

IEQ Indoor Environmental Quality

A project of the National Institute of Building Sciences (NIBS) with funding support from The Architectural and Transportation Barriers Compliance Board (Access Board)



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Introduction

The Architectural and Transportation Barriers Compliance Board (Access Board) is an independent federal agency devoted to accessibility for people with disabilities. The Access Board is responsible for developing and maintaining accessibility guidelines to ensure that newly constructed and altered buildings and facilities covered by the Americans with Disabilities Act and the Architectural Barriers Act are accessible to and usable by people with disabilities. In November 1999, the Access Board issued a proposed rule to revise and update its accessibility guidelines. During the public comment period on the proposed rule, the Access Board received approximately 600 comments from individuals with multiple chemical sensitivities (MCS) and electromagnetic sensitivities (EMS). They reported that chemicals released from products and materials used in construction, renovation, and maintenance of buildings, electromagnetic fields, and inadequate ventilation are barriers that deny them access to most buildings.

Americans spend about 90 percent of their time indoors, where concentrations of air pollutants are often much higher than those outside. According to the U.S. EPA Healthy Buildings, Healthy People: A Vision for the 21st Century, www.epa.gov/iaq/hbhp/hbhptoc.html "Known health effects of indoor pollutants include asthma; cancer; developmental defects and delays, including effects on vision, hearing, growth, intelligence, and learning; and effects on the cardiovascular system (heart and lungs). Pollutants found in the indoor environment may also contribute to other health effects, including those of the reproductive and immune systems." (p. 4). The report further notes that "Most chemicals in commercial use have not been tested for possible health effects. (p. 8).

There are a significant number of people who are sensitive to chemicals and electromagnetic fields. Surveys conducted by the California and New Mexico Departments of Health and by medical researchers in North Carolina found 16 to 33 percent of the people interviewed reported that they are unusually sensitive to chemicals, and in the California and New Mexico health departments' surveys 2 percent to 6 percent reported that they have been diagnosed as having multiple chemical sensitivities. C. Miller and N. Ashford, "Multiple Chemical Intolerance and Indoor Air Quality," in *Indoor Air Quality Handbook* Chapter 27.8 (McGraw-Hill 2001). Another California Department of Health Services survey has found that 3 percent of the people interviewed reported that they are unusually sensitive to electric appliances or power lines. P. LeVallois, et al., "Prevalence and Risk Factors of Self-Reported Hypersensitivity to Electromagnetic Fields in California," in California EMF Program, "An Evaluation of the Possible Risks From Electric and Magnetic Fields (EMFs From Power Lines, Internal Wiring, Electrical Occupations and Appliances, Draft 3 for Public Comment, April 2001" Appendix 3 (<http://www.dhs.ca.gov/ehib/emf/RiskEvaluation/riskeval.html>).

Individuals with multiple chemical sensitivities and electromagnetic sensitivities, who submitted written comments and/or attended the public information meetings on the draft final rule, requested that the Access Board include provisions in the final rule to make buildings and facilities accessible for them.

The Board has not included such provisions in their rules, but they have taken the commentary very seriously and acted upon it. As stated in the Background for its Final Rule **Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Recreation Facilities**: <http://www.access-board.gov/recreation/final.htm>

"The Board recognizes that multiple chemical sensitivities and electromagnetic sensitivities may be considered disabilities under the ADA if they so severely impair the neurological, respiratory or other functions of an individual that it substantially limits one or more of the

individual's major life activities. The Board plans to closely examine the needs of this population, and undertake activities that address accessibility issues for these individuals.

The Board plans to develop technical assistance materials on best practices for accommodating individuals with multiple chemical sensitivities and electromagnetic sensitivities. The Board also plans to sponsor a project on indoor environmental quality. In this project, the Board will bring together building owners, architects, building product manufacturers, model code and standard-setting organizations, individuals with multiple chemical sensitivities and electromagnetic sensitivities, and other individuals. This group will examine building design and construction issues that affect the indoor environment, and develop an action plan that can be used to reduce the level of chemicals and electromagnetic fields in the built environment.”

This report and the recommendations included within are a direct outgrowth from that public comment process. The Access Board contracted with the National Institute of Building Sciences (NIBS) to establish this Indoor Environmental Quality Project as a first step in implementing that action plan.

A broad and distinguished Steering Committee was established and met in January 2004 in Bethesda, Maryland, to review the project objectives. Subsequently four task teams (committees) were established to address specific issues in buildings related to Operations & Maintenance, Cleaner Air Rooms, Design and Construction, and Products and Materials. The following reports from these four committees offer recommendations for improving IEQ in buildings. They also list valuable resources and references to allow readers to investigate the pertinent issues in greater depth. The focus of the project was on commercial and public buildings, but many of the issues addressed and recommendations offered are applicable in residential settings.

Many volunteers worked diligently to create the recommendations in this report. These individuals are listed in the separate committee sections of the report, but special thanks go to the committee chairs: respectively Hal Levin, Building Ecology Research Group; Michael Mankin, California Division of the State Architect; Roger Morse, Morse-Zentner Associates; and Brent Kynoch, Kynoch Environmental Management, Inc. Lastly, an enormous debt of gratitude is owed to four amazing individuals who made significant contributions to the work of all four committees: Mary Lamielle, National Center for Environmental Health Strategies; Ann McCampbell, MD, Multiple Chemical Sensitivities Task Force of New Mexico; Susan Molloy, National Coalition for the Chemically Injured; and Toni Temple, Ohio Network for the Chemically Injured.

The overall objectives of this project were to establish a collaborative process among a range of stakeholders to recommend practical, implementable actions to both improve access to buildings for people with MCS and EMS while at the same time raising the bar and improving indoor environmental quality to create healthier buildings for the entire population.

This IEQ project supports and helps achieve the goals of the Healthy Buildings, Healthy People project, which acknowledges that "We will create indoor environments that are healthier for everyone by making indoor environments safer for the most vulnerable among us, especially children." (p.17)

Summary Recommendations

The recommendations in this report are only a first step toward the action plan envisioned by the Access Board.

The NIBS IEQ committee offers several recommendations for further action. It is recommended that a follow-on project organize and convene one, or more, workshops to deliberate the issues and recommendations in this report. It is also recommended that a project be organized to develop a single guidelines document. Such guidelines would be built on refinement and coordination of the recommendations of the Design & Construction and Products & Materials committees in this report. This same, or a separate project, should develop new building code provisions to accelerate the implementation of improved IEQ. Lastly, it is recommended that a project be organized to develop guidelines for the design of an “ideal space” for people with MCS and EMS. The recommended follow-up projects should involve collaborative effort and funding from a range of organizations across the building community; e.g., American Institute of Architects (AIA), Associated General Contractors of America (AGC), Building Owners & Managers Association International (BOMA), American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), Environmental Protection Agency (EPA), and, of course, the Access Board.

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**National Institute of Building Sciences (NIBS)
Indoor Environmental Quality (IEQ) Project
Operations & Maintenance Committee**

May 26, 2005

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INTRODUCTION AND OVERVIEW

Problem Summary

The operation and maintenance of commercial and public buildings can affect their accessibility for people with asthma and multiple chemical and/or electromagnetic sensitivities. The presence of many products or conditions involved in cleaning, maintaining, using, and operating buildings often contributes to poor indoor environmental quality and are access barriers for these individuals.

Problematic substances include, but are not limited to, pesticides, fragrances, disinfectants, many cleaners and new building materials and furnishings, and smoke and other engine exhaust. Inadequate ventilation of a building further contributes to poor indoor environmental quality.

The presence of electromagnetic fields from office equipment and other sources is a barrier for those with electromagnetic sensitivities. Noise and vibration can adversely affect some people with chemical and/or electromagnetic sensitivities and trigger seizures in susceptible individuals.

General Solutions

Measures taken to improve indoor environmental quality, such as reducing air pollutants, noise and electromagnetic fields in buildings, will increase their accessibility for people with asthma and chemical and/or electromagnetic sensitivities, as well as provide a more healthful environment for all building occupants.

While “green” and “environmentally-friendly” practices and products for construction and maintenance of buildings sometimes provide more healthful indoor environments and improves access for those with asthma and multiple chemical sensitivities, this is not always the case. The U.S. EPA notes that there is growing concern that standards being promoted by the green building movement, such as Green Seal and Green Guard standards, are not sufficiently protective of health (1).

For example, some measures recommended to promote energy and water conservation -- such as reducing outdoor air supplied and/or reducing time of HVAC usage, using motion sensors that can create electromagnetic fields, using waterless urinals that require continuous chemical treatments, recommending cold water for cleaning, and promoting the use of alcohol hand wipes instead of hand washing – can cause or lead to increased indoor pollution and less healthful and accessible environments.

In addition, “greener cleaners” often promote the use of citrus- and/or pine-based products, which can react with even low levels of oxidants, such as ozone, to produce hazardous byproducts, as well as make buildings inaccessible for many people with chemical sensitivities. The addition of either synthetic or natural fragrances to cleaning and other products is also problematic for chemically sensitive individuals.

Other common green building recommendations, such as building on brownfields, using tuck-under parking, and putting heliports or gardens on roofs can also lead to diminished indoor air quality and create barriers for people with chemical sensitivities.

Lastly, the green building community has yet to provide guidance on the issue of electromagnetic fields.

BARRIERS & ISSUES

Fragrances

The presence of perfume, cologne, scented cleaners and other scented products contributes to poor indoor air quality and is one of the major access barriers for people with asthma and multiple chemical sensitivities.

“Fragrances” are chemical compounds added to a product to give it a scent. There are approximately 3000 chemicals used in the manufacture of fragrances. Most of these chemicals are synthetic and derived from petroleum. Chemicals found in fragrance formulations include toluene, alcohols, formaldehyde, styrene, benzene, limonene, phthalates, and musk. An individual fragrance formula may contain over 100 chemicals, but their identity is protected as a trade secret. Fragrances do not have to be tested for safety before they are put on the market (2).

