, dust accumulation, deterioration (e.g., release of fibers), or off-gassing (odors released from new materials);
- New equipment and furniture;
- Chemical pest control;
- Odors from sanitary sewer systems (dry traps and unsealed pipe joints); and
- Renovation or new construction within a building.

Effects of Building Design and Materials on IAQ

The Task Force did not hear a great deal of testimony on the subject of building design, except to note that modern office building contain a large number of organic materials such as wallboard and acoustic ceiling tiles, that provide a favorable environment for organisms under the right environmental conditions. There is a significant literature on building design, but the Task Force decided that it would concentrate primarily on the existing building stock.

Other Factors Affecting IAQ

In addition to the HVAC system and the building envelope design, other factors can affect IAQ. The most important is the quality of the outdoor air. Outdoor air is conditioned and treated when it is brought into the building through the HVAC system, as described above. If outdoor air is particularly high in specific pollutants, the HVAC system may not be able to remove the pollutant completely. Deficiencies related to the filtering capacity of the HVAC filter media and the filter retention bracket also may contribute to this problem.

Health Effects of Indoor Air

Broadly speaking, one can divide indoor air contaminants into two categories, those from indoor sources and those from outdoor sources. This classification scheme is useful because it assists in devising strategies to control contaminant levels and subsequent exposures.

Biological Agents

The Task Force investigated a wide variety of biological agents present in indoor environments that could potentially cause health problems. Although SB 283 specifically mentioned molds as a source of potential health concerns, a number of biological agents in addition to molds are commonly found in office environments, including viruses, bacteria and bacterial constituents, dust mites and cockroaches, and animal antigens.

Fungi are organisms lacking chlorophyll that typically produce spores. Molds (fungi that typically grow on organic matter) and other fungi are ubiquitous in the environment. Typically,

outdoor concentrations of most molds and fungi are higher than indoor concentrations, unless there is a local source of mold growth within the structure. Molds and fungi grow in areas that contain favorable conditions, notably moisture, oxygen, light, and a suitable substrate that varies according to the organism.

Molds and fungi can cause significant health effects, including allergies, hypersensitivity pneumonitis, and other health effects. The specific health effects produced depend both on the nature and extent of the exposure, and the underlying health status of the exposed individual(s). For example, individuals with pre-existing allergies, or immune compromise, may be at increased risk from exposures to certain molds and fungi.

Some molds have also been shown to produce toxins (termed mycotoxins) which have been shown to have significant health effects in animals when given in high doses. While there is considerable scientific debate about the potential for these molds to cause toxic effects in people in concentrations typically seen in office buildings, there is consensus among the Task Force and most health professionals that:

(1) Mold growth in buildings can have adverse health consequences;

(2) Normal background levels of mold can be found in all buildings;

(3) There is an inadequate base of scientific knowledge at this time to set health-based mold standards for buildings because of uncertainties about levels of exposures, the relationship between exposure and different health effects, and differences in susceptibility from person to person;

(4) While background levels of mold and mold exposures in buildings cannot be completely eliminated, exposures due to indoor mold contamination can and should be minimized; and

(5) Mold growth and contamination in office buildings can and should be prevented or controlled through the use of adequate and ongoing maintenance of the building and building systems, as well as through good housekeeping.

In addition to mold, other biological agents found in buildings typically include bacteria and bacterial products. Although bacteria are ubiquitous in the environment, several bacterial species are of special concern in indoor air, either because their growth is promoted by conditions within a structure, or because the likelihood of exposure is much greater indoors than outdoors. The first case is represented by *Legionella pneumophilia*, the second by *Mycobacterium tuberculosis*.

Certain areas within a building, notably water reservoirs and areas of high moisture content with a temperature range of 35^{o} - 46^{o} C., can promote the growth of *Legionella* species including *Legionella* pneumophilia. These gram-negative bacteria can infect individuals causing one of two conditions, either Legionnaires' disease – a sometimes fatal pneumonia – or Pontiac fever, a non-fatal flu-like condition. Vulnerable areas include cooling towers, hot water systems, and

humidifiers. Where *Legionella* grows in cooling towers, exposure of building occupants may occur through nearby air intakes. This can be controlled by periodic maintenance, including chemical treatment. Optimal siting of cooling towers and careful consideration of the type of cooling system during the design phase can prevent *Legionella* exposure.

By contrast, *Mycobacterium tuberculosis* is a concern in buildings not because of its source – which is respiratory droplets coughed by actively infected and sick individuals – but because of its high infectivity and ability to survive in small respiratory droplets suspended in air for a considerable period of time and the need for adequate ventilation.

The health impacts of exposure to endotoxins, which are constituents of bacteria, are under study. Preliminary evidence suggests that some individuals can be adversely affected by endotoxins, but further study is necessary to establish dose effects and exposure mechanisms.

There are a large number of indoor bioaerosols (bioaerosols are particles from biological sources that are small enough to be found in the air). Among the most important bioaerosols are viruses; dust mites; insects and proteins from insect parts (particularly cockroaches); rodent dander and urinary proteins; animal dander (including dander imported from household pets); and molds and fungi (as discussed above). In addition, pollens (which are usually found in the circulating atmosphere) may be either imported from the external atmosphere, or be produced by indoor plants under some circumstances. There is also considerable interest in the health effects of cellular components, notably endotoxin (which is found in the membranes of gram-negative bacteria), which may be a potent allergen. In most cases, control of these bioaerosols is best achieved through ongoing housekeeping and maintenance activities within the building, to prevent the buildup of dust, dirt, food particles, and other contaminants.

Particulates

Particulates (small particles) consist of fibers, dust, combustion products, pollens, and other bioaerosols that have properties of mass and size. Particulates that are made up of fibers may act as mechanical irritants, while bioaerosols such as pollens, bacteria, and fungi may cause both non-specific irritation and specific allergic inflammatory responses including asthma and rhinitis.

The properties of particulates in the air and in the body are dictated primarily by their size and mass. Heavier, larger particles (>10 μm) tend to settle more rapidly, while smaller, lighter particles (0.001 to 10 μm) may stay airborne for some time and are more likely to penetrate the defenses of the upper respiratory tract to end up in the deep lung. Thus, small particles are more likely to penetrate deep into the lung and alveoli, while larger particles are caught in the nose and upper airway.

Combustion Products

During the combustion of fuels, a number of chemicals and particulates are produced, including oxides of nitrogen and sulfur, carbon monoxide, carbon dioxide, polycyclic aromatic hydrocarbons (PAH's), and particulates. These substances can be respiratory irritants, and in the case of carbon monoxide, directly toxic. In typical office environments, the primary concern may be combustion products from traffic sources or exhaust from boilers and furnaces imported

from outside. Carbon monoxide from defective furnaces and gas fired hot water heaters can also be a hazard to building occupants.

Important means of control for these pollutants is design of the HVAC system, particularly the location of the fresh air intake; location and isolation of parking areas and loading docks; regular inspection and maintenance of boilers and heaters; proper building pressurization; and appropriate use of detectors.

Volatile Organic Compounds

Volatile organic compounds (VOCs) include a wide variety of small organic (carbon-containing) compounds typically released from plastics, solvents, dyes, adhesives, paints, and other synthetic materials found in office environments. Many of these sources are indoors; some may be brought in from outside, although outdoor concentrations are typically much lower than indoor concentrations. These compounds have been shown to act as irritants at higher concentrations; at concentrations typically seen in well-ventilated office buildings they may act as irritants or may be perceived as irritating by reason of their odor (which may be detected at quite low levels, depending on the particular compound). As yet, there is no straightforward dose-response relationship for VOCs that relates low-level exposures typical of office buildings to specific health effects.

Strategies to limit VOC exposures in buildings include substitution of products that contain lower amounts of VOCs; restriction of their use to certain areas; and changes in work practices.

Fibers

Fibers may be synthetic, for example fiberglass, which is commonly found in insulation. Or they may be natural fibers, include asbestos or wood (cellulose). In either case, they share certain properties, primarily that they are particles. There is great concern about asbestos, a known carcinogen that was commonly used as a building insulation and fire-proofing material for many years up until the 1970's, and is still commonly found today. Many other fibers, such as fiberglass or the man-made mineral fibers (MMF), are used today in industrial and commercial applications. Exposure to fiberglass and other MMFs can cause skin, eye, and upper respiratory tract irritation. Whether these fibers are potentially carcinogenic is still being investigated. Fiberglass is of particular relevance in office buildings, because it is commonly found as an insulating material and airborne fibers are highly irritating, whether it is on the skin or in the respiratory tract. Because of its ability to limit the noise from HVAC systems, fiberglass has been and still is used to line HVAC systems. In some cases these interior duct linings degrade and fiberglass becomes airborne, resulting in reports of irritation and other health effects.

Control of fibers depends on stabilization or removal of fiber sources, as well as appropriate use of filters in the HVAC system.

Pesticides

Pesticides are used in office buildings primarily to control pests and vermin. Pesticides are regulated by the U. S. Environmental Protection Agency. Pesticide applicators use a wide variety of chemical preparations, which may include volatile carrier compounds as well as the active pesticide ingredients. The pesticides may be organophosphates, carbamates, inorganic compounds such as copper arsenate, chlorinated chemicals, or one of many other chemicals.

Control of pesticide exposures in buildings is beyond the scope of this report, but has been extensively discussed by a number of agencies, including the U.S. Environmental Protection Agency.

Indoor Air Quality in Maryland

The Task Force heard from a number of individuals and agencies that had first-hand experience with IAQ problems and management in the State. Testimony and exhibits covered a number of topics, including: (1) the current regulatory framework of IAQ; (2) technical and scientific aspects of indoor air quality; (3) certification and training of professionals involved in HVAC system installation, maintenance, testing and balancing; and (4) individual and agency experiences with IAQ problems. A schedule of meetings and witnesses is presented in Appendix 3.

Building Ownership and Management

The Task Force heard that one of the complexities in assigning responsibility for IAQ is the diversity of building management. Increasingly, building owners depend on property management companies to manage their assets. These companies vary in the service they provide to building owners. Most provide comprehensive building management services that include operation and maintenance of tenant space. The larger property management firms often utilize sophisticated computerized scheduling and work order maintenance systems to control their operational and building maintenance requirements. These automated programs may be integrated into the preventive maintenance schedules for building mechanical services. Still other firms provide tenant retrofit and ventilation redesign to accommodate multiple use tenant requirements.

The property manager frequently is an interface between the building owner and occupants. However, the obligation to provide a safe and healthful workplace for employees always rests with the employer, who may be far removed from the building owner in his/her authority to initiate a response to an IAQ complaint.

In the public sector, buildings can be leased or owned by the public sector agency. Leases are typically contracted by the Department of General Services (DGS), which also administer the contract between the State and the landlord. The Task Force heard from the section of DGS responsible for leased/rented properties that these lease agreements require the building owner to maintain the building's mechanical systems.

The Secretary of DGS noted in written communication with the Task Force that, "Our experience has found that the best way to handle these complaints is to take them seriously, promptly investigate the concerns, and communicate openly with the employees involved (Appendix 4)." The Task Force also heard from occupants in state-owned buildings that there are inconsistencies and inadequacies in the operation, preventive maintenance, and capital improvements necessary to assure adequate IAQ in these buildings.

The Task Force has been unable to establish the number of buildings in both the public and private sector that may have IAQ problems. We are also uncertain as to the resources that will be needed to upgrade buildings to a level that will assure that acceptable IAQ is achieved and maintained.

Regulatory Framework

The regulation of IAQ is complex and incomplete. Three agencies in the State have some interest in IAQ. The Maryland Department of the Environment (MDE) historically had a voluntary, unfunded program in indoor air, and has some current regulatory authority over specific air contaminants, notably asbestos (COMAR 26.11.21). However, MDE has no currently active IAQ program due to the lack of any statutory authority, as well as any staffing or funding.

The Maryland Department of Health and Mental Hygiene (DHMH) has no regulatory authority over chemicals in the air, but has responsibility for some conditions that can affect health acutely, particularly infectious agents such as *Legionella*. The Task Force heard that DHMH has established a website concerning the health effects and control of indoor molds. The Task Force also heard there are some local health departments that become involved in IAQ problems, primarily through the use of nuisance health regulation.

The Department of Labor, Licensing and Regulation (DLLR) has regulatory authority for the health and safety of workers through the Maryland Occupational Safety and Health program (MOSH). The Task Force heard that MOSH has regulations governing the allowable concentration of specific chemical and physical agents in the workplace. These permissible exposure limits (for example, for carbon dioxide) are significantly higher than the concentrations found in office buildings and are more applicable to industrial enterprises and construction operations. MOSH also has authority to regulate worker safety and health through the "general duty clause", which states that employers have a general duty to maintain a safe and healthy workplace. Unfortunately, the Task Force heard from individuals who had IAQ problems and from MOSH that this authority is currently insufficient to deal with many IAQ problems. In addition, MOSH has authority over the employer, but usually not the building owner or manager (unless the employer is the building owner).

DLLR also has licensing authority over contractors who install HVAC systems through the HVAC licensing board. This authority governs the installation but not the operation and maintenance of HVAC systems. The Task Force heard testimony that there are no regulations governing the operation and maintenance of installed HVAC systems, although there are efforts underway to develop a nationwide certification system for HVAC technicians.

Local building codes determine building design factors that can affect IAQ. Unfortunately, building and mechanical codes in general are not specific enough to define many of the parameters necessary to ensure the building will achieve and maintain acceptable IAQ. There are voluntary consensus standards adopted by ASHRAE that apply good engineering principles to the design and operation of HVAC systems. These standards, which are continuously updated by ASHRAE through a peer review process, describe design and operating characteristics for HVAC systems. There is an ASHRAE standard for Ventilation for Acceptable Indoor Air Quality (Standard 62-2001) and for Thermal Environmental Conditions for Human Occupancy (Standard 55-1992). These standards, along with principles in the HVAC Handbook series published by ASHRAE, define the best practices for the design, installation, operation, and maintenance of HVAC systems.

The Task Force heard from individuals working in State agencies who had developed IAQ-related problems. These individuals pointed out some of the difficulties of resolving their IAQ problems:

- There was no central agency with designated authority and responsibility for IAQ
- The employer lacked the ability to compel the building owner/operator to take corrective actions
- There were no IAQ standards that individuals could point building owners/operators to and monitor the success or failure of any corrective actions

The Task Force heard testimony from the Department of General Services (DGS) concerning its efforts to reduce IAQ-related problems in State-leased buildings. DGS now incorporates in its contract language a requirement for a comprehensive building management approach to IAQ. This information is provided in appendix 5.

The Task Force's enabling legislation refers specifically to office buildings, so the Task Force did not consider schools, manufacturing enterprises, or other specialized indoor environments. However, it should be noted that some of the IAQ problems discussed in this report may apply to some of these other environments.

The Magnitude of the IAQ Problem

The Department of Health and Mental Hygiene was unable to provide any useful estimates of the incidence or prevalence of IAQ problems, that is, how many cases there are at any one time or how many new cases occur per year. There are at least two reasons for this. First, there are no specific diagnostic codes used by the medical community for building-related or IAQ problems. Illnesses are coded according to diagnosis, for example asthma, allergic rhinitis, or Legionnaire's disease, but they are not coded according to where the disease exposure occurred or for the environmental factors that might be related to the cause of the disease. Therefore, with the exception of illnesses that are likely to occur in specific environments – for example, Legionnaire's disease – a review of diagnostic codes from hospitals and physician billing records is not useful to estimate the magnitude of building-related illnesses in the State.

The second reason that the Department could not estimate the magnitude of the problem is that there is no surveillance system in place to identify IAQ problems in the State. Occupational diseases are reportable in Maryland, but studies have shown that reporting for all occupational diseases is very rare. Most physicians are probably unaware of the reporting requirements, and even if they are aware of it, the mechanism for reporting is cumbersome.