Exposure to fragrances can trigger asthma attacks and migraine headaches, and aggravate sinus conditions. In those who are chemically sensitive, fragrance exposures can also cause irregular heartbeat, memory loss, confusion, fatigue, and neurological, vascular, and other problems. In addition, some fragrance chemicals are implicated in causing cancer and/or damaging the liver, kidneys, and central nervous system. Fragrance chemicals can enter the body via inhalation, skin absorption, or nasal passageways.

According to a 1986 U.S. House of Representatives Report:

"In 1986, the National Academy of Sciences targeted fragrances as one of the six categories of chemicals that should be given high priority for neurotoxicity testing. The other groups include insecticides, heavy metals, solvents, food additives and certain air pollutants. The report states that 95 percent of chemicals used in fragrances are synthetic compounds derived from petroleum. They include benzene derivatives, aldehydes, and many other known toxics and sensitizers, which are capable of causing cancer, birth defects, central nervous system disorders and allergic reactions " (3)

If a product label lists “fragrance” as an ingredient on the back of the label, it contains added fragrance, even if the front label says the product is “unscented” or “fragrance-free”. If “fragrance” is not listed as an ingredient, it may still contain fragrance chemicals or contain natural fragrances.

The main sources of fragrances in buildings are from 1) fragrance-emitting devices (FEDS), sprays, and deodorizers, 2) other scented cleaning and maintenance products, 3) perfume; cologne; essential oils; and scented skin and hair products, cosmetics, and other personal care products, 4) clothing that has been laundered with scented detergents, fabric softeners, or dryer sheets, and 5) potpourri, incense and scented candles (even when incense or scented candles are not burning). Sometimes fragrance is added to and dispersed by a building’s ventilation system.

Pesticides

Pesticides are hazardous chemicals designed to kill or repel insects, plants, and other pests. The term pesticide applies to insecticides, herbicides (weed-killers), fungicides, rodenticides, disinfectants, and other substances used to control pests. Many pesticides contain volatile and/or semi-volatile chemicals that contribute to poor indoor air and environmental quality (IAQ/IEQ).

A pesticide product consists of the active ingredient(s) and “inert” ingredients. Active ingredients are the chemicals that kill or repel the pest. The rest of the product is composed of “inert” ingredients, which often comprise over 95% of the pesticide product. “Inert” ingredients are commonly solvents and may be as, or more, toxic than the active ingredient(s).

Individuals exposed to pesticides are at risk for both acute and chronic health effects (4, 5, 6, 7). Pesticide exposures can exacerbate asthma and cause nausea, headaches, rashes, dizziness, fatigue and memory loss. Many pesticides are also linked with causing cancer, birth defects, neurological and reproductive disorders, and the onset and exacerbation of chemical sensitivities. Pesticide exposure can occur long after its application because pesticide products are often designed to be persistent in the environment.

For people who are chemically sensitive, exposure to even minute amounts of pesticides from, for example, pesticide drift from neighborhood lawn treatments, driving on a road where herbicides have been sprayed weeks earlier, or being in a building that was treated with pesticides even several years earlier, can cause severe, sometimes, life-threatening and/or prolonged illness (8). Thus the presence of pesticides is one of the greatest access barriers for people with chemical sensitivities.

The use of pesticides can be eliminated or significantly reduced through implementation of Integrated Pest Management (IPM) programs. IPM is a program of prevention, monitoring, record-keeping, and control that eliminates or drastically reduces the use of pesticides. The focus of IPM is to prevent pest problems by reducing or eliminating sources of pest food, water, and shelter and by maintaining healthy lawns and landscapes. The first approach to controlling a pest outbreak is to improve sanitation, make structural repairs (such as fixing leaky pipes and caulking cracks), and using physical or mechanical controls such as screens, traps and mechanical weed cutters. A least hazardous chemical is used only when other strategies have failed.

IPM strategies are being increasingly implemented in schools, parks, government facilities, and hospitals nationwide. One needs to be aware, however, that the term IPM is sometimes inappropriately used for pest management programs that use or recommend the use of significant amounts of pesticides.

Cleaning Products & Disinfectants

Many toxic chemicals are found in janitorial cleaning supplies used in industrial and commercial facilities. They often emit volatile organic compounds (VOC's) (9), contribute to poor indoor air quality (IAQ), and create access barriers for people with asthma, allergies, and/or chemical sensitivities. Some of these chemicals are associated with human health effects, including cancer, damage to major organs, interference with normal reproduction and development, and even death. (10).

Even “greener cleaners” may contain volatile substances, like citrus or pine, that can cause adverse health effects in building occupants.

There is a wide range of cleaning and maintenance products that include, but are not limited to, air fresheners, deodorizers, bathroom and tile cleaners, dusting aids, engine and other degreasers, lubricants, fabric protectants, floor polishes and waxes, furniture polish, general purpose cleaners, glass cleaners, laundry products, oven cleaners, carpet and upholstery cleaners, graffiti remover, and floor strippers. One of the most hazardous cleaning operations for workers and building occupants is the stripping and refinishing of floors.

Some cleaning products also contain disinfectants. The U.S. EPA notes that one major concern from a health standpoint is the increased incorporation of antimicrobial agents and fragrances in cleaners and air fresheners marketed to reduce indoor air contamination (1).

Many commonly used disinfectant or sanitizer products contain chlorine, phenol, quaternary ammonium compounds, and isopropyl and other alcohols. These produce hazardous fumes and present access barriers for people with chemical sensitivities.

Electromagnetic Fields

For people who are electromagnetically sensitive, the presence of cell phones and towers, portable telephones, computers, fluorescent lighting, unshielded transformers and wiring, battery re-chargers, wireless devices, security and scanning equipment, microwave ovens, electric ranges and numerous other electrical appliances can make a building inaccessible.

The National Institute for Occupational Safety and Health (NIOSH) notes that scientific studies have raised questions about the possible health effects of EMF's. NIOSH recommends the following measures for those wanting to reduce EMF exposure – informing workers and employers about possible hazards of magnetic fields, increasing workers' distance from EMF sources, using low-EMF designs wherever possible (e.g., for layout of office power supplies), and reducing EMF exposure times (11).

Renovation/Remodeling/Furniture

Many new building materials, such as paints, adhesives, wallboard, carpet, and insulation, as well as upholstered furniture, particleboard cabinets, and other furnishings emit hazardous volatile organic compounds (VOC's), contribute to poor indoor air quality (IAQ) and create significant access barriers for people with asthma and/or chemical sensitivities. These materials often outgas and are problematic for prolonged periods of time.

Smoke & Combustion

Many people with asthma and most people with chemical sensitivities are made sick by exposure to: 1) smoke, such as that from tobacco, fireplaces, candles, incense, and barbeques, and other outdoor fires, 2) vehicle and other engine exhaust, especially exhaust from vehicles using diesel or oxygenated fuel, and 3) combustion appliances burning kerosene, propane, or natural gas (natural gas usually being better tolerated than kerosene or propane). If combustion appliances are used, they should be directly vented to the outdoors. Electrical appliances are preferred by people with chemical sensitivities.

Noise & Vibration

Noise and vibration from HVAC systems, vacuums, pumps, helicopters and other sources can trigger severe symptoms, including seizures, in susceptible individuals.

Synergistic Effects of Indoor Air Pollutants

Indoor air is a "chemical soup" made up of a variety of chemicals emitted by building materials, cleaning products, pesticides, personal care and consumer products, emissions from building equipment and activities, etc. While individual chemicals may be hazardous, combinations of chemicals can be even more hazardous through additive or synergistic effects. Synergistic effects

occur when the health impacts of a chemical combination is greater than the sum of the impacts of the individual chemicals.

Indoor Air Chemistry

In indoor air, chemicals can react with one another to form other compounds that are more hazardous than the original chemicals. Increasing evidence has shown that ozone and hydroxyl radicals formed by other oxidants can react with alkenes (such as limonene found in citrus and fragrance formulations, as well as terpenes emitted by many wood products) to generate secondary pollutants, including formaldehyde, as well as hydroxy radicals that can react with organics to form other potentially toxic air pollutants. The toxicity of many of these secondary pollutants is well-established while for others it has yet to be evaluated (12, 13, 14, 15, 16). These reactions can be limited by employing carbon-based filters in locations where outdoor ozone concentrations commonly approach or exceed the National Ambient Air Quality Standards (NAAQS) promulgated by the U.S. EPA.

Persistence of Indoor Air Pollutants

Many porous building materials and furnishings, such as carpeting, couches, drapes, and wallboard, absorb cleaning chemicals, fragrances, pesticides, and other air pollutants. Chemicals adsorb to virtually all indoor surfaces but more strongly to rough rather than smooth surfaces. These processes are known as the “sink effect”. These chemicals can be re-emitted into the air for long periods of time leading to prolonged air pollution. For example, it is not uncommon for a building to retain the odor of a fragrance-emitting device (FED) months after it has been removed. Similarly, residual tobacco smoke can still be detected in buildings long after a no-smoking policy is implemented. Air pollutants clear more readily from buildings that contain a higher percentage of hard impermeable surfaces.

RECOMMENDED ACTIONS FOR FACILITY MANAGERS AND OPERATIONS & MAINTENANCE STAFF

The O & M Committee identified *pesticides* (indoors & outdoors), *fragrances* (especially fragrance-emitting devices/FEDS, air fresheners, and deodorizers), and volatile *cleaners* (including citrus & pine) as the biggest access barriers for people with chemical sensitivities related to operations and maintenance of a building. Cell phone use was identified as a significant barrier for people with electromagnetic sensitivities.

The Committee developed recommendations for making buildings more accessible for people with chemical and/or electromagnetic sensitivities in the areas of pest control, cleaning & disinfecting, mechanical / HVAC, landscape maintenance, and enclosure maintenance. They are listed in bullet form in the Appendix and summarized in the body of the report below.

In addition, recommendations are given for renovation, remodeling, and furnishings and for adoption of policies on smoking, fragrances, cell phone use, notification of building activities, and vehicle idling.

The Committee recognizes that the list of recommendations is long and that few buildings will be able to implement all of them. The recommendations are the ideal goal towards which to strive. Any steps taken to reduce the levels of the problematic substances or conditions listed above will improve access for people with chemical and/or electromagnetic sensitivities and create a healthier building.

Some of the recommendations will not apply to certain types of buildings or geographic areas. The recommendations are given in sufficient detail to help those who need to address a specific issue. Resources from which to obtain more information or guidance are also provided in the Appendix and at the end of the document in Additional Resources.

Recommendations for Pest Control

Adopt an Integrated Pest Management (IPM) program for building interiors and grounds as described in “Healthy Hospitals, Controlling Pests Without Harmful Pesticides” (17). The Los Angeles Unified School District also has an exemplary plan for an IPM program (18).

IPM is a program of prevention, monitoring, record-keeping, and control that eliminates or drastically reduces the use of pesticides. The focus of IPM is to prevent pest problems by reducing or eliminating sources of pest food, water, and shelter and by maintaining healthy lawns (19) and landscapes.

The first approach in controlling a pest outbreak is to improve sanitation, make structural repairs (such as fixing leaky pipes and caulking cracks), and using physical or mechanical controls such as screens, traps, vacuums, and mechanical weed cutters. Increased sanitation measures include more frequent trash removal, restricting eating to designated areas, securing trash container lids, and steam cleaning trash containers. The IPM approach uses knowledge of a pest’s biology, habitat, and needs to time specific interventions to prevent and control pests. A least hazardous chemical is used only when other strategies have failed.

Pesticide use is discouraged in a true IPM program. If pesticides are used indoors or outdoors, however, the following precautions should be taken -- notification of applications (even for “spot” or crack & crevice treatments) should be given through posting of signs (before, during, and after applications) and by other means to building occupants, especially those on a pesticide notification

registry (20), applications should only be made by a licensed applicator, applications should not be made inside buildings by spraying, fogging, bombing, or tenting, and applications should not be made in occupied areas or areas that may become occupied during the 24 hours (at a minimum) following an application. In buildings that are constantly occupied, pesticide applications should be made when they are least occupied. It is recommended that pesticides be applied when there is the longest time before the area will be re-occupied, such as at the beginning of a weekend or vacation period.

The Committee recommends that certain pesticides, such as organophosphates, carbamates, pyrethroids, and other neurotoxic insecticides; 2,4-D, other phenoxy herbicides, and glyphosate; and fungicides such as mancozeb, chlorothalonil, and maneb, never be used.

Recommendations for Cleaning & Disinfecting

Use fragrance-free, low-VOC cleaning products. Do not use fragrance-emitting devices (FEDS), plug-ins, or sprays; urinal or toilet blocks; or other deodorizer/re-odorizer products. Reduce odors by increasing cleaning and ventilation and/or using baking soda or zeolite to absorb odors. Do not use products containing paradichlorobenzene (21) or naphthalene, which are common ingredients in FEDS.

Do not use cleaner/disinfectant combination products. Avoid or limit the use of products containing chlorine, ammonia, quaternary ammonium, phenol, isopropyl and other alcohols, formaldehyde, and other petroleum distillates. Do not use citrus- or pine-based products. Hydrogen peroxide-based products are the preferred disinfectants, but still should be used with caution and care. Use hot water for cleaning to reduce the need for soaps, detergents, and disinfectants.

Use disinfectants only in areas and at strengths (i.e., levels of disinfection) required by law. Check with local health department to obtain details of all legal requirements. Clean surfaces thoroughly before disinfecting. Leave disinfectants in place for the correct amount of time before wiping surfaces clean.

Audit cleaning chemicals currently in use and develop a plan to replace with safer alternatives.

Vacuum frequently and thoroughly using vacuums with HEPA filters and strong suction. If carpets must be cleaned, use steam or least toxic all-purpose cleaner or carpet cleaner that does not contain petroleum solvents. Spot clean whenever possible. Clean stains while they are fresh to avoid the need for aggressive cleaning later. Dust hard surfaces with a lint-free cloth, or with water only.

Spray cleaning products on to cloths rather than on to surfaces or into the air. Dry all washed surfaces with a dry cloth or mop to reduce chemical residue and chance of mold growth. Minimize the use of floor waxes and buffing.

Ventilate well when using cleaning products. Post signs during cleaning. Make cleaning schedule available to employees or others upon request.

Schedule heavy cleaning, repairs and maintenance during low or no-occupancy periods whenever possible.

Prohibit occupant usage of cleaning chemicals except as authorized. Establish a list of least toxic, low-VOC cleaning products (and/or provide them to employees) which they can use to clean computers, erase felt pen writing on white board, and perform other similar activities.

In decorative building fountains, use the minimum amount of chlorine necessary for disinfection, avoid the use of bromine, use closed ozone water treatment systems to the maximum extent possible, and make use of newer, less-toxic disinfecting technologies as they become available.

Avoid the use of wall-mounted devices, similar to fragrance-emitting devices (FEDS), that operate automatically or by pushing a button to dispense deodorizers, disinfectants, and pesticides.

Recommendations for Mechanical Equipment / HVAC

Adhere to a strict maintenance schedule for HVAC equipment and make sure it is working properly. Use the highest efficiency filters compatible with current HVAC system, and if necessary, consider retrofitting the system to increase filtration capabilities. Maintain relative humidity between 30% and 50%.

Use non-chemical methods to maintain HVAC ducts free of particulate matter, dust, and debris, such as physical removal or use of vacuums. Do not use the HVAC system to disperse fragrances or other materials.

Seal return air openings into HVAC system during remodeling and exhaust directly to the outdoors, by temporarily removing window glazing if necessary.

Use demand controlled ventilation (DCV) that provides liberal amounts of air flow and outdoor air ventilation. Before a building is re-occupied in the morning or after weekends, flush with at least three complete outdoor air exchanges.

Create door and window-opening protocol to maintain proper pressure relationships and air flow in the building. Educate and provide protocol to staff and other building occupants. Policy should include provision that allows chemically sensitive and other individuals to open windows on a temporary or regular basis, as needed because of a health condition. Windows should also be permitted to be opened by occupants when the HVAC system is not working or shut off, such as may occur during nights and weekends.

Make maximum use of economizer cycle. Avoid energy conservation practices that reduce intake of outside air below minimum requirements.

Avoid or minimize the use of humidifiers in the building's HVAC system. Prohibit the use of personal humidifiers except when an occupant has a medical need for one. Maintain the cleanliness of all humidifier equipment and use the minimum amount of water treatment chemicals necessary to control dissolved solids and pH and prevent antimicrobial contamination. Do not allow the use of portable air "cleaners" that emit ozone.

Repair plumbing with least toxic, low-VOC materials. Use snakes or other mechanical methods to clear clogged drains. Use bacterial enzymes to prevent drain clogs. Inspect floor and other drains, especially those that are infrequently used, to ensure there is water in the P-traps, thereby avoiding sewer gas backup. Treat grease traps daily with bacterial enzymes.

Recommendations for Landscape Maintenance

Maintain lawns and gardens organically. Use integrated pest management (IPM) to eliminate or minimize the use of herbicides, fungicides, insecticides, and other pesticides. Maintain soil health. Avoid the use of synthetic fertilizers.

Pull, mow, or use mechanical weed cutters to remove weeds. Vinegar can be used to kill weeds along fence lines and other hard to reach places.

Avoid dust-blowing equipment like leaf blowers. Sweeping, raking, and use of vacuums are the preferred methods for removing debris.

Avoid diesel-powered and 2-cycle engine equipment. Use electric lawn and landscape equipment whenever possible.

Use rock, gravel, flat stones, or pavers for mulch, and/or use tytar landscape barrier to suppress weeds. Avoid organic mulches, like cocoa beans, peat moss, wood chips, and bark, especially near operable windows and doors of buildings. These mulches usually emit volatile fumes and may produce or harbor mold.

Avoid the use of CCA wood or wood chips because they contain arsenic and other toxic chemicals which can leach into the environment. Do not use railroad ties because they contain creosote.

Apply pesticide, fertilizers, and lime only when there is little or no wind and apply them in a manner that prevents drift. Post signs and provide advance notification to building occupants before starting these applications.

Use least toxic, low-VOC paints, stains, and finishes on outside equipment, like benches, poles, decks, and porches.

Recommendations for Enclosure Maintenance

It is important to properly maintain the building envelop in order to prevent mold problems and block pest entry.

Routinely inspect and clean roof and gutters to make sure they are draining properly. Promptly repair roof or plumbing leaks. Regularly inspect walls and foundations, especially all utility entrance seals (e.g., phone, water, electric, and cable) for cracks and repair promptly if found. Insulate cold pipes to prevent condensation.

Promptly remove wet ceiling tiles and wall panels.

Remove excess water from carpeting damaged by clean water and quickly dry it to avoid mold buildup. Do not use disinfectants or moldicides (other than hydrogen peroxide-based ones). Instead, utilize a steam extraction carpet cleaning system with a hydrogen peroxide-based cleaner/disinfectant. Inspect carpet after it is completely dried to ensure there is no mold or mildew. Those with asthma or chemical sensitivities should be removed from areas where there is wet carpeting. Remove carpeting if it has been wet longer than 24 hours.

Immediately remove and do not re-use any wet carpeting that has been contaminated with sewer water, heavy dirt and soils, or toxic chemicals.

Seal rusted surfaces with a least toxic low VOC sealant to minimize emissions of airborne particles.

Recommendations for Renovation/Remodeling/Furnishings

It is recommended that buildings and furnishings be well maintained to reduce the need for renovation and remodeling. Chemically sensitive individuals often tolerate older building materials and furnishings better than new ones because older materials have usually outgassed and emit lower levels of VOCs.

If renovation and remodeling is done, however, efforts should be made to limit activities to select areas, rather than being done on a wide scale. They should be performed when the areas are unoccupied (or the least occupied in buildings that are in constant use).