The Task Force attempted to assess the costs of IAQ-related problems. Economic impacts of IAQ are a function of: (1) the number of people affected by IAQ problems who seek or are referred for medical evaluation; (2) lost time due to IAQ-related problems; (3) decreased productivity due to IAQ-related problems; and (4) costs to building owners and operators of addressing and correcting IAQ-related problems. As noted above, DHMH was unable to provide any estimate of the number of people affected by IAQ problems who might have sought medical evaluation. There was no estimate of time lost or decreased productivity due to IAQ-related problems, for a similar reason.

The Task Force also asked DGS to estimate what costs it might have incurred in the past in addressing IAQ problems. In written comments to the Task Force, the Secretary of DGS noted:

> "Our Lease Management and Procurement Unit reported IAQ complaints in 13 leased office buildings since July 2000. This is out of an inventory of 375 commercial leases totaling 4.2 million net usable square feet statewide. The largest and most visible IAQ issue was at the 180,000 square foot Investment Building in Towson, which was occupied by the Department of Social Services and the [Baltimore] County Health Department. After some corrective action to remediate mold, the decision was made to relocate the agencies. It is reported that approximately $20 million in lawsuits by employees are pending against the property owner. This one case alone had consumed over 250 hours of staff time to address." (Written comments of DGS Secretary Peta Richkus, Appendix 4).

The Task Force reviewed published estimates of IAQ costs. Chen and Vine (1997) reviewed insurance company databases and found that in most cases even insurers are unable to provide systematic estimates of IAQ-related illnesses. However, the authors noted that, "Although there are no figures for total costs due to unfavorable judgments in IAQ lawsuits because so many of these suits are settled out of court, sizable awards in several recent cases suggest that defending parties, including insurance companies, could be liable for tens of millions of dollars per building."

The Task Force requested the Secretary of DLLR to identify the number of cases of IAQ complaints submitted to MOSH annually. While there is no systematic data collection for such cases, anecdotally MOSH receives a significant number of requests for assistance with IAQ problems each year.

Development of Task Force Recommendations

The Task Force considered several possible recommendations that affect different aspects of the IAQ problem. Throughout its deliberations, the Task Force consistently focused on developing evidence-based recommendations that would improve public health, while ensuring flexibility for building owners, operators, and others involved in managing office building environments.

Early on, the Task Force discussed whether to just recommend a guidance document that would define "best practices" for operating a building with acceptable IAQ. Although this would greatly aid building owners who are looking for guidance on the proper techniques to implement an IAQ program, the Task Force felt that a voluntary approach would not sufficiently address some of the most difficult IAQ problems in buildings where owners had been unwilling to undertake voluntary corrective actions.

Another approach considered was to recommend an incentive program for building owners who take corrective action to upgrade building systems to achieve acceptable IAQ. Depending on the incentive, which could be in the form of either tax-credits or a limitation on tort liability claims pertaining to IAQ, this approach might induce building owners and operators to initiate positive actions. However, the Task Force felt that the proposed incentive programs could affect many issues unrelated to IAQ and might be infeasible at this time. In addition, it was felt by many on the Task Force that incentive programs might not sufficiently address IAQ problems in buildings where building owners and operators had already demonstrated an unwillingness or inability to expend resources to correct problems.

Finally, the Task Force considered a regulatory enforcement approach. This took two forms. The first was a third party building inspection program using government certified inspectors. The second approach was to assign IAQ responsibility to a State Agency. The former approach was considered infeasible because there was not time to develop inspection criteria or procedures, and establish and administer a third party accreditation program for IAQ inspectors. In addition, the Task Force could not agree on how the inspection program might be enforced.

An enforcement program through a governmental agency was considered the best option available to the Task Force. However, the Task Force recognized that this option requires that the General Assembly adopt specific statutory authority and grant it to the designated agency, since none currently exists. Also, establishing a new agency program will require the allocation of sufficient funds and staffing to make the program functional.

The Task Force was offered a number of other potential recommendations to consider. The Task Force decided against recommending a new licensure or certification requirements for HVAC operators and technicians, feeling that this proposal would have a negligible impact on IAQ problem in the State. A number of Task Force members supported the idea of an incentive program to encourage office building owners to voluntarily develop model IAQ management programs. While this proposal was not adopted as one of the principal recommendations of the Task Force, there was a consensus that such an incentive program could be valuable, and would encourage the new IAQ Advisory Council and Office of IAQ to consider such incentive programs.

The Task Force was also cognizant of the fact that its recommendations only affect office workers in the State, and there are a large number of workers in other workplaces who would not be affected by these proposals. For example, the Task Force received numerous comments that indoor air quality in schools is an important problem that needs to be addressed, although the legislative charge to the Task Force dealt only with office buildings. The Task Force has therefore recommended that the new Advisory Council on Indoor Air Quality consider how and whether to extend some or all of these provisions to other workplaces and indoor environments in the future.

The four principal recommendations of the Task Force are based on findings from Task Force hearings:

Recommendation 1: Statutory authority for regulating indoor air quality (IAQ) in office buildings should be granted to primarily the Maryland Department of the Environment along with the budget and staff to execute this authority. An Office of Indoor Air Quality should be established within the Maryland Department of the Environment (MDE). The Office would, among other responsibilities, enforce new indoor air regulations for building owners.

The Task Force believes that there is a need for one lead agency that has familiarity with IAQ problems and management to take responsibility for enforcement of any new IAQ initiative in the State. The Maryland Department of the Environment (MDE) has familiarity with IAQ problems and the Task Force believes that the MDE is best able to provide the combination of technical expertise, interaction with other agencies, and experience with IAQ management necessary for this new authority (figure 1). The agency's responsibilities would include:

- Enforcement of new IAQ requirements (described in Recommendation 2);
- Provision of technical assistance and outreach to building owners and operators interested in IAQ management; and
- Other such activities as are recommended by the new State Indoor Air Advisory Council (defined below).

Upon receiving a complaint, staff would investigate a building and review the operation and maintenance of the HVAC system based on documentation maintained by the Building Owner, as well as reviewing the facility's comprehensive indoor air quality management plan. Field investigation would be conducted as necessary to determine the extent of compliance. Facilities without a plan would be subject to monetary penalties. The monetary penalties should be put in a special fund account to augment allocated funds needed for program operations, such as training and specialized instrumentation.

Since the Task Force was not able to define the extent of IAQ problems in Maryland buildings, the staffing needs for The Office of Indoor Air Quality are uncertain. At least 7 FTE (full time employees) staff members with expertise in industrial hygiene, HVAC systems, and the health effects of IAQ will be needed to develop the program and respond to technical assistance request as well as to carry out initial enforcement actions.

As the extent of IAQ problems become better understood, additional staff could be necessary to enforce IAQ laws and regulations.

The Task Force recognized that in a time of budget constraints, it was important to consider alternatives to establishing a new government organization. The Task Force evaluated alternatives such a voluntary compliance plan that would depend on building owners to meet a set of standards without any regulatory authority. Task Force members felt that this approach would not substantially change the situation from where it is now for workers in "problem" office buildings. The Task Force also considered adopting a system of incentives for building owners, based on relief of certain taxes liabilities, tort liabilities, or some other direct financial incentives. Testimony from Task Force members and witnesses suggested that this approach would be likely to be of greatest benefit to office workers who already work in buildings with few problems, while it would not affect those working in buildings with the greatest need for improvements.

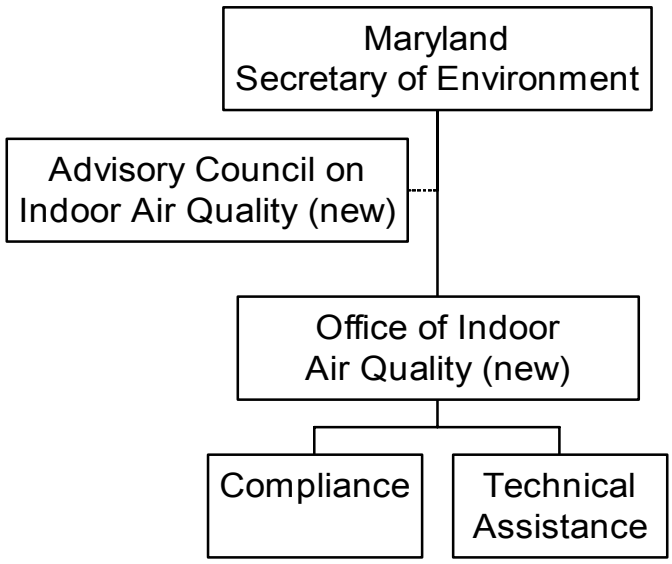

Figure 1. Proposed structure of Indoor Air Quality Management in Maryland

Recommendation 2: Building owners should be required to comply with standards for operation and maintenance of an office building that will prevent the development of most IAQ problems.

Owners of buildings greater than 2,500 square feet where office activities comprise at least 50% of the activity would be required to develop Operation and Maintenance (O & M) plans for the building consistent with current ASHRAE guidelines. At a minimum, these O & M plans would describe procedures for regular inspection and maintenance of the HVAC system and other building systems that can affect IAQ. The O & M plans

would also contain a description of how the building owner or operator responds to occupant concerns about IAQ problems.

The Task Force believes there is a need for some minimal IAQ standards that office workers, building owners and operators, and public officials can turn to and cite when evaluating IAQ conditions within an office building. The Task Force considered adopting standards based on specific pollutants or agents and their health effects. However, the Task Force concluded that there is currently an inadequate scientific base of knowledge to justify adopting health-based standards for most substances, and therefore elected to base standards on the evidence presented to it, that many if not most IAQ problems can be prevented by regular preventive maintenance, and early identification and correction of the problems that invariably occur in buildings. The Task Force heard from many witnesses, that many if not most IAQ problems stem from a few basic causes: (1) a failure to perform routine preventive maintenance on HVAC systems; (2) inappropriate balancing and reassessment of HVAC systems when buildings are renovated or modified; (3) inadequate housekeeping and maintenance of buildings, particularly with respect to moisture control; and (4) failure to respond to employee IAQ complaints and communicate the findings and corrective actions back to the employees.

Based on the testimony presented to the Task Force and experience of Task Force members, the types procedures that could be addressed in mandatory O & M standards could include (but not necessarily be limited to):

- Items described in current ASHRAE guidelines for operating and maintenance documentation for building systems, which would encompass procedures for the operation of HVAC and other physical plant equipment and for maintenance tasks to be performed within the building. O & M documentation shall encompass both routine and emergency situations.

- At a minimum, the O & M documentation for buildings should address the following specific elements {These examples were considered by the Task Force to be important in maintaining building IAQ}:

    - HVAC Systems
        - Filters and air cleaning device maintenance and replacement, as recommended by the manufacturer.
        - Regular inspection of:
            - Outdoor air dampers and actuators (equipment not operating as intended should be repaired as soon as practicable)
            - Humidifiers (should be cleaned regularly to minimize microbial growth).
            - Cooling coils and drain pans (at least annually), to be cleaned when fouling or microbial growth is observed. Any adjacent areas subject to drain pan overflow should also be cleaned and the cause of unintended wetting rectified.

- Outdoor air intake louvers and adjacent surfaces, removing any visible debris or biological material.

- Sensors used to control outside air shall have their accuracy checked semi-annually. The facility owner (or his designee) shall calibrate or replace sensors failing to meet accuracy specified by the manufacturer.
- For air handlers exceeding 2000 CFM, the total quantity of outdoor air shall be measured every five years. Outdoor airflow shall be adjusted where the flow rate is more than 10% below the design flow.
- Cooling towers shall be treated to limit the growth of microbiological contaminants including *Legionella spp*.
- Areas needed for equipment access to provide for inspection and maintenance activities specified in section 5(c)(i) 1-9 shall be kept clear of obstructions.

- Sewer Systems
  - Floor drains shall be maintained to prevent release of sewer gas.

- Sanitation

  - Where water intrusion or excess moisture occurs, take measures to dry and sanitize the area as quickly as possible.
  - Inspect all accessible building surfaces quarterly for evidence of suspect mold growth.
  - Where suspect mold growth is observed, remove or treat the affected surfaces, ensuring that workers are adequately protected and use appropriate cleaning methods.
  - Identify and correct any ongoing sources of excess moisture.

- Complaint Management
  - The O & M documentation will describe the process by which employee concerns about IAQ will be collected, managed, and corrected, including the manner in which building occupants will be informed about the management of their concerns.

The Task Force expects that one of the tasks of the Office of Indoor Air Quality will be to develop guidance documents to assist both small and large building owners in preparation of the O & M documentation and procedures.

The proposed standard in the draft legislation (Appendix 6) would have several advantages. First, it incorporates guidelines from an independent body of experts – the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) – that are constantly reviewed and updated to incorporate new understanding of IAQ management and health effects. Second, it gives all of the stakeholders in the process – building occupants, owners and operators, maintenance and technical personnel,

government compliance officers alike – one standard reference point to use in assessing indoor air quality. Third, these standards are not particularly difficult for building owners and operators to achieve, but they establish a minimal floor of operational proficiency that should be a reasonable expectation of all office buildings in the State.

The Task Force considered whether to establish requirements only for buildings owned or leased by the Maryland Department of General Services. The Task Force concluded that this would be an inadequate response to the problem, although several buildings with IAQ problems that have recently come to public attention have been State office buildings, which often lack sufficient funding for capital and operational improvements to achieve and maintain acceptable indoor air quality. It was noted that buildings are owned or leased by other public entities and a broader focus was required. The Task Force recognizes that upgrading IAQ in publicly owned buildings will require a substantial increase in capital improvement and facility maintenance budget allocations.

With limited enforcement resources available, the Task Force feels that applicability should be limited to larger office facilities (e.g., over 2,500 square feet) in buildings used primarily (e.g., at least 50%) for office activities.

Complaint investigations could be handled as follows:

- The Complainant would complete a form providing specific information;
- A notice would be sent to the building owner requiring a written response to the complaint;
- A follow-up call would be made to the complainant by the Office of IAQ; and
- An enforcement action would occur if the owner were unresponsive or an investigation by the Office of IAQ showed there were deficiencies in the O&M plan.

The State or County would have the right to expedite inspections under existing authority where specific health problems are alleged.

This is obviously not a complete or perfect solution to IAQ problems in the State. Many building owners and operators already go well beyond these efforts. Some causes of IAQ problems – for example, VOCs generated by products inside the building – would not necessarily be addressed in the O&M plan for the building. However, we believe that by addressing the operation and maintenance of building HVAC systems and the condition of the building envelope through regular inspection and good housekeeping, most IAQ problems, particularly those related to mold, could be avoided.

Recommendation 3: A permanent Maryland Advisory Council on Indoor Air Quality should be established to advise the Secretary of the Environment on IAQ issues.

The Task Force recognizes that there are great many unanswered questions regarding the appropriate management of IAQ in office buildings. The proposed Office of Indoor Air

Quality within MDE will need guidance from technical experts as more knowledge of IAQ problems develops. The Task Force recommends that a permanent advisory council on IAQ be established to advise the Secretary of the Environment on new scientific findings and technical developments that could affect IAQ policy. The IAQ Advisory Council should consist of public representatives, government agency representatives, and professionals with certification, experience and expertise in indoor air quality, as described below:

Public Representatives

- Office workers or members of the public who have experienced problems related to IAQ
- Building owners
- Labor representatives from companies involved in HVAC installation, maintenance, and testing

Agency Representatives

- Department of the Environment
- Department of Labor, Licensing and Regulation
- Department of Health and Mental Hygiene
- Department of General Services
- Department of Education
- Housing and Community Development

Certified Professionals with Expertise and Experience in Disciplines Related to IAQ

- Architecture
- HVAC system installation, operation and maintenance
- Medicine
- Industrial hygiene
- Mechanical engineering of HVAC systems
- Testing and balancing of HVAC systems

Several IAQ management recommendations considered by the Task Force appeared to have merit but require further investigation. The Advisory Council should evaluate the following items:

1. Recommendations for adoption or modification of IAQ standards for building owners and operators.
2. How best to provide additional technical assistance and training to promote recognition and resolution of IAQ problems in the private and public sectors.
3. Recommendations on the collection of data regarding the impacts of state IAQ activities on the health and well-being of Maryland workers.
4. Evaluation of the economic impacts of IAQ management.
5. Recommendations concerning integration of IAQ activities in MDE with other State agencies such as DLLR, DHMH, Department of Education, DGS, and other appropriate governmental agencies.
6. Measures to improve IAQ management in State owned and leased buildings.

7. Guidelines for construction or renovation in occupied facilities to maintain acceptable IAQ conditions.
8. Design guidelines for achieving optimal IAQ in new buildings.
9. Guidelines for the balancing and commissioning of HVAC systems.
10. How best to implement operational standards for HVAC systems, such as applicable ASHRAE standards.
11. Adoption of best practices or standards for housekeeping that will assure good building IAQ, such as ASTM Standard E1971-1998, "Standard Guide for Stewardship for the Cleaning of Commercial and Institutional Buildings".

Recommendation 4. As one of its first tasks, the new Maryland Advisory Council on Indoor Air Quality should consider how to implement an effective IAQ surveillance program.

The Task Force feels the IAQ Advisory Council should, as one of its first tasks, study whether and what kind of surveillance system should be established by the State in order to better understand the scope of IAQ problems within the State. The Task Force repeatedly confronted an absence of information needed to tailor recommendations to the most significant IAQ problems. However, the Task Force felt that the precise design of such a surveillance program – what criteria should be used for reporting, whether the reporting system should rely on voluntary reporting or use some kind of active outreach, whether it should use representative sampling or be universally applied, whether it should be located in the new Office of IAQ or another agency such as DHMH – should be left to the IAQ Advisory Council, in consultation with the Secretary of MDE and other officials.

Glossary of Terms

ASHRAE – American Society of Heating, Refrigeration and Air Conditioning Engineers

Bioaerosol – biological material that is generally small enough to be airborne

HVAC – Heating, ventilation and air conditioning

IAQ – Indoor air quality

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Appendix 1. Authorizing Legislation

SENATE BILL 283

Unofficial Copy 2001 Regular Session
M3 (1lr1353)

ENROLLED BILL

-- Economic and Environmental Affairs/Environmental Matters --

Introduced by **Senators Conway, Currie, Della, Exum, Frosh, Hollinger, Hughes, Kelley, Lawlah, McFadden, Mitchell, Pinsky, Sfikas, Teitelbaum, and Van Hollen**

Read and Examined by Proofreaders:

_____
Proofreader.

_____
Proofreader.

Sealed with the Great Seal and presented to the Governor, for his approval this _____ day of _____ at _____ o'clock, _____M.

_____
President.

CHAPTER_____

AN ACT concerning

Task Force on Indoor Air Quality

FOR the purpose of establishing a Task Force on Indoor Air Quality; providing for certain membership, duties, and staffing of the Task Force; providing for the designation of a chairman of the Task Force; requiring the Task Force to issue a certain report by a certain date; prohibiting a member of the Task Force from receiving certain compensation; *prohibiting a member of the Task Force from participating in certain activities of the Task Force under certain circumstances;* authorizing a member to receive certain reimbursements; providing for the termination of this Act; and generally relating to the Task Force on Indoor Air Quality.

SECTION 1. BE IT ENACTED BY THE GENERAL ASSEMBLY OF MARYLAND, That:

(a) There is a Task Force on Indoor Air Quality.

SENATE BILL 283

(b) The Task Force consists of the following ~~13 16~~ *20* members:

(1) Two members of the House of Delegates appointed by the Speaker of the House;

(2) Two members of the Senate of Maryland appointed by the President of the Senate;

(3) The Secretary of the Environment, or the Secretary's designee;

(4) The Secretary of Health and Mental Hygiene, or the Secretary's designee; and

(5) The Secretary of Labor, Licensing, and Regulation, or the Secretary's designee;

(6) ~~Six Nine~~ *Thirteen* members appointed by the Governor as follows:

(i) Two representatives of the heating, ventilation, and air conditioning (HVAC) repair industries;

(ii) Two representatives of not-for-profit organizations that focus on indoor air quality and related health issues, one of which shall come from the Maryland Industrial Hygiene Council; ~~and~~

(iii) One representative from the Johns Hopkins School of Public Health;

(iv) One representative of local government;

(v) One building owner or manager; ~~and~~

~~(iii)~~ (vi) Two citizens affected by HVAC-related illnesses;

(vii) One representative from the Maryland State Licensed Beverage Association;

(viii) One representative from the Maryland Hotel and Motel Association;

(ix) One physician representative of the Maryland College of Occupational and Environmental Medicine with credentials and experience in the evaluation and treatment of illnesses related to indoor air quality; and

(x) *One person with expertise in architecture or building design and engineering*.

(c) The Governor shall designate the Chairman of the Task Force.

(d) The Task Force shall:

SENATE BILL 283

(1) Study the nature, location, and extent of health and environmental risks posed to workers as a result of molds, spores, and other toxic organisms located in the HVAC systems of ~~office~~ *office* buildings, including:

(i) The relative risks associated with the manufacture, maintenance, and repair of HVAC systems;

(ii) Actual and projected costs for the medical treatment of HVAC-related illnesses; and

(iii) Actual and projected costs in loss of worker productivity because of HVAC-related illnesses;

(2) Make recommendations regarding:

(i) The prevention of workers' HVAC-related illnesses, including a monitoring program to identify the probable onset of HVAC-related illnesses and their underlying causes;

(ii) The institution of appropriate remedies and controls in ~~office~~ *office* buildings that, because of the dangers of indoor air quality, expose workers to unwarranted health risks, including the best available treatment technology and the feasibility of voluntary prevention and pollution reduction programs;

(iii) A plan to provide educational information and, as may be necessary, warnings to affected workers regarding health and environmental risks associated with the indoor air quality of their ~~office~~ *office* building sites; and

(iv) Legislative or regulatory measures that are necessary and appropriate to address current gaps in federal, State, and local protection of ~~office~~ *office* workers from HVAC-borne toxins; and

(3) Submit a final report of its findings and recommendations to the Governor, and subject to § 2-1246 of the State Government Article, to the General Assembly, on or before July 1, 2002.

(e) The ~~Department of the Environment, in cooperation with other appropriate State agencies,~~ State agencies represented on the Task Force shall provide staff support for the Task Force.

(f) A member of the Task Force may not receive compensation for serving on the Task Force, but is entitled to reimbursement for expenses under the Standard State Travel Regulations, as provided in the State budget.

(g) A member of the Task Force who misses two meetings of the Task Force may not participate in any decision making processes or recommendations of the Task Force.

SECTION 2. AND BE IT FURTHER ENACTED, That this Act shall take effect July 1, 2001. It shall remain effective for a period of 1 year and 1 month and, at the

end of July 31, 2002, with no further action required by the General Assembly, this Act shall be abrogated and of no further force and effect.

Appendix 2. Task Force Members

Joan Carter Conway (appointed by Senate President)
Senator

Leonard H. Teitelbaum (appointed by Senate President)
Senator

Dan K. Morhaim (appointed by House Speaker)
Delegate

Theodore J. Sophocleus (appointed by House Speaker)
Delegate

Clifford S. Mitchell, M.D. Chair (chosen by the Governor)
Representative from the
Johns Hopkins School of Public Health
Baltimore City

Hung K. Cheung, M.D. (appointed by the Governor)
Maryland College of Occupational and Environmental Medicine

Patricia Ann Christensen (appointed by the Governor)
HVAC repair industry

Tameka E. Collins (appointed by the Governor)
Citizen effected by HVAC-related illnesses

Brian P. Dicken (appointed by the Governor)
Local Government

Ernestine Holley (appointed by the Governor)
Not-for-Profit Organization

Tom (Goose) Kaiser (appointed by the Governor)
Representative from the Maryland State Licensed Beverage Association

Patrick H. Kelly (appointed by the Governor)
HVAC repair industry

Philip A. King (appointed by the Governor)
Citizen effected by HVAC-related illnesses

Jon P. Koscher (appointed by the Governor)
Representative from the Maryland Hotel and Motel Association

Edward N. Light (appointed by the Governor)
Maryland Industrial Hygiene Council

David B. McCormick (appointed by the Governor)
Architecture and/or Building Design and Engineering

Sharon R. Perera (appointed by the Governor)
Building Owner or Manager

Jim Lewis (Secretary of Environment's designee)

Tara Funk (Secretary of Health and Mental Hygiene's Designee)

Ileana O'Brien (Secretary of Department Labor, Licensing and Regulation's (Designee)

Sandra K. Crisafulli
Staff

Appendix 3. Schedule of Committee Meetings and Witnesses

Schedule of Committee Meetings

October 9, 2001
November 13, 2001
December 11, 2001
January 8, 2002
February 12, 2002
March 12, 2002
April 9, 2002
May 14, 2002
June 11, 2002

Schedule of Witnesses

December 11, 2001

Ken Sufka, Sufka & Associates
Representative of several trade associations affiliated with indoor air quality

Charles Austin, Sheet Metal Occupational Health Institute Trust
Industrial Hygienist

Don Davis, Air Conditioning and Refrigeration Institute

January 8, 2002

James E. Woods, President and Director of HP Woods Research Institute

Deborah Veystrk, Citizen affected by HVAC-related illness

Patrick Murphy, Director of Technical Development for North American Technician Excellence

Albert Donnay, Environmental Health Engineering

February 12, 2002

John Schaefer, Environmental Health Officer with Johns Hopkins

Larry Schoen, ASHRAE Standard 62 Committee

Barry Hemler, Environmental State Coordinator with Montgomery County Public Schools

Jim Bailey, Edward Light, Building Dynamics

March 12, 2002

Steve Cassard, Department of General Services, Real Estate

Linda McGovern, Department of General Services, Lease Procurement Unit

Appendix 4. Selected Written Testimony Presented to the Task Force

What Constitutes a Safe Environment and How is it Quantified?

James E. Woods, Ph.D., P .E.
Founding Director and President
HP-Woods Research Institute
(703) 471-4400
jwoods@hpwoods.org

In Proceedings of Laboratory Safety and Environmental Management Conference, Alexandria VA, July 11-12, 2000, pages 13-20

Introduction

Indoor environments in laboratory and other facilities are controlled by combinations of three strategies: 1) source control, such as containment and exhaust ventilation; 2) dilution control, such as infiltration, natural ventilation, and mechanical ventilation; and 3) contaminant removal, such as particulate and gaseous air cleaning. The fundamental objectives of this control are to prevent adverse health effects and to provide environmental conditions that are conducive to the well being of the occupants and to the productivity of the facility. To achieve these objectives, simultaneous control of thermal, indoor air quality, lighting, and acoustic exposures is required. These four primary environmental stressors affect human response, collectively, as each is associated with physiological receptors in the body that integrate the perception of total exposure. Unfortunately, measurable and controllable values for this set of exposure parameters are not generally available as codes, standards, or guidelines. Rather, prescriptive and disaggregated criteria are promulgated such as ventilation rates, pressure differences, air flow rates, background noise levels, illuminance, and room air temperatures and relative humidities. As a result, indoor environments often fail to meet their expectations and, not infrequently, degrade to discomforting or deleterious conditions because the parameters that are measured and controlled only indirectly relate to those that are perceived by the occupants.

In this presentation, a brief historic perspective of the development of indoor environmental criteria is given, the concepts of Healthy Buildings, Continuous Degradation, Continuous Accountability, and Building Diagnostics are described, and methods for evaluating and classifying the performance of buildings are discussed. The presentation concludes with an example of how these methods can be used to track and manage the quality of the indoor environment.

Healthy Buildings

The concept of "healthy buildings" is not new. When fire was first brought into caves for heat, light, security, and cooking, it was soon realized that exhaust ventilation was required. Glazing was first used ~1500 BC to enlarge useable indoor spaces by providing daylighting and reducing heat loss in occupied spaces. Operable windows were used extensively during the Renaissance Period, King Charles I may have promulgated the "first building code" in 1629 to minimize risk of incurring the plague in London, and carbon dioxide was first used ~1824 in

Welch coal mines as an indicator of adequate ventilation. In the late 1800s, ventilation rates of 30 to 60 cfm/person were promulgated in the U.S. to minimize the risk of disease (e.g., tuberculosis) in public assembly buildings. After World War II and until the energy shortages of the 19705, architects and engineers designed systems to "maximize" comfort, as energy became plentiful and cheap in the U.S.

In the 1920s, an important bifurcation occurred in the methods by which indoor environments were evaluated. Two researchers at Harvard School of Public Health, Constantine Yaglou and Alice Hamilton, independently published works that established the bases for general ventilation (i.e., engineering) and exposure control (i.e., industrial hygiene). In the late 19705, these concepts were again integrated through research published by the National Research Council and through promulgation of the ASHRAE Standard 62-1981: "Ventilation for Acceptable Indoor Air Quality." These documents provided information with which ventilation rates and exposure values could be rationalized. However, after twenty years, these criteria continue to be used separately:

- Outdoor air ventilation rates (e.g., cfm/person, cfm/ft^2), which are easier to calculate than to measure, are typically used for design purposes (e.g., the Ventilation Rate Procedure in ASHRAE Standard 62-1999);
- Exposure values (e.g., ppm, $\mu g/m^3$), which are easier to measure than to calculate, are typically used for assessing indoor environments during operations (e.g., TLVs in ACGIH publications, and the - Indoor Air Quality Procedure in ASHRAE Standard 62-1999).

During the last twelve years, two basic definitions for healthy buildings have been proposed. At the first Healthy Buildings Conference, in Stockholm in 1988, Berglund et al stated that, ideally, "healthy buildings are free from Building Related Illness and discomfort, promote well being and health, and provide for: non-hazardous conditions, thermal comfort, pleasant air quality, illumination and acoustic satisfaction, social needs and productivity, and distinguished aesthetic qualities." In 1993, Woods et al proposed a pragmatic definition of healthy buildings in measurable and controllable terms. This definition states that "a healthy building minimizes occupant complaints and complies with 'acceptable criteria' for exposures, system performance and economic performance."

Continuous Degradation

Today, more than 90 million residential and more than 5 million non-residential/ non-industrial buildings are occupied in the U.S. With an annual replacement rate of approximately 1-2%, it is anticipated that 80-90% of the buildings that will be in use in 2020 already exist. Similar statistics also pertain to Western Europe and Japan. Current data also indicate that allergic rhinitis is the most common chronic disease in the U.S., asthma is the leading cause of school absences, and tuberculosis is the most lethal infection that occurs in health care facilities, worldwide.

From studies that have been reported over the last 15 years, see Fig. 1, it is estimated that approximately 20-30% of the existing building stock in the developed world has degraded to conditions that cause excessive rates of occupant symptoms (i.e., Sick Building Syndrome, SBS[1]) or frank illness (i.e., Building Related Illness, BRI[2]).

[1] Sick Building Syndrome has been defined by the Building Research Board and by the U.S. E.P.A as a building or area within it in which a substantial percentage of occupants (i.e., more than 20%) are affected by a set of symptoms

It is also estimated that 10-20% of the building stock has undetected problems (UPB), leaving a residual population of 50-70% of potentially "healthy buildings" (HB).