If new materials and finishes are applied (especially wet-applied products such as paints, sealants, caulks, and adhesives), maximum outdoor air ventilation with no recirculation should be employed during and for a reasonable period of time after the application.

When possible, new furnishings should be thoroughly aired out before being brought into the occupied space.

GENERAL RECOMMENDATIONS

Indoor Air & Environmental Quality Program

The O & M Committee recommends that facilities adopt an Indoor Air & Environmental Quality Program (IAQ/IEQ) to promote practices that prevent or reduce the contamination of indoor air, thereby contributing to a safe, healthy, productive and comfortable environment for building occupants. Benefits of good IAQ/IEQ may include improved health of occupants, decrease in the spread of infectious disease, protection of susceptible populations, increased productivity of occupants, improved relationships/fewer complaints, reduction in potential building closures (due to unhealthful conditions), less deterioration of buildings and equipment, reduced maintenance costs, and decreased liability and risk (22).

An IAQ/IEQ Program should include the maintenance of a log that records building problems and health complaints reported by building occupants.

Policies

The O & M committee recommends the following policies be adopted in commercial and public buildings:

No Smoking Policy

It is recommended that smoking be prohibited inside buildings. Smoking should be restricted to designated outdoor smoking areas that are 100 feet from paths of travel, entryways, operable windows, and air intakes.

Fragrance-Free Policy

It is recommended that a fragrance-free policy include prohibition of fragrance-emitting devices (FEDS) and sprays; use of fragrance-free maintenance, laundry, paper and other products; restrictions on perfume, cologne, and other scented personal care products used by employees, visitors, and other occupants; and prohibitions on use of potpourri and burning incense and scented candles.

An important first step is educating staff and others about the need for and benefits of reducing or eliminating the use of fragranced products.

Resources

No Scents Makes Sense brochure, Lung Association of New Brunswick:
<http://www.nb.lung.ca/pdf/NoScentsMakeSense.pdf>

Guidelines on Wearing Scented Products and We Share the Air posters, University of Waterloo, Ontario, Canada, www.safetyoffice.uwaterloo.ca/hspm/hspmm_intro/safety_manual_index.htm, (under 12. Hygiene).

See “*Steps for Implementing a Scent-free Policy in the Workplace*” in Additional Resources.

Cell Phone Use Policy

It is recommended that cell phone use be prohibited in areas of a building when requested by an electromagnetically sensitive individual who needs to work or visit that area. Also, see information on use of a Cleaner Air Symbol in the Designated Cleaner Air Room report.

Notification Policy

It is recommended that facilities adopt a posting and notification policy to notify staff, visitors, and other building occupants of pesticide applications, cleaning and maintenance activities, renovation and construction, and other activities that may produce hazardous fumes or dust.

Vehicle Idling Policy

It is recommended that facilities limit or prohibit idling of vehicles, especially diesel vehicles, near entryways, loading docks, operable windows, and air intakes (23).

Recommendations for Future Actions

1. The O & M Committee recommends that the U.S. Access Board sponsor a meeting with stakeholders, including architects, building owners and managers, government officials, scientists, advocates, sensitive and vulnerable individuals, and others to evaluate the recommendations of this report (Operations & Maintenance). This meeting should provide a forum for increasing awareness of the report, facilitating dialogue among stakeholders, assessing the feasibility of the recommendations, and identifying ways to advance the recommendations.

2. The recommendations on cleaning products and practices in this report are based on information that is currently available. The O & M committee found that much more information and research is needed to better define cleaning products and practices that are effective and that will best protect occupant health. Some of the data gaps or problems the Committee identified are lack of information on labels and Material Safety Data Sheets, lack of information on fragrance ingredients combined with incomplete information on their health effects, and safety questions about citrus- and pine-based cleaning products because, among other things, they react with ozone to produce hazardous byproducts.

We, therefore, recommend that the U.S. Access Board and/or NIBS, in conjunction with U.S. EPA and other stakeholders, sponsor a workshop to examine existing information on cleaning products and practices, identify those products and practices that have the least adverse impact on indoor environmental quality and occupant health (including impacts on sensitive and vulnerable individuals), develop best practices, and determine research needs.

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APPENDIX - DETAILED RECOMMENDATIONS

Detailed Recommendations for Pest Control

Use Integrated Pest Management:

Use integrated pest management (IPM) – a program of pest prevention, monitoring, record-keeping, and control that eliminates or drastically reduces the use of pesticides.

Follow recommendations for integrated pest management (IPM) in "Healthy Hospitals, Controlling Pests Without Harmful Pesticides". The Los Angeles Unified School District also has an exemplary plan for an IPM Program.

Eliminate the use of chemical pesticides or minimize their use to the greatest possible extent.

Pest management program should be part of an overall Indoor Air & Environmental Quality (IAQ/IEQ) program.

Designate an IPM coordinator.

When contracting for IPM services, give clear instructions on the type of service requested, including which, if any, pesticides are acceptable for use under specific conditions.

Eliminate all scheduled or routine use of pesticides. Use chemical pesticides only as a last resort when non-chemical methods have failed to control a pest problem.

Use organic methods to maintain lawns and landscape vegetation.

Do not use fertilizers that contain herbicides (e.g., "weed and feed" products).

Do not use herbicides to kill grass, shrubs, or other unwanted vegetation prior to removal or replacement.

If control methods are needed, preference should be given to physical (e.g., barriers), mechanical (e.g., mouse traps, pulling weeds, vacuuming, fly swatters, hosing insects off plants), and cultural (e.g., improved soil health, proper watering and pruning) controls, using bio-controls (e.g., natural predator insects) if those methods fail, and only using chemical pesticides as a last resort.

Prevent Pests:

Emphasize pest prevention through non-chemical means.

To avoid creating conditions attractive to pests, clean thoroughly, promptly fix building cracks and plumbing leaks, restrict eating to designated areas, and promptly dispose of waste.

Adopt and adhere to strict maintenance schedules to determine and repair points of possible pest entry, such as torn screens, cracks and holes in walls, and damaged or improperly placed door seals and sweeps.

Initiate additional housekeeping routines to reduce the chances of pest infestation, including more frequent trash removal, securing trash container lids, and steam cleaning trash containers.

Locate trash cans and dumpsters, compactors, and recycling areas away from the building.

Maintain healthy lawns and landscape vegetation to increase resistance to pests.

To maximize health of lawns, develop healthy soils, mow often and with sharp blades, reduce thatch, and water deeply but not too often.

Maintain soil health. Avoid the use of synthetic fertilizers.

Prevent mosquitoes from breeding by draining stagnant water from bird baths, swimming pool covers, buckets, tires and other areas where water may be collecting. Drill holes in bottom of recycling bins that must be kept outside. Check rain gutters to ensure they are draining properly.

Discourage the introduction or presence of indoor plants because they attract pests, encourage pesticide use, and often promote mold growth.

If indoor plants are present, minimize mold growth by being careful not to over water, loosening the top layer of soil every week, and not keeping plants in wicker baskets. Do not use synthetic fertilizers or pesticides on indoor plants.

Change the water in flower vases frequently.

Pesticides:

USE PESTICIDES ONLY AS A LAST RESORT WHEN NON-CHEMICAL METHODS HAVE FAILED TO CONTROL A PEST PROBLEM

Use the least toxic pesticide in the least amount necessary to accomplish the job. Spot treatments are preferred.

Least hazardous pest management materials include:

- Boric acid and disodium octoborate tetrahydrate;
- Soybean oil and corn gluten meal;
- Diatomaceous earth;
- Nonvolatile insect and rodent baits in tamper-resistant containers or for use in crack and crevices;
- Microbe-based insecticides (such as *Bacillus thuringiensis*, B.t.);
- Botanical insecticides that do not contain synthetic pyrethroids or toxic synergists;
- Biological control agents, such as parasites and predators; and
- Soap-based products.

[Note that due to individual variations in sensitivities, some people with allergies, asthma, or chemical sensitivities may not tolerate one or more of the above least hazardous materials.]

Least hazardous physical pest management methods include the use of liquid nitrogen for cold treatment of termites.

Pesticide applications should only be made by a licensed pest control applicator.

The O & M Committee recommends that certain pesticides, such as organophosphates, carbamates, pyrethroids, and other neurotoxic insecticides; 2,4-D, other phenoxy herbicides, and glyphosate; and fungicides such as mancozeb, chlorothalonil, and maneb, never be used.

Do not apply pesticides to buildings by fogging, bombing, or tenting or by space, broadcast, or baseboard spraying.

Do not apply pesticides in occupied areas or areas that may become occupied during the 24 hours (at a minimum) following an application. In buildings that are constantly occupied, pesticide applications should be made when they are least occupied. It is recommended that pesticides be applied when there is the longest time before the area will be re-occupied, such as at the beginning of a weekend or vacation period.

Minimize contamination of the HVAC system by sealing all inlets and outlets to the area where pesticides are applied. When the seals are removed, ventilate the area with 100% outside air with no recirculation at least until the building is re-occupied.

No application of pesticides should be made along paths of travel or in the vicinity of entrances, windows, or outside air intakes.

Do not use pesticides that contain added fragrance.

Ensure proper training of all personnel working with pesticides.

Prohibit other staff and building occupants from using pesticide products.

In the event of a scheduled structural or lawn care pesticide application (including spot or crack & crevice treatments), provide pre-notification and post signage in appropriate disability formats before, during, and after the application.

Signage for pesticide applications should include the name of the pesticide product applied and EPA registration number, date and time of application, name of the applicator, and the name and number of contact person from whom to obtain more information. For examples of notification requirements, see Healthy Hospitals report (17) and New Jersey regulations (20) under References.

Require that pest control applicators provide the building manager or designated agent copies of Material Safety Data Sheet(s) and product label(s) for all pesticides used inside the building or on facility grounds. These documents should be provided to building occupants and the public upon request. Note, however, that neither the MSDS or product label provide complete information on product ingredients or their potential health effects.