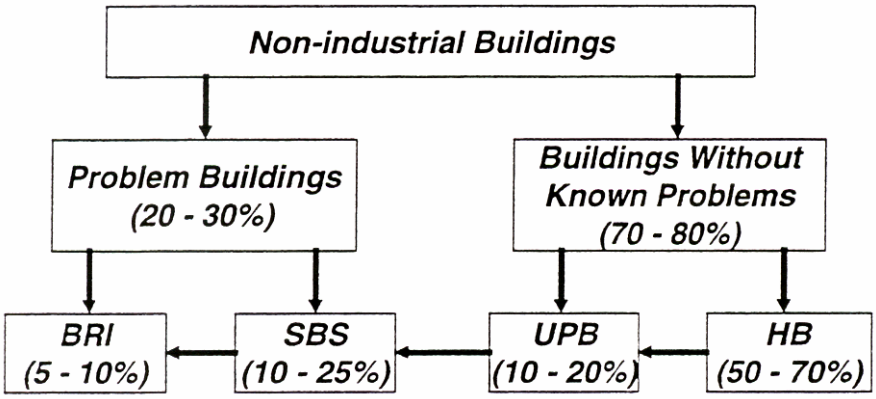

Figure 1. Concept of Continuous Degradation

The consequences of not detecting or intervening in the continuous degradation process can be significant" Results of research and litigation indicate that when a building has degraded to the Problem Building classification the following can be expected:

- More than 20% of the occupants will have acute discomfort complaints (i.e", symptoms).
- More than 20% of the occupants will report hampered performance.
- More than 50% of the occupants will report loss of confidence in management.
- The cost of recovering "good will" of the facility from SBS may exceed the cost of mitigation.
- The cost of recovering "good will" of the facility from BRI, including insurance and litigation costs, may exceed the original cost of the facility.

Continuous Accountability

Degradation of building performance can be intercepted and healthy building performance can be assured through a process involving building diagnostics, intervention, and quality assurance measurements. This process may be considered as "Continuous Accountability," a concept that was introduced in 1990 at the Fifth International Conference in Indoor Air Quality and Climate. The Continuous Accountability cycle begins at the planning and conceptual design phase of a building when the Accountable Person (i.e., owner, financier, or planner) sets the measurable and controllable building performance criteria. During the design process, the Accountable Person (i.e., designer or builder) translates the performance criteria to prescriptive criteria, drawings and specifications. During the commissioning and substantial completion period, the Accountable Person (i.e., owner) evaluates the delivered building for compliance with the performance criteria. During the occupancy period, the Accountable Person (i.e., owner, tenant, or occupant) assures continued compliance with the performance criteria. When the function of the space requires change, the cycle repeats.

that persist for at least two weeks, the symptoms dissipate soon after exiting the building, and the cause or causes are unknown.

[2] Building Related Illness has been defined by the Building Research Board and by the U.S. E.P.A as a building or area within it in which clinical signs of illness exist in more than one occupant and the illness has been diagnosed as building related.

For the Continuous Accountability cycle to be effective, three commitments are required:

- An Accountable Person must be identified for each phase in the building's life.
- Each Accountable Person must be empowered with authority to assure building performance.
- Each Accountable Person must be educated and trained to assure adequate building performance and occupant protection.

Building Diagnostics

The concept of building diagnostics was introduced in 1985 by the Building Research Board of the National Research Council as a means by which the performance of a building can be evaluated. This concept, which was derived from the principles of medical diagnostics, was defined as "a process in which a skilled expert draws on available knowledge, techniques, and instrumentation in order to predict a building's likely performance over time." This process consists of four essential elements:

1. A knowledge of what to measure.
2. Availability of appropriate instrumentation.
3. Expertise in interpreting the measurements.
4. Capability of predicting likely performance over time.

The evolving concepts of building diagnostics now incorporate three phases of investigation:

1. *Observation* from which preliminary hypotheses are formed.
2. *System Analysis* through which the preliminary hypotheses are tested.
3. *Exposure Analysis* through which the hypotheses are validated or refuted with quantitative data.

These procedures may be used to diagnose the performance of a building and its systems at any stage of its life cycle, from planning, design, and construction (i.e., "virtual building") through commissioning, occupancy, and renovation (i.e., "actual building"). During the building diagnostic process, hypotheses should be written in terms of "three related Ss": Sources, Systems, and Symptoms. As in medical diagnostics, the focus of the building diagnostic procedure should be to evaluate and classify.

Evaluation and Classification Criteria

In order to achieve this focus and to effectively use the four essential elements through the three phases of building diagnostics, a set of evaluation and classification criteria is required that is valid and reliable at each phase of the building's life (i.e., planning, design, construction, and operations).

Evaluation Criteria. As a basis for defining the evaluation criteria, a rational model was introduced in 1993 at the Sixth International Conference on Indoor Air Quality' and Climate. As shown in Fig. 2, this model relates aspects of human responses to the four primary environmental stressors (i.e., exposures). These, in turn, are linked to four types of systems that control the loads or sources related to the exposures. This classic epidemiological model rests on an economic platform that interacts with each of the other elements in the model.

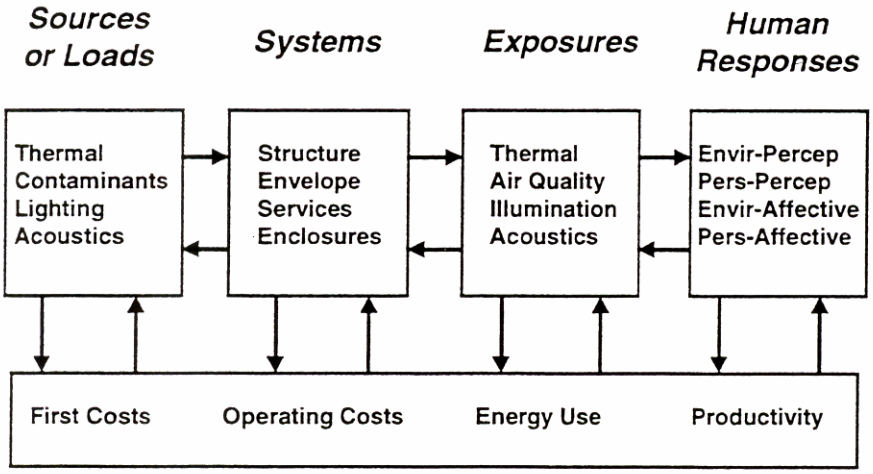

Figure 2. Rational Model

This model recognizes that the primary control objective is to achieve desired human response. In this rational model, four domains of human response have been defined, consisting of two objects of response (i.e., the environment and the person) and two aspects of response (i.e., perception, and affect or judgment). The environmental-affective domain, which includes responses such as "acceptability" or "preference," is often the basis for design criteria (e.g., codes and standards) and for assuring healthy building performance as it tends to minimize the probability of incurring false-positive errors. Conversely, the personal-perceptual domain, which includes responses such as complaints (e.g., I'm hot) or symptoms (e.g., I have a headache), should be the focus for investigations of occupant complaints as it tends to minimize the probability of incurring false-negative errors in building diagnostics.

This model also recognizes that direct control of human response is not feasible from a building perspective, and that control of exposure parameters that closely correlate to desired human responses is required. Each of the four exposure parameters shown in Fig.2 is associated with a physiological receptor and has values published in ASHRAE Standards and Handbooks. These values are typically associated with 80% "acceptability" for human response. If each of these parameters is controlled at the boundaries or limits of values for 80% acceptability, the probability of achieving an overall acceptability for the environment is closer to 40% than to 80%. Compliance with these disaggregated values minimizes the probability of incurring false-positive errors, but maximizes the probability of incurring false-negative errors in assuring healthy building performance or detecting the causes of problem buildings. Thus, to minimize the risk of incurring false-positive and false-negative errors, it is necessary to specify a set of values for exposure parameters that, controlled simultaneously, will achieve the expected overall acceptability (e.g., 80%).

Once the set of exposure values is selected, the system performance criteria can be selected to provide for the desired exposure during all occupied periods. As a minimum, two system performance criteria are suggested:

- At design loads, which occur approximately 10% of the year, the system capacity should maintain the set of exposure values within the specified limits (i.e., $C/L = 1.0)_{peak}$.
- At part loads, which occur approximately 90% of the year, the system controls should maintain the set of exposure values within the same limits as at design conditions (i.e., $C/L = 1.0)_{part}$.

These system performance criteria may also be translated into system prescriptive criteria, such as building envelope characteristics, outdoor air ventilation rates, supply airflow rates, exhaust airflow rates, zone pressurization, and ventilation effectiveness. However, these translations must assure that compliance with the system performance criteria is not compromised.

For healthy building performance, two economic criteria are also recommended:

- The building energy efficiency[3] should be maintained at 80%.
- The building's life-cycle costs should be minimized wherein comparison of alternatives includes weighting for productivity improvements in the environment (e.g., cost of salaries).
-

Classification Criteria. At the Fourth International Conference on Healthy Buildings in 1995, a set of classification criteria was introduced that relates the evaluation criteria in the rational model to the goals of building diagnostics: evaluate and classify. These classification criteria now consist of eight classes in three categories that were defined to minimize false-positive and false-negative errors:

- *Healthy Category*
  - H2: Compliance with all evaluation criteria (enhanced performance and productivity).
  - H1: Compliance with all evaluation criteria (transparent performance).
- *Marginal Category*
  - M3: Non-compliance with economic criteria.
  - M2: Non-compliance with system performance criteria.
  - M1: Non-compliance with exposure criteria.)
- *Problematic Category*
  - P3: Non-compliance with discomfort criteria
  - P2: Non-compliance with symptom criteria.
  - P1: Non-compliance with illness criteria.

Managing Indoor Environmental Quality

Application of building diagnostic principles, including the use of evaluation and classification criteria, is useful in assuring the performance of a building in its design phases (i.e., vir1ual building) as well as its operational phases (i.e., actual building). One application is the use of a Building Performance Chronology Chart, which was introduced at the Fifth International Conference on Healthy Buildings in 1997. An example of its use in a retrospective analysis of the performance of an office area in the Mid-Atlantic region of the U.S. is shown in Fig. 3.

[3] Building energy efficiency has been defined as the ratio of energy required to provide the specified exposure criteria to the energy consumed for this purpose. Thus, energy efficiency focuses on minimizing energy waste rather than minimizing energy consumption.

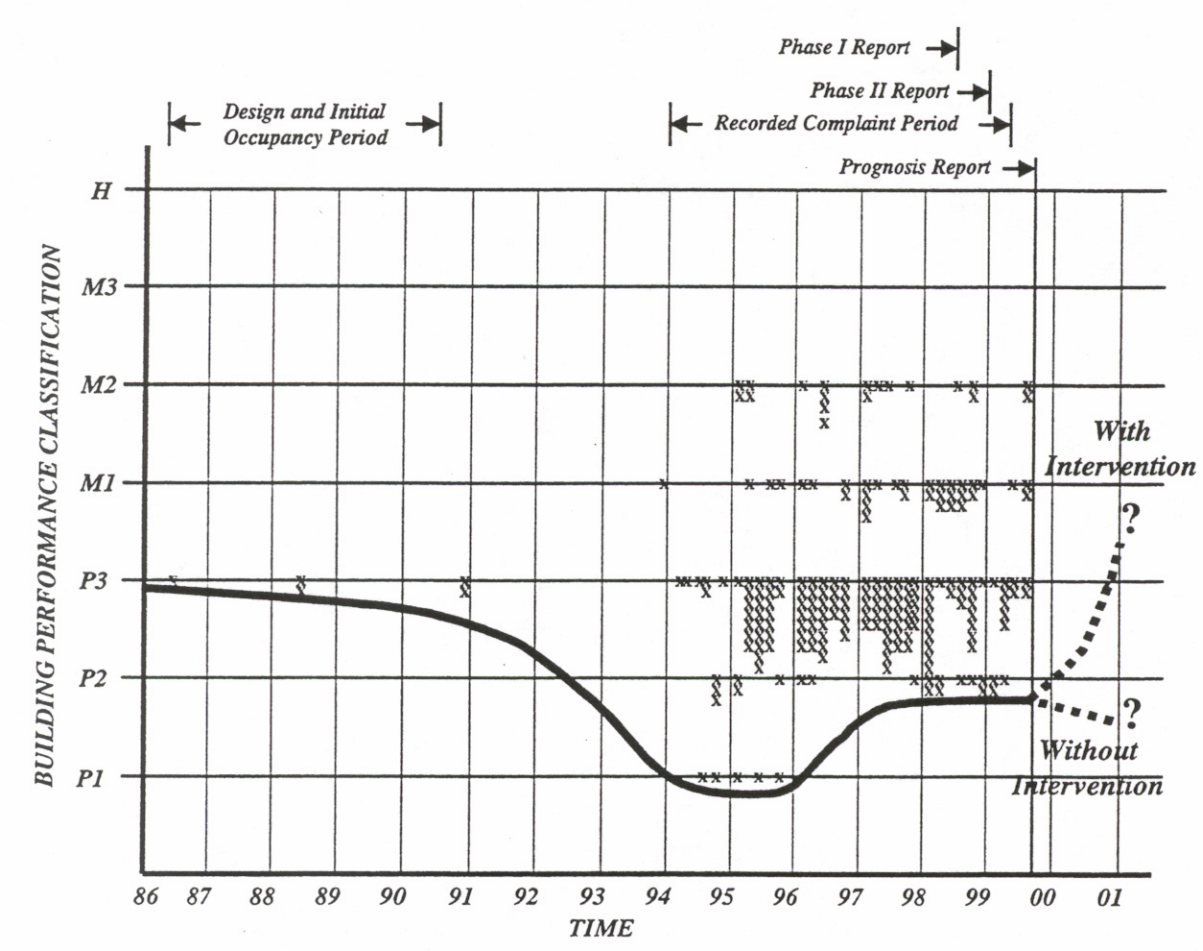

Figure 3. Chronology of Building Performance

The objectives of this analysis were to diagnose the prior performance of the building from available data, beginning with design and through the current operations in 1999 and, from that diagnosis, to provide a prognosis for two alternatives: 1) no additional intervention, and 2) interventions that would achieve an H1 performance within one or two years. Before the diagnosis was begun, an agreement was achieved with the client on a set of evaluation criteria. The diagnosis consisted of analyzing the available design documentation, maintenance records, and personnel records (i.e., calls to the nurse's station and attendance records), comparison of the available data with the evaluation criteria, and classification of the performance. In this diagnosis, no additional physical measurements were obtained. As shown in Fig. 3, results indicated that the design did not comply with the P3 criteria that the performance degraded to P1 classification within three years of initial occupancy, and recovered to a P2 classification where it is currently performing. Also shown in Fig. 3, are the predictions for the two alternative actions.

Conclusions

Two questions were asked in the title of this presentation: What constitutes a "safe" environment? And, how is the safety of the environment quantified? From this presentation, it may be concluded that:

1. As a minimum, a "safe indoor environment" should comply with "acceptable" exposure criteria and the number of discomfort complaints, symptoms and illness should be minimal. This level of performance would be classified as M2.
2. For higher levels of assurance of a "safe indoor environment," the building and its systems should provide desired indoor exposures, reliably and economically. These levels of performance would be classified as H1 or H2.
3. Response to occupant complaints should be rapid and thorough. In these responses, false-negative errors should be minimized.
4. Building diagnostic procedures can be used to quantify the performance of virtual and actual buildings, in both reactive and proactive modes.
5. Agreed upon sets of measurable and controllable evaluation criteria should be developed and maintained on a site-specific basis. Compliance with these criteria should be the focus of the building diagnostic procedures.
6. Periodic evaluations of the building performance should be conducted.