Maintain a voluntary registry of persons at increased risk of injury or harm from pesticide exposures who wish to receive individual notification prior to pesticide applications (or notified after an emergency application).

Reasonable accommodation to programs, services, and employment needs to be readily available to people whose disabilities require that they avoid exposures to pesticides.

Maintain secured separate storage for pesticides and limit access to authorized personnel only.

Store any pesticide and disinfectant products away from food, laundry areas, paper product storage, areas occupied by children, and HVAC air intakes.

Maintain separate equipment, including mixing containers, for use with pesticides. Avoid cross contamination with equipment used for cleaning and other maintenance activities.

Establish a reporting procedure and encourage individuals who are experiencing adverse health effects from a pesticide exposure to report the incident to the building manager and the U. S. Environmental Protection Agency. See EPA Pesticide Health Incident Reporting, <http://www.epa.gov/pesticides/health/reporting.htm>

Resources

IPM for Schools: A How-to Manual, EPA 909-B-97-001, March 1997,

<http://www.epa.gov/pesticides/ipm/schoolipm/>

Pest Prevention: Maintenance Practices and Facility Design by Sewell Simmons, California School IPM, California Department of Pesticide Regulation,

http://www.cdpr.ca.gov/cfdocs/apps/schoolipm/managing_pests/71_pest_prevention.cfm?crumbs_list=1,34

School Integrated Pest Management Program, California Department of Pesticide Regulation, www.cdpr.ca.gov/cfdocs/apps/schoolipm/main.cfm

Responsible Pest Management: Best Practices and Alternatives, Canada

<http://www.pestinfo.ca/main/ns/22/doc/23/lang/EN>

Second National Report on Human Exposure to Environmental Chemicals, Centers for Disease Control and Prevention, U.S. Department of Health and Human Services, 2003,

www.cdc.gov/exposurereport/2nd

ExToxNet (Extension Toxicology Network) Pesticide Information Profiles, Cornell University, <http://pmep.cce.cornell.edu/profiles/extoxnet/> (Does not include information on all health impacts experienced by people with pesticide/chemical sensitivities)

The Safety Source for Pest Management: A National Directory of Least-Toxic Service Providers, www.beyondpesticides.org/safetysource

Beyond Pesticides
701 E Street, SE, Suite 200, Washington DC 20003
202-543-5450

info@beyondpesticides.org

www.beyondpesticides.org

Bio-Integral Resource Center
P. O. Box 7414, Berkeley CA 94707
510-524-2567

birc@igc.org

www.birc.org

Californians for Pesticide Reform
49 Powell Street, #530, San Francisco, CA 94102
415-981-3939

pests@igc.org

www.pesticidereform.org

International Pest Management Institute
P. O. Box 474, Ash Fork AZ 86320
928-637-2378

Bill Currie, Director
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IPM Institute of North America
1914 Rowley Avenue, Madison WI 53705
608-232-1528

ipmworks@ipminstitute.org

www.ipminstitute.org

National Center for Environmental Health Strategies

1100 Rural Avenue, Voorhees NJ 08043
856-429-5358

ncehs@ncehs.org

www.ncehs.org

Northwest Coalition for Alternatives to Pesticides
P.O. Box 1393, Eugene OR 97440-1393
541-344-5044

info@pesticide.org

www.pesticide.org

Pesticide Action Network North America
49 Powell Street, Suite 500, San Francisco CA
94102

415-981-1771

panna@panna.org

www.panna.org, www.pesticideinfo.org

U.S. Environmental Protection Agency
Office of Pesticide Programs
Ariel Rios Building
1200 Pennsylvania Ave., NW, Mail Code 3213A
Washington, DC 20460
202-260-2090

www.epa.gov/pesticides

National Pesticide Information Center
Cooperative effort between Oregon State University and U.S. EPA
333 Weniger, Corvallis OR 97331
800-858-7378

npic@ace.orst.edu

<http://npic.orst.edu>

(Good site for basic pesticide information, but does not include full range of possible health effects experienced by people with pesticide or chemical sensitivities)

Detailed Recommendations for Cleaning & Disinfecting

Do not use fragrance-emitting devices (FEDS), plug-ins, or sprays; urinal or toilet blocks; or other deodorizer/re-odorizer products.

To reduce odors, increase cleaning and ventilation and/or use baking soda or zeolite to absorb odors.

Do not use products containing paradichlorobenzene or naphthalene (common ingredients in FEDS).

Avoid or limit the use of products containing chlorine, ammonia, quaternary ammonium, phenol, isopropyl and other alcohols, formaldehyde, and other petroleum distillates.

Discourage the use of alcohol-based hand washes.

Do not use products that contain or have a fragrance.

Do not use citrus- or pine-based products.

Use vegetable-based surfactants rather than petroleum-based ones. Do not use citrus- or pine-based solvents.

Cleaning and disinfecting programs should be part of an overall Indoor Air & Environmental Quality (IAQ/IEQ) program.

Establish an audit of all cleaning chemicals currently in use. Develop a priority list and plan to establish alternatives for chemicals and cleaning methods.

Raise awareness among building maintenance staff and occupants that "green" and "environmentally friendly" products are not necessarily good for occupant health.

Minimize the number of cleaning and disinfecting products used.

Perform cleaning maintenance on an as needed basis – use spot or area cleaning rather than broad-based cleaning.

Clean stains while they are fresh to avoid need for aggressive cleaning later.

Choose cleaning products and disinfectants that emit the lowest levels of volatile fumes.

Dust with a dry lint-free cloth, or with water only. Avoid or minimize the use of polish dusting products.

Avoid perfumed and/or chemically-treated cleaning products and supplies, such as cleaning rags, vacuum bags, trash bags, tissue, toilet paper, and hand soaps.

Increase scrubbing and other mechanical methods of cleaning to reduce the need for chemicals.

Inspect areas to insure there has been proper cleaning using visual inspection, white cloth, or ultraviolet light.

Do not use cleaner/disinfectant combination products.

Hot water should be available for hand washing and cleaning.

Whenever possible, clean with hot water to reduce the amount of soap, detergent, and disinfectant that must be used.

Spray cleaning products on to cloths rather than on to surfaces or into the air.

If carpets must be cleaned, use steam or least-toxic all-purpose cleaner or carpet cleaner that does not contain petroleum solvents. Spot clean whenever possible.

Adopt fast-drying methods for carpet cleaning, 4 hours maximum. Steam cleaning + highest extraction + higher dry air flow = fast drying.

Dry all washed surfaces and floors with a dry cloth or mop to minimize chemical residues and reduce the chance of mold growth.

Use vacuums with HEPA (High Efficiency Particulate Attenuation) filters and strong suction. Vacuum frequently and thoroughly.

Minimize the use of floor waxes and buffing, and if done, notify employees and the public.

Order cleaning products for use with pumps rather than spray or aerosol dispensers to minimize chemical contamination of the air and HVAC system.

Take control of your own dispensing to ensure proper measurements. Establish minimal dosing for applications. When chemical has multiple uses, dispense separately for each use. A good dispensing program can save 25% to 40% in chemical consumption and costs.

Educate staff that mixing cleaning chemicals is dangerous because it can create new compounds that are more toxic than the original products.

Initiate protocol to authorize, supervise, and provide safe areas to mix authorized chemicals.

Store cleaning chemicals securely, separated from paper, cloth, or other absorbent materials.

Post signs during cleaning activities. Make cleaning schedule available to employees or others upon request.

Schedule heavy cleaning, repairs and maintenance during low or no-occupancy periods whenever possible.

Maintain strict protocol for training employees who use hazardous products or materials.
Maintain an active list of those authorized to perform those duties.

Restrict cleaning to authorized personnel only.

Prohibit occupant usage of cleaning chemicals except as authorized. Establish a list of least toxic, low-VOC cleaning products (and/or provide them to employees) which they can use to clean computers, erase felt pen writing on white board, and perform other similar activities.

Use micro vacuums for cleaning electronic equipment. Do not use solvent cleaners.

Increase air intake to a building to dilute cleaning products present in indoor air, especially during major cleaning activities such as cleaning of carpet, walls, etc.

Provide a well-ventilated room with exhaust fans in which to service computers and other portable equipment whenever toxic chemicals are involved in the repair process.

Develop protocol to dispose of cleaning solutions safely.

Reduce tracked-in dirt by using mats and grills in entryways. Where appropriate, exhaust air between separated doorway entrances.

Replace wet entrance mats and dry wet floors and carpeting as soon as possible.

Utilize only those floor mats that do not emit odors/fumes or particles.

Reasonable accommodation to programs, services, and employment needs to be readily available to people whose disabilities require that they avoid exposures to cleaning, disinfecting, and maintenance chemicals.

Waterless urinals should be maintained using products containing bacterial enzymes that biodegrade urea.

Disinfectants

Eliminate combined cleaner/disinfectant products.

Use disinfectants only when and where necessary. This includes:

- 1) Knowing what organisms need to be reduced/disinfected. Disinfectants are formulated to target certain organisms or combination of organisms. It is important to use the right product in the right place.
- 2) Knowing what surfaces do (or do not) need to be disinfected, and how often.
- 3) Cleaning surfaces thoroughly before disinfecting. Disinfectants can only be effective through contact. A layer of surface grime is likely to prevent sufficient contact.
- 4) Using proper disinfectant mixing and cleaning procedures. This includes leaving disinfectants in place for the correct amount of time before wiping surfaces clean.

Limit or avoid the use of disinfectant or cleaning products containing chlorine, quaternary ammonium, phenol, and isopropyl and other alcohols.

Hydrogen peroxide-based disinfectants are preferred, but should be used judiciously with caution and care.

Use disinfectants only in areas and at strengths (i.e., levels of disinfection) required by law. Check with local health department to obtain details of all legal requirements.

Restrict or eliminate the use of alcohol-based hand washes.

Do not use hand soaps containing triclosan or other disinfectants.

Resources

See Addendum B for more information on Cleaning

Detailed Recommendations for Mechanical Equipment & HVAC Systems

If a building has poor indoor air quality, investigate the extent to which outdoor air contaminants are contributing to the problem.