Principles for
Design and Operation of
Healthy Buildings
By
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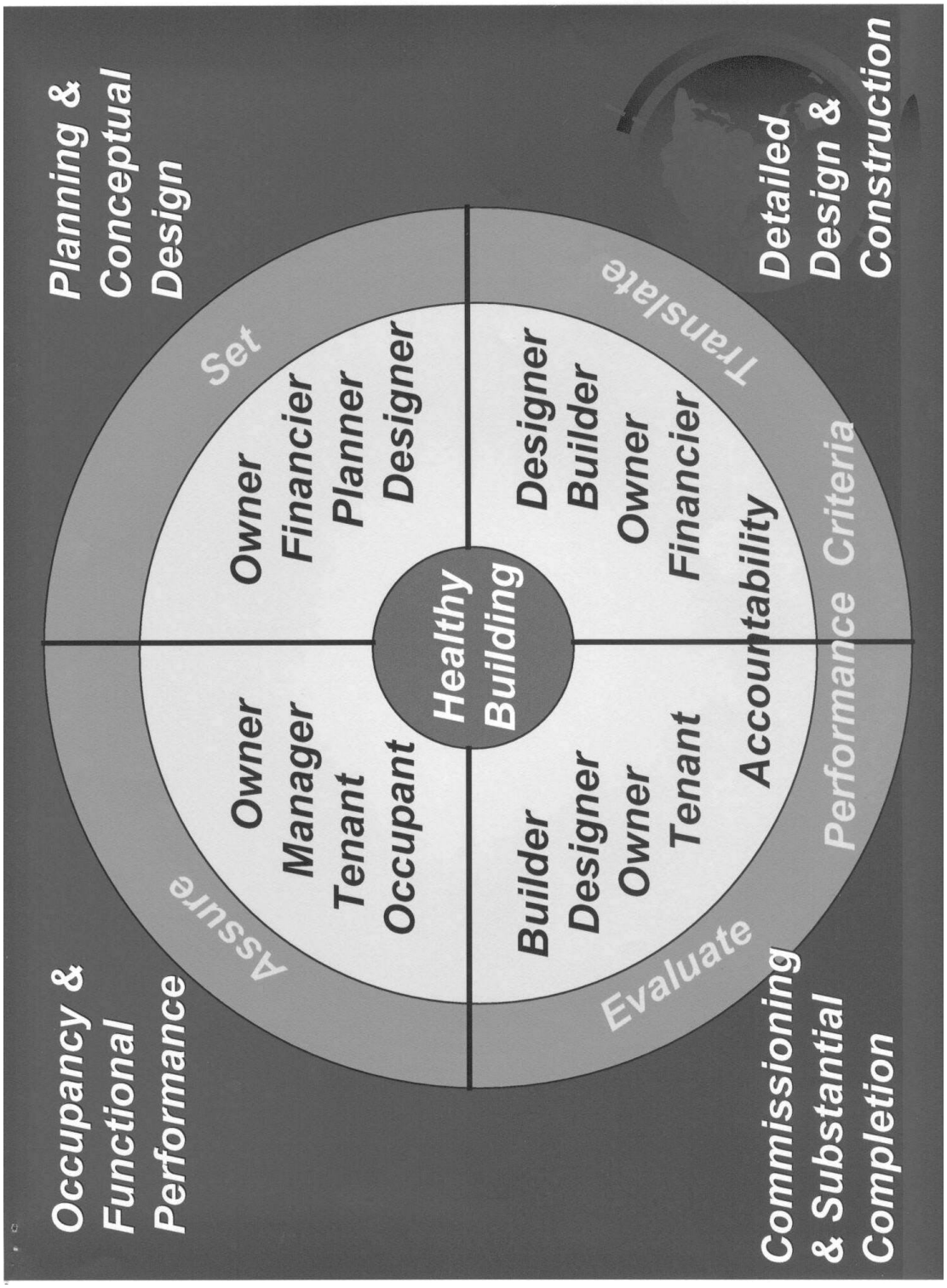
Herndon, Virginia
© HP-Woods Research Institute


Planning & Conceptual Design
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Commissioning & Substantial Completion
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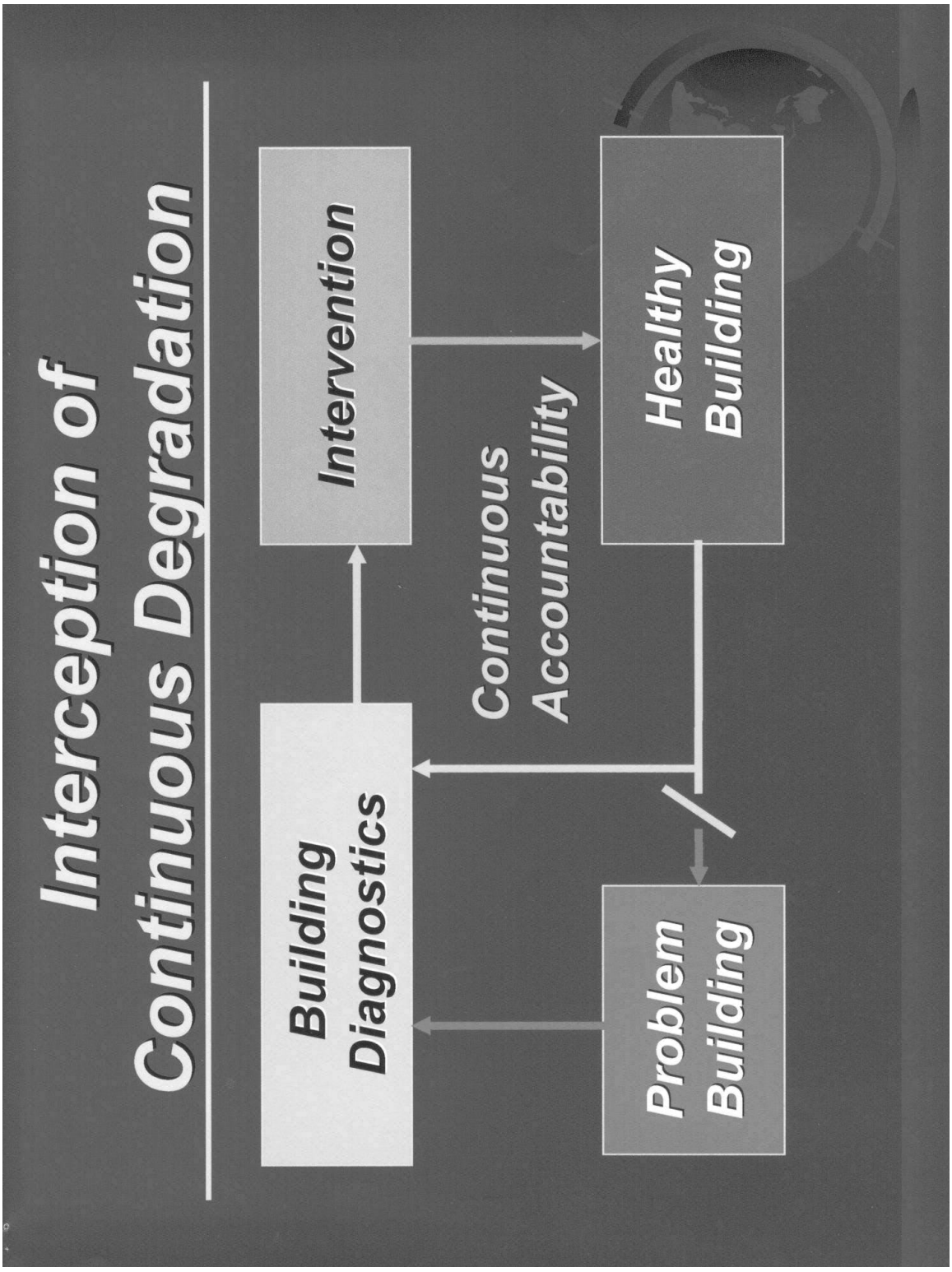
Interception of
Continuous Degradation
Building
Diagnostics
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Accountability
Healthy
Building
Problem
Building

Testimony to the Governor's Task Force on Indoor Air Quality January 8, 2002

Thank You for the opportunity to speak with you today. The task before you is important. You are presented with a challenge to set standards that will prevent serious health problems and improve the quality of life for many people who currently \work in unhealthy settings. This is a problem about which few people are aware and many people, even in the healthcare field, don't take seriously.

I work in a building that has made many people sick and exacerbated pre-existing conditions in others. I have colleagues who developed asthma and colleagues whose asthma worsened: others developed skin rashes, nosebleeds, headaches, fatigue, recurring bronchitis and sinus infections which were resistant to antibiotics. There are numerous other symptoms and individual cases but I will be focusing today on my own situation. I hope this information is useful.

I'd like to share some history regarding my experiences. I had been hearing people expressing concern for years about the air quality in my work place. I was one of those people who didn't take it very seriously. Complaints about cold and flu-like symptoms attributed to the building could have been the cold or the flu! It's true, I had been writing memos to my supervisor for 5 years to do something about the lack of air conditioning in the space where my staff worked. The thermometer often read 84 degrees but the response was consistently "Nothing we can do." So we lowered the blinds on sunny days and staff brought in their own fans and we continued to do our jobs.

One staff person in particular believed her health problems to be related to the air quality. Because concerns expressed to the agency for which she worked were not addressed, she arranged to gather her own samples from the insulation in a vent near her desk. This was June 1999. The results came back indicating an unusually high level of cladosporium. After taking these results to the agency, the building owners apparently arranged for additional testing. I say "apparently", because employees were refused any information regarding the results. My secretary, who developed asthma during this time, was undergoing numerous tests to determine what she might be allergic to. She also had frequent upper respiratory and ear infections. Her allergist was interested in developing a serum to de-sensitize her but needed to know the specific allergens. In October, 1999, I believe, she was told that the building owners had had some testing done of the fan coil unit insulation in different parts of the building. She requested the report from the building manager to share with her physician. He stated that he needed to get permission from the building owners' attorney. According to the building manager, the attorney stated that her employer had a copy and she would have to get it from her employer. Her employer refused to release it saying it was not theirs to release. When requested under the Freedom of Information Act, it was still not released and the attorney later denied its existence. Sometime in 2000, the report, dated 9/23/99 was "leaked" to employees. The report reflected the presence of several types of cladosporium. aureobasidium pullulans, penicillium corylophilum. chaetomium. and yeasts including rhodotorula. Nine of the ten samples taken suggested fungal growth.

As I stated, we did not have that information until late in the year 2000. Although we did not realize it at the time, there was an increase in discussion of symptoms among staff around the

time that the fungal sampling was done (Fall 1999). Perhaps because someone was diagnosed with Legionnaire's disease, more people were talking with each other about their health and the condition of the building. The symptoms people were relating, however, were not symptoms customarily associated with Legionnaire's disease. The frequency, intensity, and commonality of our symptoms, however, concerned people enough that we began to meet. We were aware of the employee who bad her own culture come back positive for cladosporium. As we looked into the effects of mold on health, it appeared quite possible that we had a mold problem in the building.

I asked an administrator in my agency to arrange for a health survey because 2 people I supervised were having problems, I began to experience symptoms, and many other people I had spoken with were also having symptoms. Some of the symptoms included dry, itchy eves, sore throats, rashes, sensation of fullness in the tongue, inability to smell, increased sensitivity to perfumes, and detergent smells. The administrator stated "There is no way that will be agreed to-it's like accepting responsibility for these health problems." Although MOSH came in, I believe, because of the legionella problem, there were no staff interviews and a health survey was not conducted. I think they stated that the building was "very dirty". We were unable to get MOSH to come in and look into the air quality or mold issue. Eventually we learned that NIOSH accepted some referrals for investigation and that process was initiated in November 1999.

NIOSH agreed to come in to complete an initial survey and visited June 14-15, 2000. Days prior to their arrival, contractors were feverishly removing water stained ceiling tiles while we worked, literally over workers' heads. Broken fans in the underground garage were fixed and leaking faucets and pipes in the bathrooms were repaired. The NIOSH report noted problems related to water incursion, poor housekeeping, and problems with air circulation. The fan units in the space where my unit was located were found to be disconnected. As I previously noted, I had been complaining about the lack of circulation and high temperatures in that space for a number of years. NIOSH, however, decided not to return to complete a full evaluation because building owners were planning to upgrade the ventilation systems.

This work was also done while we were in the building. Reports of illness increased and affected more people. Smells of mold and mildew emanated from some of the vents, ceiling tiles continued to get wet, as did carpets. Because of continued resistance on the part of our employers to advocate on our behalf, some of us decided to take a more public stand. When the media brought attention to the problem and we demonstrated publicly, our employers became more interested in our concerns. A committee was brought together to oversee the work done in the building. Standards were established to ensure that the workers were not subjected to unsafe conditions.

People remained sick, however, and this committee was not charged with addressing that issue. They were charged with overseeing the renovation efforts of the building owners. Throughout this time, my symptoms were relatively minor - daily sore throat that went away when I was out of the building and occasional bronchitis and sinus infection. The smell of mold and mildew blew out of the vent over my head when the fan came on. I reported this so many times to our Central Services office and the building management that the workman finally told me that the only way to correct the problem was to get behind the wall which he was prohibited from doing. I filed a complaint with MOSH and was told they did not have any authority to investigate air

quality since there were no standards in the State of Maryland. I continued to follow internal procedures to report the ongoing problem. When building management changed, the new workman suggested disconnecting the fan and sealing the vent. While this has been successful, I have had no heat or air conditioning in my office since January 2001. I also have not had a sore throat, bronchitis, or a sinus infection since that time. The two people in my unit who I previously mentioned left their jobs. One was able to get another job and her health has improved. The other, unfortunately, had to resign and recently was successful in his worker's Comp case and is receiving disability benefits from the State. Numerous other people were relocated, resigned, or retired due to health problems.

In summary, air quality standards are desperately needed. Many other buildings have the same construction and associated problems due to what was thought to be energy efficient design. Couple that with building owners or managers whose primary motivation is profit, and you have the situation I have described. Standards can help but monitoring will also be needed with strong sanctions that are enforced. Workers need to have information about air quality and health problems associated with poor air quality. Where it is thought to be a problem, employers should do a health survey in a non-judgmental and supportive way so that employees feel comfortable discussing their concerns. Individuals may go to their own physicians but the symptoms related to unhealthy buildings often look like many other illnesses. Seeing patterns of symptoms is useful. One of the major impediments in our situation, I believe, was fear of litigation on the part of our employer and building owners. As a result there was refusal to accept responsibility or even acknowledge the existence of a problem. Consequently, the poor working conditions continued and worsened over time as they tried to fix the problems during work hours and without the knowledge of staff. As people got sicker, the situation became increasingly antagonistic. If there had been a focus on addressing the problem responsibly we might not be here today.

Respectfully submitted,

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January 8, 2002

TESTIMONY PRESENTED TO
MARYLAND INDOOR AIR QUALITY TASK FORCE

Thank you for giving the public an opportunity to testify today. I understand this task force was chartered by the Maryland legislature to focus on indoor air quality problems related to mold contamination of office buildings, but as an environmental health engineer who specializes in other more common albeit less publicized causes of poor indoor air quality, I urge you to broaden your focus to consider the impact of other toxins that are deliberately introduced into Maryland workplaces of all kinds and not just office buildings. In particular, I urge you to look into the effect on human health of the widespread use of volatile toxic paints and cleaning products, volatile toxic pesticides, and volatile toxic air "fresheners" (actually air "odorizers") - especially in hospitals and nursing homes (the primary workplace of doctors and nurses), and schools (the primary workplace of teachers) where so many non-employees are also exposed and at even greater risk due to their age and/or impaired health. Many less toxic alternatives are now available and their use has been promoted for years in federal office buildings by GSA through its environmentally preferable purchasing program. Massachusetts has a similar program for its state office buildings.

The quality of indoor air in any building depends not just on the type and amount of toxins being released into it (from both animate and inanimate sources) but also on the degree of filtration (if any) provided by the HVAC system, and the percent of fresh makeup air being brought in from outside in different seasons. Building owners and managers are currently free to control these variables as they like, and usually choose to do so in ways that reduce their costs, which unfortunately also usually reduces indoor air quality, In assessing indoor air quality, I urge you to focus on the two most common indoor air quality contaminants that are often overlooked as both are undetectable by human senses-namely carbon monoxide (primarily from attached garages) and carbon dioxide (primarily from human breath). Both can now be tracked easily in real time with relatively small and inexpensive electronic detectors that also can be used to control ventilation systems, but few HVAC contractors in Maryland have these instruments or know how to use them, In my opinion, this should be made a requirement of their licensing. I hope you also will follow the lead of California, which now requires public schools to monitor and maintain CO2 levels in all classrooms under 800ppm. Maryland should go further and set a CO2 limit for all public buildings. This would do more than anything else to improve ventilation and thus also indoor air quality.

Thank you for your attention.

Appendix 5. Department of General Services New Lease Requirements Relating to Indoor Air Quality Management

DEPARTMENT OF GENERAL SERVICES
GENERAL PERFORMANCE STANDARDS AND SPECIFICATIONS
FOR THE STATE OF MARYLAND
LEASED FACILITIES
10,000 NET USABLE SQUARE FEET AND UP

SECTION B. BUILDING REQUIREMENTS

1. GENERAL

All space submitted for possible lease to the State of Maryland shall meet the specifications presented below. Generally, all specifications are mandatory in all space leased, and the costs of meeting those specifications shall be borne by the Lessor. The State will share in some of the costs for a limited amount of the "fit-up" requirements listed in Section E.

2. BUILDING DESIGN AND SYSTEMS INTEGRATION

It is the obligation of the Lessor to provide professional design services to integrate all aspects of the project with the overall approach to integrated building systems and high performance sustainable design. These services must provide at a minimum the following:

Site: Sustainable site development which utilizes resources naturally occurring on the side such as solar and wind energy, natural shading, native plant materials, topography, drainage and optimizing use of existing infrastructure and transportation.

Enclosure: An enclosure which provides natural ventilation or capable of 100% make up air and day lighting with high performance glazing and glare control device for at least 25% of the surface area and provides the interior surface temperatures as specified.

Infrastructure: The mechanical equipment shall be high efficiency and minimize the production of greenhouse gases and the depletion of ozone. For office occupancies, wherever possible - raised flooring is preferred for data, telephone, power, and electrical.

Interiors: The lighting systems shall be split task -ambient with light sensitive, dimming electronic ballasts and high efficiency T-5 or T-8 lamps.

Materials: The building shall emphasize the use of materials and furnishing that are non-toxic, no or low-VOC, sustainable, contain high post consumer recycled content and are recyclable. The following performance standards must be achieved in the design and construction or rehabilitation of this project.

Energy Budget: The leased space shall consume 40,000 btu/square foot/year or less of primary energy not including plug loads.

Lighting Budget: The leased space shall consume 0.9 watts/square foot or less of electrical energy for ambient lighting.

HVAC Chiller: HVAC chiller must be properly sized to meet temperature requirements.

Windows: The indoor window surface temperature shall not be less than 62°F. when the outdoor temperature is 20°F .

Interior Surfaces: The indoor surface temperature of opaque wall surfaces shall not be less than 70°F. when the outdoor temperature is 20°F .

Ventilation: The ventilation system must provide air to the desk with less than 700 ppm CO2 during hours of occupancy.

Indoor Temperatures*:* The indoor temperature at the workspace shall be at 73°F. +/-1°F. with building setback capability during non-operational hours. Setback setting to be approved by the Department of General Services.

Cooling Humidity: The indoor relative humidity shall not exceed 45% during the cooling season at established design conditions.

Heating Humidity: The indoor relative humidity shall be no less than 35% during the heating season at established design conditions.

3. BUILDING VALIDATION

A validation plan shall be adopted by the Lessor during the design phase and carried through post-occupancy evaluation to measure and verify building performance. Building validation will ensure, through documented verification that all building systems within the facility perform interactively according to the documented design intent and operational needs. The systematic process shall begin in the design phase and last at least one year after occupancy, including the training of operating staff. In addition to testing, adjusting and balancing mechanical systems, functional testing shall be performed to determine how well mechanical and electrical systems work together and help identify system deficiencies. Functional testing of equipment and systems will be performed by the contractors to help determine whether the equipment meets operational goals or requires adjustment to increase efficiency and effectiveness. The primary goal of the validation is to identify system deficiencies as early in the project as possible and track their status until they are corrected. The validation is to assist the construction team by providing input regarding building systems prior to occupancy.

4. PROFESSIONAL SPACE PLANNING AND INTERIOR DESIGN SERVICES

The selected Lessor will be required to provide detailed architectural and engineering plans to meet all requirements. It is intended that the Lessor will provide a completed structure with fully-developed interior fittings and features. Lessor shall furnish to the Department of General Services for approval complete as-built drawings of the completed structure and interior design.

The Lessor shall retain professional space planning/interior design services and provide them to the Lessee as a part of this project. These services shall be performed by a licensed architectural design firm fully experienced in all aspects of sustainable design and green architecture practices, particularly in regard to the design, colors and materials, case goods, seating and other interior materials and products. The architectural firm must have, or exhibit the willingness to learn, the fundamentals of sustain ability as it relates to construction, packaging, waste management, human ergonomics, productivity and good interior air quality.

These services are to insure that the final character and configuration of the leased space, furnishings, and equipment fully satisfy the functional and aesthetic requirements of the Lessee while meeting all applicable
codes and regulations.

5. CODES AND STANDARDS

The following codes and standards shall apply to the design and construction of all areas. In the event of conflicting code requirements, the most stringent code must be applied. No grand fathering of any laws, codes or standards will be allowed.

In counties where statutory building codes are in effect, space leased to the State of Maryland must comply with such codes and the Maryland Building Performance Standards upon delivery and shall be maintained in compliance with such codes, throughout the lease term. Prior to notifying the State of completion of the Demised Premises, the Lessor will obtain all use permits, completion certificates or other documents and clearances if required by local ordinance. Copies of such documents must be provided to the Department of General Services.

a. The Attorney General has ruled that the State of Maryland is not subject to certain zoning or use permits in State owned or leased space. However, this exemption will not be invoked.
b. The Lessor must comply with all applicable federal, state and local code, laws and regulations in affect at the time of procurement. The listing of codes below does not constitute a waiver of any other applicable federal, state or local code, laws or regulations.
c. In counties where no building codes are in effect, leased space must comply with the following codes:
    1) The Maryland Building Performance Standards.

    2) BOCA National Code Series - Latest edition, including Basic Building Code; Fire Prevention Code; Mechanical Code; Plumbing Code and relevant codes and standards referenced therein.

3) The NFPA No. 101 Life Safety Code, of latest edition, as interpreted by the State Fire Marshal.
4) State of Maryland Fire Prevention Code, latest edition.

5) Sediment Control Regulations of the State Water Resources Administration (where applicable).

6) The National Electric Code of latest edition (NFPA70).

7) Maryland State Department of Health and Mental Hygiene Regulations for Eating and Drinking Establishments. This applies whenever food preparation or serving areas are included in the leased area. Interpreted by the Environmental Health Services Section of the State Department of Health and Mental Hygiene.

8) Regulations Governing Elevators, Dumbwaiters, Escalators and Moving Walks ANSI-A 17.1 of latest edition, and requirements of the State Department of Licensing and Regulation, Division of Labor and Industry.

9) Regulations governing the recycling of solid waste, Annotated Code of Maryland, Environment Article, Section 9-1706.

10) The Americans with Disabilities Act of 1990 (42 United States Code, Section 12101 et. seq.)

11) Local Zoning Ordinances -Latest edition with all amendments.

12) The latest revision of ASHRAE/IES Standards 90.1 "Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings." OSHA -Latest edition.

13) ASHRAE 62-1989 or latest edition -Design guide for indoor air quality. Act 101 of 1988 or latest edition -Recycling.

14) NFPA 90.A -Installation of Air Conditioning and Ventilating Systems.

15) ASNI/IESNA #RP-1-1995, latest edition, American National Standard for Office Lighting by the Illuminating Engineering Society of North America proposed use. The Lessor and the design team should carefully consider lighting standards in concert with available day light, task/ambient considerations, the use of computer and control strategies to reduce reliance on artificial lighting.

16) Radon Gas Exposure -Lessor must evaluate the site for radiation level and Radon/Radon Progeny concentration and deal appropriately with

results. Results must be provided to the Department of General Services prior to occupancy. If at any time during occupancy the Radon/Radon Progeny levels exceed the EPA recommendations, the Lessor shall take immediate necessary corrective action.

17) Asbestos -No asbestos insulation or asbestos-based materials may be used in construction. The Lessor hereby agrees to abide by all applicable federal, state, and local regulations regarding the removal or abatement of asbestos. In addition, the Lessor further agrees to protect, indemnify and save harmless Lessee from and against any and all liabilities, losses, damages, costs, expenses, cause of action, suits, claims, demands or judgments of any nature arising from any injuries to, or the death of any person growing out of or connected with the presence of asbestos in the premises.

18) Zoning -The facility must be located in an appropriately zoned site and must allow operations as required by the conditions of the lease.

19) Flood Plain -Both site and access must be outside the 100-year flood zone as defined by the Federal Emergency Management Agency, United States Army Corps of Engineers.

20) Wastewater and Grey Water -Any proposed facility must be connected to public sewer and water systems. These systems must have legal and adequate treatment systems and capabilities for the proposed use. The resulting connections and/or utilization of public systems must be in compliance with local, state or federal laws, rules and regulations. The Department of General Services encourages the use of bio remedial waste water treatment facilities and landscape options including grey water use. Use of advanced waste and grey water systems will be considered on a case by case basis.

21) Drinking Water -Lessor shall provide and maintain hot and cold bottled drinking water dispenser on every floor if testing and treatment of on-site water does not meet drinking water standards.

22) Sound and Noise Control- The Lessor shall maintain construction practices and materials to conform with STC ratings in accordance with ASTM E-90-83, latest edition.

23) HVAC/Mechanical Equipment Minimum Requirements - The Lessor shall furnish all labor, materials, supervision, equipment and services necessary for and reasonably incidental to operation, maintenance, replacement and service of the mechanical systems to provide a safe working environment.

24) Indoor Air Quality - The Lessor shall furnish annual indoor air quality testing in accordance with standards established by the Department of General Services.

25) Maryland Occupational Safety And Health Law - All space leased by the State of Maryland must comply with MOSH standards upon delivery.

d. Enforcement. The Department of General Services reserves the right to take whatever action is necessary to enforce compliance with applicable codes throughout the term of the lease. Acceptance of the space by the Department of General Services does not relieve the Lessor of the responsibility for any defects in the space subsequently found to exist.

1) Prior to acceptance by the State the Lessor will certify that, to the best of its knowledge, the space meets the requirements of all applicable building codes and acts.

2) During inspections for acceptance any violations found by the Department of General Services will be immediately reported to the Lessor. The Lessor will correct any reported discrepancies prior to acceptance of the space.

3) During the lease term, any violations found by the Lease Management and Procurement Division or Unit personnel will be immediately reported to the Lease Management and Procurement Division and the Lessor. The Lessor will correct any reported discrepancies within 15 days. If the discrepancy cannot be corrected within 15 days, the reason for the delay and expected completion date will be reported to the Lease Management and Procurement Division.

4) Failure to correct will be considered a default of the lease and the Lease Management and Procurement Division will take whatever action it deems necessary or appropriate in each case. Actions taken by the State as a result of Code violations will be in addition to, and not in lieu of, any civil or criminal penalties to which the Lessor may be subject.

6. STRUCTURAL DESIGN

The Lessor shall design the required space such that the following minimum live loads are permissible in all areas of the structure:

Office areas	-	70 PSF
File/storage areas	-	150 PSF
High density filing system(s)	-	200 PSF

7. UTILITIES PAID BY STATE OF MARYLAND

When a utility, public or private, is to be paid for by a Unit, the Lessor shall at its expense, furnish and install a separate meter for measuring each utility consumed in servicing the space leased or for any special purposes, as required in the solicitation. Utility meters so provided shall meter only State of Maryland usage and no other usage by other occupants of the building will be recorded on the same meter for the purpose of prorata payment by the Lessee of utilities consumed.

8. ALTERATIONS, REPAIRS, OR IMPROVEMENTS REQUESTED AFTER INITIAL OCCUPANCY

a. Any repairs required to the Demised Premises during the lease term will be immediately reported to the Lessor. The Lessor shall be required to promptly complete the repair. The Lessor shall bear the cost of all repairs to the Demised Premises, including, as may be necessary, the costs of moving Lessee's machinery, equipment, furniture and fixtures, except when it can be established that the damage resulted from the carelessness of the Lessee or its employees. The liability for the cost of repairs to damage caused by clients of the State shall be determined on a case by case basis. Normally, damage done by clients in areas of the premises not under the control of Lessee will be borne by the Lessor, whereas damage done in the leased areas will be borne by the Lessee.

b. During the Lease term, all requests for improvements or alterations to existing space must be negotiated and approved by the Lease Management and Procurement Division with the Lessor.

    1) Where such requests include an increase in the area leased, the provisions of Section E apply. The amounts to be provided by the Lessor will be determined by the amount of increase in leased space, but all or a portion of the alterations may be applied to the existing area. For example, an increase of 1,500 square feet in the leased area requires that the Lessor provide 150 lineal feet of partitioning. All, or a portion of, that partitioning may be applied to the existing space.

    2) The cost of alterations or improvements to existing leased space which do not include an increase in the area leased will be borne by the Unit.

c. All materials used in State leased space must be of Commercial grade and finish acceptable to the Department of General Services.
d. The Department of General Services:

    1) Reserves the absolute right to reject any existing finishes and/or materials in the Demised Premises.

    2) Requires all wall surfaces to be finished with no exposed masonry.

    3) Requires that all buildings consisting of more than one floor level having wood structure (floors columns, walls etc.) must be equipped throughout the building with an automatic fire sprinkler system.

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SECTION C. MECHANICAL SYSTEM CRITERIA

1. HEATING. VENTILATION & AIR CONDITIONING (HVAC)

The supply system shall minimize energy consumption via capacity reductions achieved through integrated building system design and utilize no CFC ozone-depleting refrigerants. Desiccant technology shall be installed at the air handlers for de-humidification to displace latent cooling load. Heat recovery and economizer capabilities must be included in the system.

HVAC systems design shall be subject to the Department of General Services approval and shall include a dual set point system for heating and cooling with direct digital controls, and shall be maintained and operated in a manner which maximizes energy efficiency. All equipment and systems shall be in operating order 24 hours per day and shall be serviced and maintained by Lessor. Systems shall be inspected and serviced quarterly to insure proper balancing and calibration.

Temperatures

Heating and air conditioning systems shall provide and maintain an inside automatically controlled temperature under all conditions for the following areas as noted:

Office and Public Areas	73° +/-1°
Storage Areas	65° heated and ventilated only
Physical Plant Areas	68° heated and ventilated only
Enclosed Loading Dock and/or Garage Areas	65° heated only
Stairs no less than 65° heated/no more than	80° cooled

Humidity

Humidity shall not exceed 45% during the cooling season and shall be no less than 35% during the heating season in all areas that are mechanically cooled and heated. Reduction or elevation of humidity levels will not be allowed to compensate for inadequate building envelope design.