In areas where poor outdoor air is a problem, use the highest efficiency filters compatible with current HVAC system, and if necessary, consider retrofitting system to increase filtration capabilities.

Use demand controlled ventilation (DCV) that utilize sensors in occupied spaces to determine when ventilation should be increased due to increased occupancy or other loads. Be wary of using motion sensors that can create significant electromagnetic fields.

Provide liberal amounts of ventilation. It is better to have more ventilation than necessary rather than too little.

Where there is an adjoining parking garage or busy roadway, or nearby heliport, anticipate the need to decrease air exchange and ventilation in buildings prior to and during “rush hours” or times of usage, respectively. During periods of decreased outdoor air ventilation, increase recirculation and filtration of recirculated air.

Adhere to a strict maintenance plan for all HVAC equipment to make sure it is working properly. This will reduce the chance of air contamination, maintain optimal efficiency, and minimize noise and vibration.

Create door and window-opening protocol to maintain proper pressure relationships and air flow in the building. Educate and provide protocol to staff and other building occupants. Policy should include provision that allows chemically sensitive and other individuals to open windows on a temporary or regular basis, as needed because of a health condition. Windows should also be permitted to be opened by occupants when the HVAC system is not working or shut off, such as may occur during nights and weekends. Policy should address emergency situations in which opening windows could exacerbate the crisis.

Maintain HVAC ducts free of particulate matter, dust, and debris. Use non-chemical methods, such as physical removal or use of vacuums.

Do not use HVAC system to disperse fragrances or other chemicals.

Before a building is re-occupied (e.g., in the mornings or after weekends), flush with at least three complete outdoor air exchanges.

Make maximum use of economizer cycle. Avoid energy conservation practices that reduce intake of outside air below minimum requirements.

Make sure the supply and return air diffusers, grills, and registers are working correctly.

Test for stagnant air areas where furniture, wall partitions, or equipment may be blocking air movement. Use ribbons or dry ice rather than smoke to study air flow patterns.

Maintain relative humidity between 30 and 50%.

Avoid or minimize the use of humidifiers in the buildings HVAC system. Maintain the cleanliness of all humidifier equipment and use the minimum amount of water treatment chemicals necessary to prevent antimicrobial contamination and to control dissolved solids and pH.

Prohibit the use of personal humidifiers except where there is a medical need.

Isolate and contain construction chemicals and particulate matter from HVAC system by covering registers and diffusers and using negative-pressure air systems.

Seal return air openings into HVAC system during remodeling and exhaust directly to the outdoors, by temporarily removing window glazing if necessary.

Quickly evacuate a building if the HVAC system becomes contaminated with a solvent, pesticide, toxic gas, or other harmful chemical at a level that can cause adverse health impacts in occupants, including sensitive and more vulnerable individuals.

Eliminate storage of toxic and/or volatile chemicals near HVAC intakes.

Do not allow the use of portable air “cleaners” that emit ozone.

Repair plumbing with least toxic, low-VOC materials.

To clear clogged drains, use mechanical methods such as snakes, or steam cleaning.

Utilize bacterial enzymes to prevent drain clogs, instead of using acids, solvents and alkalines which deteriorate pipes and necessitate repairs.

Inspect floor and other drains, especially those that are infrequently used, to ensure there is water in the P-traps, thereby avoiding sewer gas backup in the building.

Treat grease traps daily with preventive dose of bacterial enzymes, to avoid the need to use strong chemical cleaners if they become clogged.

In decorative fountains, use the minimum amount of chlorine necessary for disinfection, avoid the use of bromine, use closed ozone water treatment systems to the maximum extent possible, and make use of newer, less-toxic disinfecting technologies as they become available.

Resources

EPA, Indoor Air Quality Building Education and Assessment Guidance (I-BEAM) Software package, can be downloaded for free from EPA website at http://www.epa.gov/iaq/largebldgs/ibeam_page.htm, or can be obtained on CD from IAQ Clearinghouse at 1-800-438-4318 or via e-mail at iaqinfo@aol.com (ask for EPA 402-C-01-001).

See references regarding HVAC in Building Design & Construction report

Detailed Recommendations for Landscape Maintenance

Use integrated pest management (IPM) to eliminate or minimize the use of herbicides, fungicides, insecticides, and other pesticides. (See recommendations for Pest Control).

Maintain lawn and gardens organically.

Maintain soil health.

Avoid the use of synthetic fertilizer.

Do not use fertilizer products that contain herbicides (e.g., “weed and feed” products).

Maintain healthy lawns and landscape vegetation to increase resistance to pests.

To maximize health of lawns, develop healthy soils, mow often and with sharp blades, reduce thatch, and water deeply but not too often.

Pull, mow, or use mechanical weed cutter to control weeds. Vinegar can be used to kill weeds along fence lines or other hard to reach areas.

Avoid dust-blowing equipment, such as leaf blowers. Sweeping, raking, and use of a vacuum are the preferred methods for removing debris.

If string or other mechanical weed cutter is used, attempt to minimize dispersal of dust, dirt, and debris.

Avoid diesel-powered or 2-cycle engine equipment, use electric lawn equipment instead.

Close windows during grass cutting, or prior to pesticide, fertilizer, or lime applications, or use of gas-powered equipment or vehicles on building grounds.

Use least toxic low-VOC paints, stains and finishes on outside equipment, including benches, poles, decks, and porches, as is recommended for interior and exterior of buildings (see recommendations in Building Products & Materials report).

Use rock, gravel, flat stones, or pavers for mulch and/or use tytar landscape barrier to suppress weeds. Avoid organic mulches (e.g., cocoa beans, peat moss, wood chips, bark), especially near windows and doors of buildings. These mulches emit volatile fumes and may harbor mold.

Avoid the use of CCA wood or wood chips because they contain arsenic and other toxic chemicals which can leach into the environment.

Do not use railroad ties because they contain creosote.

Remove plants that are chronically ill and/or frequently attract insect pests.

When replacing plants or redesigning landscape, follow recommendations in Building Construction & Design report.

Apply pesticide, fertilizers, and lime only when there is little or no wind present and in a manner that prevents drift.

Provide prenotification by posting signs prior to pesticide, synthetic fertilizer, or lime applications.

Resources

Allergy-Free Gardening, Thomas Leo Ogren, www.allergyfree-gardening.com

Detailed Recommendations for Enclosure Maintenance

Routinely inspect and clean roof and gutters to make sure they are draining properly.

Promptly repair roof or plumbing leaks.

Regularly inspect walls and foundations, especially all utility entrance seals (e.g., phone, water, electric, cable) for cracks and repair promptly if found.

Insulate cold pipes to prevent condensation.

Promptly remove wet ceiling tiles and wall panels.

Seal rusted surfaces to minimize emissions of airborne particulates using least toxic low-VOC sealant.

Include proper seal of the building in commissioning and re-commissioning programs for the building.

Remove excess water from carpeting damaged by clean water and quickly dry it to avoid mold buildup. Do not use disinfectants or moldicides (other than hydrogen peroxide-based ones). Instead, utilize a steam extraction carpet cleaning system with a hydrogen peroxide-based cleaner/disinfectant. Inspect carpet after it is completely dried to ensure there is no mold or mildew. Those with asthma or chemical sensitivities should be removed from areas where there is wet carpeting. Remove carpeting if it has been wet longer than 24 hours.

Immediately remove and do not re-use any wet carpeting that has been contaminated with sewer water, heavy dirt and soils, or toxic chemicals.

Seal rusted surfaces with a least toxic low VOC sealant to minimize emissions of airborne particles.

Include proper seal of the building in commissioning and re-commissioning programs for the building.

Resources

Treschel, Hans, Ed. *Moisture Control in Buildings*. West Conshohocken, PA: American Society for Testing and Materials. 1992.

COMMITTEE

Active

Chair – Hal Levin, Building Ecology Research Group

Mary Lamielle, National Center for Environmental Health Strategies

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Charlie Reid, Hamilton County Board of Health, Ohio

Toni Temple, Ohio Network for the Chemically Injured

Contributing

Terry Brennan, Camroden Associates

Dave Rupp, Cabinet King, Inc.

ADDITIONAL RESOURCES

General Guidance for Building Cleaning Programs

By Charlie Reid, Member Hamilton County General Health District Board of Directors 1995-Present, Independent Consultant 1983 - Present.

Outdoor Air Intakes & Building Pressurization

The outside air intakes for positively pressurized buildings have a history of poor location. Many public buildings with utility or service entrances and loading docks have the outside air intake louvers near pollution sources that allow exhaust fumes from trucks to be drawn into the building. Some high-rise office buildings place air intakes in the path of drift from cooling towers on roofs, where contaminants such as bacteria that have caused Legionnaires' disease can enter the ventilation system. Air intakes of other rooftop installations have entrained roof sealants that are emitted into the air. Still others have entrained emissions from plumbing vent stacks resulting in sewer gas entrainment. Roosting birds can also be a source of contaminants that are entrained in outdoor air supply streams.

Outdoor air intakes are often poorly maintained and the areas are dirty. Getting good intake air - either by shielding or relocating intakes or by fine particle filtration eliminates the many contaminants from outside, as well as avoiding the added burden to cleaning inside. Mechanical rooms and nearby areas may also be the location for chemical storage and janitors' closets for many buildings. Mixing chemicals there sends vapors into the ventilation systems of the building. These are cleaning issues that affect indoor air quality.

Since most positively pressurized buildings do not provide for door or window ventilation, all cleaning activities create polluted air until gases and particles are diluted and removed by outside air supply and exhaust. Some older buildings, where the outdoor air supply rates are grandfathered into the energy saving criteria established in the era of President Carter and the 1970's oil embargo, have special problems with indoor air quality. They generally have lower levels of outside air ventilation and, thus, lower levels of dilution.

First Reduce Soil and Dirt:

Put emphasis on entryways. Reduce tracking in of outside soils and other particulate matter to make inside areas less difficult to clean. Mats, entryway grids, and special ventilation of vestibules reduces intake of soil and dust.