Ventilation

The ventilation system must provide indoor air quality of not more than 700 ppm CO_2 while meeting the recommendations of the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) Standard 62., current revision. All air intakes shall be located to preclude the introduction of exhaust air from all exhaust air sources. Use of an economizer package allowing up to 100% outside air is acceptable provided all other conditions of temperature and humidity are met.

Increased ventilation and dedicated outside make up air shall be supplied to areas with high indoor air pollution potential which shall be provided with separate air exhausts to the exterior of the building. Exhaust fans shall not exceed a 35 NC factor. These areas include rest rooms, lunch room, laboratories, copier rooms, service bays, garage areas and other special function spaces as defined by the Lessee.

Filtration

All heating, ventilation and air conditioning systems shall be a polyester pre-filter of a minimum 2-inch thickness and 30% efficiency installed in the system. The pre-filter shall be installed in the system in a location that all air handled by the system will pass through the pre-filter prior to distribution into the work areas and public areas. All filters shall be replaced by the Lessor on a quarterly schedule or more often as dictated by the operating conditions. During replacement operations, the HVAC system shall be completely shut off to avoid the distribution of unwanted particulate through the system.

Pressure Differentials

Sample preparation and garage areas shall maintain a negative pressure differential relative to adjacent areas to control the migration of fumes or odors. The pressure maintained in the building shall be positive relative to the outside to prevent the infiltration of air. Dedicated outside make up air shall be supplied to these spaces in order to insure full rated ventilation flow of all exhaust fans and fume hoods.

HVAC Controls

The building shall have a building automation/energy conservation system. HVAC controls shall recognize logical zoning and use patterns to maximize energy efficiency through thermal zoning and the ability to efficiently space condition when the facility is partially occupied. The system must be able to support the building use dates and times as dictated by the agency and shall have a manual, auto-resetting override for use by employees if needed for overtime work, Saturday, Sunday or holiday work. In general but subject to change at the sole discretion of the agency, the building will need to be at designated operating conditions Monday thru Friday from 7:00 AM to 7:00 PM and Saturday from 7:00 AM to 2:00 PM. A setback approved by the Department of General Services will be allowed during non-occupied periods.

2. ELEVATORS

One elevator must have inside dimensions of not less than 5'8" by 5'5" with not less than 36" door opening, if elevators are required by code unless otherwise approved by Lessee. If elevator exists, they are to be modernized to provide automatic operation and to bring equipment into compliance with the Americans with Disabilities Act. The Elevator Contractor must be an elevator manufacturer or manufacturer's approved installer.

Licenses and permits shall be provided and the required inspections and tests shall be performed. Elevators shall comply with applicable building and elevator codes, included but not limited to

the following:

- ANSI A17.3 ANSI A17.1
- National Electrical Code
- MD Department of Labor and Industry Elevator Regulations
- Americans with Disabilities Act
- Uniform Federal Accessibility Standards
- Lessor to maintain a full service elevator maintenance contract approved by the Department General Services.

Existing elevators are to be modernized with the following standards as approved by the Lessee:

- A minimum standard speed of 100 FPM.
- All In-Ground Hydraulic cylinders shall be incased in sealed PVC liners. If the owner can not prove the cylinder is encased, it shall be removed and replaced with a sealed unit or an above ground system.
- All elevators over two stories shall be equipped with over speed governor and safety mechanisms capable of stopping a fully loaded car at over speed condition.
- If elevator does not meet handicap guidelines, it shall be modernized with the following criteria in mind:

Controller shall be relay-logic or non-proprietary microprocessor based controller. Complete electrical diagrams shall be provided to Lessor including all straight line prints, electronic circuitry and microprocessor logic diagrams. If a programming tool and software is needed to troubleshoot or adjust elevator, it shall be provided with the control system at no extra charge. Microprocessor shall be an "off the shelf' industrial type controller, readily available on the open market.

Components such as door operator, selector, buttons etc. shall be able to be replaced and upgraded independent of the elevator controller.

Lessor must demonstrate that all components are the most energy efficient available. When full elevator replacement or new construction is needed, buildings over four floors in height should view traction elevators as the most desired type of equipment.

The modernization shall include complete operational and control systems, new door operators, car operating stations, hall button fixtures, new cab and hoist way doors, complete cab modernization and various adjustments, safety tests and related repairs.

3. PLUMBING/UTILITIES

All plumbing and utilities shall meet the current plumbing and building codes of the municipality within which the facility is located. In no instance will grand fathering of nonconforming plumbing or utilities be allowed. All plumbing and utilities shall meet codes as designated for new construction.

All domestic hot water systems shall be equipped with an external or internal heat trap on all inlets and outlets. All water heaters shall initially be set at 110°F.

In addition to the hot, cold and waste water systems required by code, the Lessor shall provide floor drains in specific areas as approved by the Department of General Services.

Drinking Fountains

Centrally cooled, filtered, water system, drinking fountains, or the automatic electric type fountains shall be located at appropriate locations so that a person will not need to travel more than 150 feet on one floor to reach same. The water shall be chilled to between 48 and 52 degrees Fahrenheit. There shall be a minimum of one fountain on each floor containing office space.

Restroom Fixtures

Restrooms shall be provided within the leased space for employees and sized in accordance with the Restroom Fixture Schedule within.

Toilet Fixtures

For the purpose of determining the required toilet facilities, the actual number of persons shall be based on one person for each 150 square feet of net usable office space to be serviced by the toilet facility. The calculation is based on total space to be serviced, not just the portion leased by the State. For estimating purposes, the occupancy population should be estimated at 50% men and 50% women.

	MEN			WOMEN	
Number of Persons	Water Closets	Urinals	Lavatories	Water Closets	Lavatories
1 to 8	1	1	1	2	1
9 to 24	2	1	2	3	2
25 to 36	2	1	2	3	2
37 to 56	3	2	3	5	3
57 to 75	4	2	4	6	4
76 to 96	4	2	5	6	5
97 to 119	5	2	5	7	5
120 to 144	6	3	6	9	6
145 to 171	6	3	6	9	6
172 to 200	7	3	7	10	7
201 to 220	8	4	7	12	7
221 to 240	8	4	8	12	8
241 to 260	9	4	8	13	8
261 to 280	10	4	9	14	9
281 to 300	11	4	9	15	9

EXAMPLE:

Space leased by State - 5,000 square feet.
Total net usable square feet available for floor - 15,000
Estimated Total Occupancy: 15,000 - 150 square feet/person = 100
Number of Men - 100 x 50% = 50
Number of Women - 100 x 50% = 50

Fixtures required:	Water Closets	Urinals	Lavatories
Men's Rooms	3	2	3
Women's Rooms	5		

Toilets. Separate toilet facilities for men and women shall be provided on each floor in the building. The facilities shall be located on each floor so that a person need not travel more than 150 feet on one floor to reach same. Each toilet room shall have sufficient water closets enclosed with modern stall partitions and doors, urinals (in men's room), and lavatories in compliance with the fixture schedule set forth below. In addition, each main toilet room shall contain the following:

a) A liquid soap dispenser, shelf, and mirror above lavatory. In addition, the women's toilet rooms will require a single full length mirror approximately 2' wide and 4' high, installed near the exit.
b) A modern two or three roll toilet paper dispenser in each water closet stall is preferred. Single roll dispensers are acceptable.
c) A coat hook on inside face of door to each water closet stall and on several wall locations by lavatories.
d) A minimum of one modern paper towel dispenser and waste receptacle for every two lavatories.
e) A coin-operated sanitary napkin dispenser in women's toilet room with waste receptacle for each water closet stall.
f) Ceramic tile floor and ceramic tile-wainscot from the floor to a minimum height of 4'6". The remaining wall areas must be finished with sheet rock and paint.

DEPARTMENT OF GENERAL SERVICES
GENERAL PERFORMANCE STANDARDS AND SPECIFICATIONS
FOR THE STATE OF MARYLAND
LEASED FACILITIES
10,000 NET USABLE SQUARE FEET AND UP

SECTION E. INTERIOR CONSTRUCTION AND FINISHES

All building materials, systems, components, products and assembly techniques and methods shall adhere to the Lessee's goal of sustainable design and high performance green architecture. The Lessor and design team shall institute a program of construction waste management and recycling that will minimize construction and furnishings waste material going to landfills. All construction material, finishes, furnishings and accessories shall be environmentally responsible and appropriate for use in spaces that are designed for maximum occupant performance. These items shall emphasize low embodied energy, sustainable production, high post consumer material content, be free of deleterious chemicals and compounds, and shall be manufactured and available locally whenever possible.

1. ACCESS FLOORING SYSTEM WHEN APPLICABLE (Site Permitting)

An access flooring system shall be provided to utilize an underfloor air plenum system. Installation of the access flooring system shall use the latest techniques and procedures to design and install the access flooring system as recommended by the manufacturer. The flooring system shall be provided in the entire facility with the exception of the center core and the garage area.

2. FLOOR DIFFUSERS (When Applicable)

The appropriate number of relocatable underfloor-mounted diffusers shall be provided in the raised flooring system to allow for more direct supply of fresh air to the work locations subject to Department of General Services approval.

3. FLOOR COVERING

The Lessor shall provide fifty percent (50%) of the demised premises in carpeting and fifty percent (50%) in alternate floor covering. Any modification to the above at the request of the agency and the Department of General Services will be treated as a debit/credit calculation when determining excess tenant fit-up.

Carpeting

The Lessor shall install new carpeting in all rooms except in rest rooms, central duplicating rooms, stairs, designated storage rooms, lunchroom, and other areas excepted by Lessee. All carpeting materials shall be new and installation shall be wall-to-wall and completed prior to installation of all interior de-mountable walls. Carpet material shall be 100% commercial grade nylon fiber 6 or 6.6 which is solution dyed with EPA.

An approved antimicrobial protection and be 100% recyclable to an equal or higher use. Carpet tiles shall be provided and be cut by the die cut method only. Carpet material shall have a face weight of 28 ozs. with a 1/13 tufted multi-level loop, 9.0-9.5 stitches per inch or better, static resistant of 1.0 KVS and a minimum dennier of 6000 with unitary backing. The Carpet must have a minimum 15 year wear '3D(warranty such as manufactured by Collins and Aikman or Department of General Services approved equal which has Green Seal's recommendation or certification. Color of carpeting shall be subject to approval of Lessee.

All doors in carpeted areas shall be undercut sufficiently to permit free swinging. The grade and color of carpeting shall be subject to approval of Lessee. Carpeting must conform to Federal Occupation Safety and Health Regulations concerning fire proofing.

Carpet shall be replaced during the term and option period(s) as needed and as requested by the Department of General Services where normal wear and tear so requires.

Linoleum Flooring-Sheet Goods

Flooring areas designated by Lessee shall consist of Marmoleum floor covering. Flooring shall be installed using 1/10" gauge and have jute backing. Flooring shall be installed in a workmanlike manner in strict accordance with manufacturer's approved installation instructions using the appropriate recommended 100% solvent-free adhesive. Heat welded is to be used as recommended by manufacturer. Flooring shall be replaced during the term and option period(s) as needed and as required by the Department of General Services where normal wear and tear so requires.

Tile Flooring

Tile flooring provided in the lobby, reception and other designated area(s) shall be manufactured with no toxic substances or waste and consisting of 70% recycled post industrial and post consumer glass in a ceramic matrix as approved by the Department of General Services. Tile flooring shall be installed in a workmanlike manner in strict accordance with manufacturer's approved installation instructions, using the appropriate environmentally friendly adhesive. The color and pattern of the tile shall be subject to approval by Lessee.

4. FLOOR MATS

Floor mats of appropriate size and material shall be provided for all exterior entrances into the facility. Floor mats shall be replaced during the term and option period(s) as needed and as required by the Department of General Services where normal wear and tear so requires. The style and color of mat(s) shall be subject to approval by Lessee.

5. INSULATION

In all its procurement documents for renovations to the premises, the Lessor shall require that any insulation provided for the renovations must contain the minimum percentage of post consumer paper or recovered material as shown below for the applicable product:

Material Type Percentage By Weight

Cellulose Loose-fill and spray on paper	75% post consumer
Perlite composite board paper	23% post consumer
Plastic rigid foam, polyisocyanurate/ polyurethane:	
Rigid Foam	9% post consumer or recovered material
Foam-in-place	5% post consumer or recovered material
Glass ridge foam	6% post consumer or recovered material
Phenolic ridge foam	5% post consumer or recovered material
Rock wool	75% post consumer or recovered material

The Lessor shall provide documentary evidence that the insulation provided for the renovations was produced with the required minimum percentage of post consumer paper or recovered material as appropriate.

6. TENANT DEMISING/SEPARATING PARTITIONING

The Lessor will provide all partitioning separating the State leased space from common areas of other tenants. Such partitioning shall meet minimum code requirements and have a minimum sound transmission class of 50 (Where space is leased for several Units, the partitioning separating the various Units will be considered "interior partitioning")

a. Interior Partitions and Walls. The partitioning requirements as established in these specifications may be met with existing partitions and walls, provided that, in the opinion of the Department of General Services, the location and type of partitions lend themselves to efficient office layout. Low density, combustible fire board materials shall not be used as interior finish. In the event existing partitions are unacceptable to the Department of General Services, new partitions must be furnished in accordance with the requirements and standards.

    1. Amount: Interior ceiling high and bank type sub-dividing partitions including nonpermanent corridor partitions necessary for internal flow of traffic, shall be furnished by the Lessor at the rate of one linear foot of partitioning for each 10 net usable square feet of office space, except as provided in the above paragraph.

b. Minimum type and quality.

    1. Ceiling High Partitions. Minimum Partition Type: Demountable with all metal components or a combination of metal and gypsum wall board components with a minimum sound transmission class of 35. Upon request of the Department of General Services, Offerors must specify type of partitioning to be provided and certification as to the minimum sound transmission rating.

    2. Wallboard and Metal Stud: These partitions are to be installed on the finished floor and must be of metal stud and wallboard

refinished construction minimum 5/8" sheet rock taped and finished in a workmanlike manner.

3. Metal Movable Partitions: These partitions are manufactured in ceiling height and approximately 7' 3" high (3/4 height). They shall be flush type not less than 2 1/4" nor more than 3" thick and shall consist of movable hollow metal insulated panels and may contain opaque or clear glass upper panels with double insulated and fillers (omit glass if not specified). Base shall be removable and provide for lay-in concealed wiring on both sides. Partitions shall be factory fabricated, designed for erection over finished floors, and shall be in standard units. Where panel and glazed or door units are of different width, the increments shall be maintained. Design shall permit extension two, three, or four ways, without removing adjacent units. Provision shall be made for electrical wiring throughout the assembly.

4. Demountable Panel Partitions: Construction is similar to the metal movable partition except that the panel surfacing material shall be either gypsum or other materials acceptable to the Department of General Services.

5. Bank-Type Partitions: Partitions shall be flush type with lower panel 1 5/8" thick with a plus tolerance of 1/8" and a minus tolerance of 3/16", approximately 5'7" high and shall consist of movable and interchangeable hollow metal insulated panels and post construction with upper corrugated plastic or plate glass panels. Posts shall be 1 3/4" square. The panels shall be uniform widths. The bottom of each panel shall be approximately 6" clear of the floor and have recessed space for electric wiring for exterior attachment, including spring clip holder for the wire.

c. Sound conditioning material shall be provided for 10% of the partitioning required in addition to all toilet rooms and mechanical room walls. The sound conditioning shall be a minimum sound transmission class of 50.

7. RESTROOM PARTITIONS

Toilet partitions installed in restrooms shall be manufactured using a minimum of 50% recycled High Density Polyethylene plastic coloring and flame retardant agents that are both recycled and recyclable such as Perma-Poly panel boards or Department of General Services approved equal. Hardware and installation shall .be in accordance with the manufacturer's recommendations. Color selection to be approved by Lessee.

8. INTERIOR DOORS

Doors. A minimum of two (2) doors will be provided permitting ingress to and egress from each leased area on each floor. In addition, interior doors will be provided on the ratio of one door for each 25 lineal feet of partitioning required by the specifications regardless of the amount of partitioning actually used. The interior doors shall consist of 36" wide solid core doors composed of 100% recycled materials such as wheat board unless otherwise specified by the Department of General Services. Doors shall be finished using nontoxic, water based urethanes or similar environmentally sensitive products, as required by their function and location. Doors shall be provided with hardware, compliant with ADA, stops and master keyed locks as indicated by Lessee. All door frames shall be steel.

9. EXTERIOR DOORS

All exterior doors and frames shall be constructed of steel or aluminum and foam insulated. All hardware shall conform to the requirements of all applicable codes.

10. FIRE EXIT DOORS INTO FIRE TOWERS

Exit doors into stair wells or fire towers shall be fire rated and as required by any applicable codes.

11. CEILINGS

Acoustical tile and grid system for ceilings shall be selected to reduce energy costs and provide sustainable design. All ceilings shall be at least 9 feet in height above finish flooring. Acoustical products shall have a Class-A fire resistance per ASTM E 1264 and a flame spread of 0-25 per ASTM E 84 100% post consumer recycled content. Ceiling tiles shall have a 89% minimum light reflectance with a minimum NRC of. 70 in compliance with ASTM C 423 and a CAC minimum of35 in compliance with ASTM E 1414, such as the Intima Hi-LR series as manufactured by Armstrong World Industries, Inc. or Department of General Services approved equal. Ceiling(s) in the telecommunication/data room(s) must be provided with acoustical tile on a suspension grid system.

All ceilings shall be acoustical tile suspended by an intermediate duty suspension grid system unless the exposed interior shell and structural system comprise an acceptable interior environment that does not need a suspended ceiling system for acceptable aesthetic, acoustic and lighting requirements. Any exposed mechanical and electrical elements are acceptable if in accordance with codes and if treated in an aesthetic manner and approved by the Department of General Services and subject to a credit for Lessee for ceiling systems not installed.

12. WINDOWS

The total window area for either an existing or constructed facility shall be a minimum of 25% of the total wall facade to create a pleasant environment for visitors and staff. Window selection and location should maximize day lighting potential and place occupants in close proximity of

windows. All windows must have approved E rating and meet performance specification criteria in accordance with Section B. 2. Building Design and System Integration.. All windows shall be professionally cleaned inside and out prior to occupancy and shall be cleaned semi-annual thereafter.

13. WINDOW COVERING

Window covering shall be provided, unless agreed upon by the Department of General Services that the building configuration is such as to preclude its need. Window covering shall be provided to allow transmittal of visible light, provide higher shading coefficients, reduce glare and reduce solar heat gain in the facility. The window covering shall be provided in a polyester screen cloth and shall be UV resistance with anti-bacterial and anti-fungi characteristics. Color and density of screen cloth to be approved by Lessee.

14. PAINTS. STAINS AND VARNISHES

All new or existing permanent walls shall be prepared and painted prior to occupancy. Paint shall be a semi-gloss latex enamel, solvent-free, water-based, and non VOC emitting paint. Preparation and application shall be completed in accordance with manufacturer's recommendations.

Paint for such items as door and window frames, steel doors, etc., shall have a minimum of two coats of paint unless stipulated otherwise. Paint for general interior and exterior applications shall be a water-based, zero- or low-VOC latex paint and primer. Water-based paints shall not be formulated with aromatic hydrocarbons, formaldehyde, halogenated solvents, mercury or mercury compounds, or tinted with pigments of lead, cadmium, chromium VI, antimony and their oxides. If solvent-based paints are required for exterior use, the VOC levels shall not exceed 150 grams/liter. Solvent based paints shall not be formulated with more than 1% aromatic hydrocarbons by weight.

The use of water-based stains and transparent finishes for the use of wood finishes shall be provided with less than 100 grams/liter for stain or transparent finishes. Immediately after occupancy, Lessor will refinish marred walls during weekends or holidays. If occupancy already occurs, painting must be done on weekends or holidays. Color selection to be approved by Lessee. Lessor shall repaint the premises every five (5) years during the term of this Lease and any option terms.

15. SEALANTS, ADHESIVES AND COMPOUNDS

All sealants, adhesives and compound products used in this project shall be non-toxic, low odor and solvent free and shall be antimicrobial with no hazardous vapors and contain no carcinogenic materials.

16. RESTROOMS

Interior finishes of toilet facilities shall consist of ceramic tile flooring and walls at least 41/2 feet

in height. Ceramic tile shall be installed in a workmanlike manner in strict accordance with manufacturer's approved installation instructions, using the appropriate environmentally friendly adhesive. The remaining wall area shall be prepared and painted. Preparation and application shall be completed in accordance with manufacturer's recommendations. Color and material to be approved by Lessee.

17. JANITOR CLOSETS

Janitor closets shall be provided on all floors, containing a service sink with hot and cold water supply and ample storage space for cleaning equipment, materials and supplies.

18. SIGNAGE Door Signs, Directory Board Service

Signage, if furnished by the Unit, shall be installed by the Lessor in an approved location adjacent to all exterior and interior office entrances. The Lessor will be responsible for furnishing and installing ADA compliant signs to indicate toilets, closets, stairways, etc. Glass-enclosed changeable letter directories of the wall mounted or upright type with lock, shall be provided by the Lessor in the main lobby areas in multi-tenant buildings.

Appendix 6. Outline of Draft Legislation on Proposed Office of Indoor Air Quality and New Indoor Air Quality Regulations

THE HEALTHY BUILDINGS ACT OF 2003

1) Preamble
   A. The State of Maryland believes that people who work in office environments are entitled to a safe and healthy environment; and
   B. It has been shown that maintaining a safe and healthy building depends in part on the appropriate use of readily and commonly available methods of building cleaning, maintenance and operation of heating, ventilation, and air conditioning systems, maintenance of building structural integrity, and control of sources of indoor air contaminants that can affect the health of occupants; therefore
   C. The State of Maryland is committed to assisting building owners and operators in achieving safe and healthy buildings through the Healthy Building Act of 2003.
2) Authority
   A. This legislation amends the Environmental Articles of the Annotated Code of Maryland by: granting statutory authority to the Secretary of the Maryland Department of the Environment to promulgate and enforce statutes and regulations pertaining to environmental conditions, including mechanical and structural systems impacting the health and comfort of occupants as well as the means to achieve healthy indoor air quality, subject to available funding and staffing.
   B. This statutory authority granted to the Secretary of the Environment shall be complementary with existing statutory authority exercised by other governmental agencies.
   C. The Secretary shall have the authority to collect monetary penalties and to establish a special fund, entitled the Indoor Air Quality Fund for receipt of penalty fees, grant money, and related fees pertaining to indoor air quality.

3) Definitions
   A. Building Related Illness – Diagnosable diseases with known causes related to contaminants or other environments factors associated with conditions within a building.
   B. Certified Industrial Hygienist – An individual granted certification by he American Board of Industrial Hygiene based on work experience and demonstration of knowledge of industrial hygiene principles and practices through a written examination.
   C. Complaint
      i) Closed Complaint – A notice of an indoor air quality problem involving comfort or health problems which has been investigated and found to be either valid or invalid and for which corrective action has been implemented if warranted.
      ii) Open Complaint -- A notice of an indoor air quality problem involving comfort or health problems which is still under investigation or for which corrective action has not been implemented.
   D. Hidden Mold – A situation in which mold growth is present in a building but is in a location not readily observable to occupants, such as on surfaces within wall cavities, behind vinyl wall paper and beneath carpets.

E. HVAC System – Heating, Ventilation, & Air Conditioning System
F. Mold – Mycelial fungi commonly found growing in the indoor environment, which are of a ubiquitous nature and are found in the outdoor environment and inside buildings with favorable growth conditions.
G. Occupiable Space – An enclosed space intended for human activities, excluding those spaces intended primarily for other purposes, such as storage rooms, and equipment rooms, that are only occupied occasionally and for short periods of time.
H. Office – The space in which the affairs of a business, professional person, or government agency is conducted.

Applicability This Act applies to:
1. Buildings of at least 2,500 square feet in which office activities comprise at least 50% of the occupied space.
2. State, local, municipal and privately owned buildings.

4) Office of Indoor Air Quality
A. An Office of Indoor Air Quality shall be established within the Maryland Department of the Environment.
B. The Office of Indoor Air Quality is authorized to:
i) Carry out regulatory programs related to indoor air quality as described in Section 5(D);
ii) Provide technical assistance to public and private entities on indoor air quality management;
iii) Coordinate outreach activities pertaining to indoor air quality; and
iv) Charge fees as necessary to offset the costs of technical assistance, training, or other non-compliance activities not otherwise covered under Section 5(D).
C. The Office of Indoor Air Quality shall advise local government agencies, should these agencies decide to implement their own indoor air quality program for their jurisdiction.
D. The Office of Indoor Air Quality shall be authorized to respond to indoor air quality complaints from building occupants, as described in Section 9.

5) Operation & Maintenance (O&M) Documentation
A. The Building Owner shall develop O&M documentation following, but not limited to current ASHRAE guidelines for operating and maintenance documentation for building systems.
B. The Building Owner shall develop written standard operating procedures for operation of HVAC and other physical plant equipment and for maintenance tasks to be performed within the building. The O & M documentation shall encompass both routine and emergency situations. The Office of Indoor Air Quality shall develop and promulgate guidelines for the preparation of O& M documentation to assist building owners and operators.
C. At a minimum, the O & M documentation for buildings shall address the following elements {This is a list of the elements considered by the Task Force to be important in maintaining building IAQ. There are other possible factors that have been raised by external reviewers.}:

i) HVAC Systems

(1) Filters and air cleaning devices shall be replaced or maintained as recommended by the manufacturer.
(2) At least quarterly, the outdoor air dampers and actuators shall be inspected to verify they are functioning as intended. Equipment not operating as intended shall be repaired as soon as practicable.
(3) Humidifiers shall be inspected at least quarterly when operating. They shall be cleaned to minimize microbial growth.
(4) Cooling coils shall be inspected at least annually and cleaned when fouling or microbial growth is observed.
(5) Drain pans shall be inspected annually during the cooling season for cleanliness and microbial growth, and cleaned if needed. Any adjacent areas subject to drain pan overflow shall be cleaned and the cause of unintended wetting rectified.
(6) Outdoor air intake louvers and adjacent surfaces shall be inspected semi-annually, removing any visible debris or biological material.
(7) Sensors used to control outside air shall have their accuracy checked semi-annually. The facility owner (or his designee) shall calibrate or replace sensors failing to meet accuracy specified by the manufacturer.
(8) For air handlers exceeding 2000 CFM, the total quantity of outdoor air shall be measured every five years. Outdoor airflow shall be adjusted where the flow rate is more than 10% below the design flow.
(9) Cooling towers shall be treated to limit the growth of microbiological contaminants including *Legionella spp*.
(10) Areas needed for equipment access to provide for inspection and maintenance activities specified in section 5(c)(i)1-9 shall be kept clear of obstructions.

ii) Sewer Systems

(1) Floor drains shall be maintained to prevent release of sewer gas.

iii) Sanitation

(1) Where water intrusion or excess moisture occurs, take measures to dry and sanitize the area as quickly as possible.
(2) Inspect all accessible building surfaces quarterly for evidence of suspect mold growth.
(3) Where suspect mold growth is observed, remove or treat the affected surfaces, ensuring that workers are adequately protected and use appropriate cleaning methods.
(4) Identify and correct any ongoing sources of excess moisture.

iv) Complaint Management

(1) The O & M documentation will describe the process by which employee concerns about IAQ will be collected, managed, and corrected, including the manner in which building occupants will be informed about the management of their concerns.

D. {These sections would describe how the O&M documentation is to be maintained, that it should be regularly updated, what information would need to be kept on file (such as major HVAC upgrades) for what period of time, and who would have access to the O&M documentation.

6) Non-Discrimination for Complaints
   i) {This section would protect building occupants from discrimination if they reported problems with indoor air quality.}

7) Indoor Air Quality Advisory Council
   A. An Indoor Air Quality Advisory Council shall be established to advise the Secretary of the Department of the Environment on the following issues related to indoor air quality:
      i) Technology and scientific findings related to the evolving field of indoor air quality.
      ii) Appropriate guidelines, which should be issued for voluntary compliance as best practices
      iii) Needed regulatory requirements and legislation
      iv) Other issues which impact the indoor environment
   B. The Indoor Air Quality Advisory Council shall be composed of permanent representatives from the following State Agencies, the designees to be appointed by the Heads of the respective Agencies:
      i) Department of the Environment, serving *ex oficio*
      ii) Department of Labor, Licensing, & Regulation
      iii) Department of Health & Mental Hygiene
      iv) Department of General Services
      v) Department of Budget & Management
      vi) Maryland State Department of Education
      vii) Department of Housing & Community Development,
      viii) Maryland Code Administration
   C. The Indoor Air Quality Advisory Council shall also have members appointed by the Governor for a three year term, representing the following:
      i) {This section would identify the public members of the Council, such as those individuals and organizations involved in indoor air quality, public health, HVAC installation and maintenance, building ownership and operation, and others}
   D. The Indoor Air Quality Advisory Council shall meet at least twice a year or more frequently as deemed necessary by the Secretary.
   E. Members of the Indoor Air Quality Advisory Council shall not receive `compensation but are entitled to reimbursement for expenses under the Standard State Travel Regulation, as provided in the State budget.
   F. The Indoor Air Quality Advisory Council, with the consent of the Secretary, shall have the power to
      i) Make inquiries of public and private entities;
      ii) Collect data; and
      iii) Hold hearings.

8) Enforcement
   A. The Office of Indoor Air Quality shall enforce requirements as outlined in this legislation and which are promulgated as regulations.
   B. The building owner shall be responsible for compliance and shall demonstrate compliance to the Department of the Environment based on records maintained by the Building Owner.
   C. The Department of the Environment may inspect the building and documentation maintained by the Building Owner based on:
      i) Complaints by building occupants; or
      ii) Focused inspections targeting specific priorities identified by the Department or the Indoor Air Quality Advisory Council.

   D. Warning Letters and Notices of Non-Compliance
      i) {This section describes the process in which the Office of Indoor Air Quality would send a warning letter in the event that a complaint-driven inspection resulted in a finding of non-compliance. The owner would have 30 days to correct the violation before penalties would be imposed.}

   E. Notice of Violation
      i) A Notice of Violation shall be issued when:
         (1) Non-conforming issues itemized in a Warning Letter have not been resolved within the stipulated time period;
         (2) A building-related illness occurs due to negligence on the part of the building owner or operator; or
         (3) Repeated non-conformities and/or violations occur.

   F. Corrective Actions
      i) The Building Owner shall be responsible for initiating action to identify the root cause of an indoor air quality complaint or non-conformity/violation of regulatory requirements and shall develop and implement an action plan to resolve the indoor air quality problem.
      ii) {These sections would describe the ability of the building owner to settle with the Department or arrange to offset fines with abatement efforts under certain conditions; or to seek injunctive relief or other solutions for situations in which the issuance of citations does not result in correction of the problem.}

9) Penalties
   A. Penalties shall be issued according to Subtitle 6, Sections 2-601 through 2-14 of the Environment Article in the Annotated Code of Maryland.