Evaluate high traffic patterns for use of removable matting that can be cleaned away from personnel in order to reduce the overall general cleaning required for carpet.

Limit eating to designated areas that can be cleaned by wiping and light mopping.

Quickly identify and clean spills and stains to eliminate the need for harsher treatments later.

Increase the light wipe and cleaning of hard floors to lessen the required stripping and finishing required. Much of this can be done with water or very light dilutions of an all-purpose cleaner.

Caution on use of the wrong mop is important because residual chemicals on an unrinsed mop can start stripping the finish from the floor, which then requires more frequent refinishing.

Employ better vacuums. Use HEPA (High Efficiency Particulate Attenuation) filtered vacuums with continuous suction. Higher suction not only reduces the amount of soil in buildings, it substantially reduces both hard floor and carpet cleaning. The removal rate makes the cost of high quality equipment worth the investment. The machines are larger, harder to manipulate, and because they have more suction, do not move as fast across the floor. Using a HEPA vacuum following a typical upright vacuum can make a visible difference in the brighter color of a carpet as the floor wand passes over a surface. Ground-in dirt is substantially reduced as is the need to clean the carpet.

Building occupants should be prohibited from having and using cleaning chemicals.

Selection of cleaning methods/general rules:

Chemicals are used to make water work better in cleaning. Chemicals add surface wetting agents, soil reduction and rinsing agents, evaporative qualities, and at times mild coating to prevent re-deposition of soils or the re-appearance of soils. The lower the soil level, the less water needs help to clean.

Higher temperature water dissolves better, cuts greasy soils, and requires less agitation. Increased agitation requires less chemical action to cut into soils.

Wiping and general rinsing after cleaning eliminate the need for many rinsing additives. Most all-purpose cleaners, window cleaners, and other hard surface cleaners have an alternative available in vegetable-based surfactant chemistry. Using many of the alternative products can eliminate alcohol, which lingers in the air long after use. Many of these products can be used in higher dilutions and thus less product is required.

Wiping needs to replace spraying. Many companies have gone to dispensing systems that fill spray bottles. Spraying not only diffuses a solution into the air as well as on the surface, it generally wastes product by over-wetting a surface - thus the need for adding evaporative alcohol to the product. By wetting a wipe lightly and applying to a surface, the excess from spraying does not require the additional labor to work off the hard surface, which saves labor.

Water can be used in general dusting of non-wood surfaces, as can lint-free wipes for most surfaces. Spray devices can be used to dispense into a wipe and this is the most efficient application method.

There is no cleaning need for fragrances and they all need to be eliminated.

There are products on the market which are advertised as deodorizers/re-odorizers that have four times the level of quaternary ammonia as a disinfectant. They are not listed as a disinfectant because they are purportedly for cleaning and reodorizing. This is not uncommon in the labeling of janitorial products.

Fragrances are leading culprits in accessibility problems related to indoor air quality.

Detergent with warm or hot water disinfects as well as disinfectant cleaners most of the time. For quality assurance, use of an ultraviolet light detects bacterial growth and areas which are evading cleaning. In problem areas that are frequently not reached – as behind toilets, around urinals, and beneath the nozzle of soap dispensers - personnel need to be trained and instructed to thoroughly clean the affected area.

Peroxides (as stabilized additives) are capable of disinfecting in more critical areas. Bathrooms, food service areas, and dining areas all follow this general guideline.

Dispensers are most often provided by the companies that sell chemicals. They install the dispensers and set the dilutions. Use of dispensers when building ownership or management is in control of the dispensers is appropriate. Supervisory control over dilutions is essential.

Carpet cleaning often results in off-gassing of toxic solvents for days and even weeks. Use of steam, non-petroleum based cleaners - even in some cases peroxides - and fast drying has proven essential to reducing the impact of cleaning.

Carpets are typically treated with numerous products, including insecticides, sealants, and optical brighteners. No matter what method is used to clean it, e.g., washing, dry-cleaning, or steam cleaning, all cause the release of the built-in chemistry of the carpet.

While it is a general rule to dry carpet in less than 24 hours to reduce the chance for mold growth, optimal drying time is less than 4 hours. This may require selecting less humid days to do the work. It may require increased airflow in the building. It may require blowers and heating to the affected area. It may require higher, more efficient extraction after chemical application. Faster drying shortens the time for the air to recover from the cleaning.

Hard floor finishing is often a process that results in off-gassing for weeks. It is recommended that the work be completed during unoccupied or low occupancy times for the building, using higher air flows for drying, and maintaining maximum dilution with outside air until off-gassing is complete.

Frequent inspections of floors and refinishing only the areas necessary reduces chemical usage and impact. Scheduled finishing may not be the best practice. Using an “inspect and finish as necessary” program allows for limited work to preserve the floors while reducing labor requirements and chemical usage.

Some gel strippers may have lower off-gassing levels and should be evaluated for potential usage. Experiment with strippers to find the lowest effective concentration to achieve the work. Refinishing material as well as strippers should be managed carefully by dispensing in proper amounts to ensure proper usage and to avoid over-usage.

Carpet de-spotting can be accomplished by using mild detergent and baking soda. This old remedy can remove many stains, particularly when fresh. Using the mixture in hot water (120 degrees) and rubbing inward from the outside of the stain can remove many without the use of strong chemicals.

Bathroom fixtures, urinal, and toilets are subject to staining. Where possible, peroxide-based cleaners are preferable. Baking soda provides a mild cleaner-abrasive capability. Use of acids in

difficult circumstances may be necessary. When this is done, the bathroom should be completely ventilated before reopening it for use.

A continuous audit of building practices, education of building personnel, and control of chemical usages by occupants will go a long way in reducing the adverse chemical impacts associated with cleaning. Safer alternative products exist for almost all cleaning needs. Cleaning protocols do not need to change much and can be phased into a building's existing program. While one may look for one practice to save the day, there is no magic bullet. Only one change in cleaning will leave others to create problems. A comprehensive approach is necessary and can be implemented step by step.

Checklist Guidance

Building managers can use the following list of questions as a guide to assess their office building cleaning efforts and to determine where to start transitioning cleaning activities. The checklist does not actually tell a building manager how to set up a cleaning program, but it serves as a starting point for educating everyone involved in a safer air cleaning program—managers, occupants, and janitors—about what they need to do to make it a successful program.

Building Considerations

- How are various areas within the building used? Determine which require the most cleaning, and why (e.g., public restrooms, kitchen areas). What are the hours of use and are there preferred times to clean when personnel are not present?
- Where do people eat (e.g., individual offices throughout the building, designated areas)?
- Are there any special considerations related to the building itself (e.g., is it an historical building that has special preservation requirements or security issues)?
- Do any office furnishings have special cleaning requirements (e.g., thick carpets, antique furniture)?
- Are there any known at-risk populations who may be more adversely affected by the use of some chemicals (e.g., children, people with asthma, allergies or chemical sensitivities, and pregnant women)?
- Does the building have an adequate ventilation system to circulate air throughout the building?
- Does the building have any plumbing or moisture problems?
- Is there a method in place to keep dirt from entering the building (e.g., mats at the front door, double-door entryways)?

Cleaning Checklist

PROCEDURE	FREQUENCY	PRODUCT BRAND (indicate whether it is purchased in concentrate or ready-to-use form)	MONTHLY PRODUCT USEAGE	CLEANING PROCEDURE
Clean furniture				
Clean walls				
Clean bathrooms				
Disinfection – Bathroom				
Disinfection – General				
Clean washroom fixtures				
Carpet spot removal				
Carpet cleaning				
Gum removal				
Concrete cleaning				
Graffiti removal				
Glass cleaning				
Metal cleaning				
Hard floor – routine cleaning				
Floor stripping				
Floor refinishing				
Other all purpose cleaning				

Adequacy of Current Cleaning Program

- What are issues of concern to management, cleaning personnel, and building occupants? Conduct interviews with all stakeholders rather than on a representative basis.
- Review the log of tenant complaints over the last year. What are the items that come up consistently?
- How is the quality of cleaning currently being evaluated/measured? How often are inspections performed? Are there trends in the problems that are identified?

Cleaning Materials Usage

- List the janitorial products that are currently in use for each of the following categories and identify how often the cleaning task is performed and how much of the product is used per month.
- Are there any reasons to change the procedure or frequency for these cleaning applications? In what manner can chemicals be eliminated or reduced? Seek methods to eliminate usage, reduce usage, and change products to those better for air quality.

Selecting Chemicals

In selecting chemicals for cleaning, there can be considerable confusion. “Green,” “environmentally safe” and various other claims as to the safety of cleaning products do not provide adequate guidance for determining which products do not adversely affect air quality. Below is a list of some terms with which a buyer of chemical products needs to become familiar. The list also includes comments and discussion of alternatives to potentially hazardous chemicals.

Bio-Degradable: The product will break down in the environment over time into supposedly harmless materials. This does not mean the product is safe for the environment, including soil, water, or air.

Chlorine-free: Contains no chlorine, a toxic chemical responsible for substantial problems in air quality as well as more poisonings each year than any other chemical. Oxygen bleaches, the chlorine-free alternatives for bleaching action, are less stable than chlorine bleaches, but much has been done to stabilize oxygen bleaches in the past few years. Do not use concentrated hydrogen peroxide in pure form for disinfection because its application to a flammable surface can cause it to ignite. For scouring, use of baking soda, borax and scrub pads provides additional cleaning capacity. Using a compound containing stabilized peroxide is useful for bleaching.

Natural: Implies the product does not contain synthetic ingredients. Since the use of this term is unregulated and the claim can only be verified by checking with the manufacturer, do not rely upon it for any selection criteria. And since naturally-occurring substances can also be harmful, this term does not have meaning with respect to air quality.

Neutral pH: The product is neither alkaline, nor acidic. These are most useful for products that require handling or mixing or are intended for application to bare skin. Even if a product has a neutral pH, it may have been refined from petroleum and other hydrocarbons and emit volatile fumes. For better air quality, it is often preferable to use a non-petroleum *alkaline* product rather than a solvent or petroleum-based *neutral* product. Very acidic or alkaline products that become airborne can cause irritation and even severe damage to skin, eyes, and lungs.

Non-Toxic: Supposedly only a very large amount will cause damage. Since this term is unregulated in its use, it has little meaning. Fewer than 5% of all cleaning compounds have been tested for safety. A few manufacturers test for skin irritation or ingestion effects. Since a product

can impact air quality and affect people with a large range of sensitivities, a product claiming to be non-toxic may still cause adverse health effects.

Oxygenated: Helps whiten and brighten by releasing oxygen which breaks up stains, and eliminates mildew and mold. See Chlorine above. Oxygenated products, such as those containing hydrogen peroxide, can be as effective as chlorine when used in proper doses and according to safety instructions.

Phosphate-free: Generally meaningless term. Phosphates are allowed by law only in certain automatic dish detergents. Not a criterion for most purchases.

Surfactant: This is the active ingredient in most detergent cleaners, such as all-purpose cleaners, floor cleaners, dish detergents, fabric softeners, and hard surface cleaners. Most often they are created from petroleum and are neutral in pH. Surfactants are used to alter the surface properties of the surface being cleaned. This can make the surface more penetrable, easier to rinse, and less able to be adhered to and more repellent of dirt. Numerous surfactants have been used as reducing agents to dissolve heavy greases and soils. Surfactants are now available in non-petroleum-based (vegetable) forms and the newer surfactants offer interesting new chemistry for air quality. In general they have higher flash points. The vegetable-based surfactants rarely have alcohol or other solvents. They can easily be wiped on and off and do not require evaporative assistance, such as adding alcohol and ether to most window cleaners.

Deodorizer/Re-odorizer: This group of products may contain higher concentrations of quaternary ammonia than disinfectants. They also frequently contain strong fragrances and/or masking agents that diminish the sense of smell. Paradichlorobenzene and naphthalene are common ingredients in fragrance-emitting devices. Deodorizer products are often used in public bathrooms found in restaurants, motels, theaters, subways, trains, airports, airplanes, and other public facilities. The use of deodorizer/re-odorizer products can be avoided by increasing ventilation/air flow and thoroughly cleaning with mildly alkaline non-surfactant detergents followed by the use of disinfectants, preferably peroxide-based ones. Inspection by ultraviolet light is recommended after all intensive cleaning to verify that surfaces have been adequately cleaned

Fragrance: This is an air pollutant that is intended to give the false impression that air is clean. Truly clean air has no smell. Fragrance formulas can contain benzene, toluene, styrene, and formaldehyde, along with other ingredients. Fragrance chemicals can enter the body through the lungs, skin, and nasal passageways. They can affect the brain and nervous system in a matter of seconds, either by their presence in the brain or via stimulation of olfactory nerves. Avoid all products that list fragrance as an ingredient or have a fragrant odor. Be aware that even if "fragrance" is not listed as an ingredient, fragrance chemicals may have been added to a product for another purpose, or claimed to be added for another purpose - such as an anti-microbial stabilizer, blending agent, or enhancer.

Solvent: Water is a solvent. Using alcohol, petroleum, and coal tar-based solvents for floor refinishing, metal cleaning, stain removal, and graffiti control is commonplace. To preserve air quality, use water as a solvent whenever possible. Use petroleum-based solvents only as a last resort. Non-water-based solvents should be used in controlled programs, with substantial increased ventilation, pre-notification of building occupants, use during low building occupancy, and retesting of air to make sure it is clear before a space is re-occupied. The use of many solvent products, such as spot stain-removers, can be eliminated by promptly cleaning stains, using mild

detergent and baking soda with a gentle rubbing action and working in from the outside perimeter of the stain.

Vinegar: An acidic fluid usable for basic surface cleaning, window cleaning, and bathroom fixture wiping. The mild acidic properties provide the ability to remove hard water spots and cut soap films. Note that while vinegar is considered a less-toxic cleaner, some chemically sensitive individuals may react adversely to it.

Getting Started

Eliminating fragranced products is perhaps the quickest and easiest step to improving air quality.

Eliminate air fresheners and fragrance-emitting devices. Do not use urinal or toilet deodorizer blocks which contain paradichlorobenzene, naphthalene, solvents or fragrances. Substitute vegetable-based surfactants combined with microbe-based urea reducing properties. Choose non-fragranced cleaners, hand soaps, and lotions. Choose basic paper items that do not contain fragrances. Do not use cleaner/disinfectant combination products. Disinfectants should be used after a surface is clean for optimal deep cleaning, which should be done on an as needed basis. Inspect cleaned areas using ultraviolet light to verify that the surface has been adequately cleaned. Concentrate heaviest cleaning on essential areas. This will control odor.

Find and remove room deodorizers and dispensing devices. Establish a policy restricting occupant usage of fragrance-emitting plug-ins.

Inventory all current products. Discontinue any product that has fragrance as an ingredient or has a strong odor – such as cleaners containing pine, tea tree oil, orange, lemon, or citrus.

Using Above Chart on Cleaning Materials Usage

Select products used most frequently. This is most often an all-purpose cleaner, a window cleaner, and disinfectant cleaner or straight disinfectant.

Most of these products are overused. In addition, suitable substitutes can almost always be found that have less impact on air quality.

Experiment with dosages to find the minimum amount of cleaning product that will accomplish the job. This is best done after selecting a new vegetable surfactant-based all-purpose cleaner, window cleaner, or oxygen-based disinfectant for bathrooms. Control dispensers to make sure that the minimum dosages necessary are dispensed.

Make increased use of mechanical/physical methods of cleaning to reduce chemical usage.

Vacuuming: Vacuuming extracts soil at a rate of barely 60% when done with typical upright vacuum systems found today. Carpets tend to absorb particles from the air as well as tracked-in grease and other contaminants. Using a stronger vacuum system with continuous suction (non-pumping action) combined with a slower motion increases the extraction rate to above 85%. Keeping vacuumed dirt and fumes from escaping from the vacuum and re-contaminating a room requires strong filtration. HEPA systems work well to remove particulate matter, but care needs to be taken to insure there are no air leaks around the filter. An activated charcoal impregnated membrane will absorb and trap gasses.

A strong vacuuming program that includes daily and thorough vacuuming is the first guard against the need for frequent carpet cleaning. Secondly, evaluate traffic patterns and use throw rugs and entry mats to protect carpeting in heavily trafficked areas that quickly become dirty. Only clean spots or small areas of carpet that require cleaning. Clean carpet on an “as-needed” basis rather than on a regular schedule.

For widespread carpet cleaning, employ extraction methods using steam; mild cleaners that do not contain fragrances or solvents; or peroxide-based cleaners and fast four hour drying to reduce impacts on air quality and chances of mold growth.

Dusting: Wipe surfaces for dusting with lint-free cloths or damp clean rags. This is usually as effective as using chemical dusting products.

Mopping & Buffing: Damp mop hard floors using soft water in high traffic areas. Wipe with a dry mop on return pattern. Frequent mopping protects the floors and reduces the need for buffing and refinishing. Buff floors during off hours using the minimum amount of product necessary to refinish the floor.

Floor Refinishing: Refinish floors based on need rather than a fixed schedule. Keep service records that include the date and area where floor was refinished and the products used. Mandate that only the minimum amount of product necessary to accomplish the job will be used. Provide personnel with information on tracking and the goal of chemical reduction. All stripping and refinishing needs to be done during non-occupancy periods with substantial increases in outside air flow.

Keep Track

Using a computer, create an ongoing tracking system on reductions in the amount and number of chemicals used, changes in chemicals used, and eliminations of chemicals. This overall program needs to be continuously evaluated and communicated to building owners, managers, and occupants.

Steps for Implementing a Scent-Free Policy in the Workplace

(Adapted from the Canadian Centre for Occupational Health and Safety)

What steps should I take when implementing a scent-free policy in the workplace?

The situation may arise and create the need for a scent-free policy. As with most workplace policies, be sure to consider the following:

- Conduct an assessment or survey of the employees to determine the extent of the problem. Collect opinions and suggestions at the same time to help you develop a policy appropriate to your workplace.
- Designate one key person to oversee the project and its development. If you work at a large company, it may be better to create a committee with members representing all groups (employees, unions, management).
- Involve the health and safety committee, and get management commitment from the beginning.
- Set and stick to deadlines for creating a draft policy, a review of the policy, and for implementation.
- Be sure that all employees have been fully informed of the policy and that they know what they have to do before the policy becomes effective.
- Educate the employees. You may choose to include brochures or flyers in payroll envelopes, publish articles in company newsletter, or give presentations. In any case, the goal is to inform all employees of the health concerns related to scents and why the policy is needed.
- Address any concerns the employees raise openly and honestly. Reinforce the idea that this policy is being implemented as a result of medical concerns - not merely because of a dislike for a certain smell.
- Make it clear that the policy applies to everyone (including visitors, patients, etc).
- Search local legislation for any supporting documentation.
- Do not limit the scent free policy to perfumes and colognes. Many cleaning and personal care products also have scents.
- Post a list of "approved" unscented products and where they are available locally.
- Review all MSDSs for the products currently used and for those you are considering using. Make sure that the ingredients are acceptable. Remember that some products which claim to be scent-free may be using additional chemicals to mask smells instead of truly being "unscented".
- Conduct trials in limited areas before purchasing large quantities of a product.
- Post notices that waxing, shampooing, painting, or spraying (etc.) will be conducted one week beforehand so that affected personnel can make arrangements or have their duties modified during that time.
- Put the policy statement notice on all appointment cards, stationery, room booking notices, employment postings, etc.
- Decide on wording for 'Scent Free' signs and where the signs will be posted.
- Let everyone know that the policy will be reviewed and can be changed because of experience or new knowledge.

What is an example of a policy?

Policies should be based on the health concerns of employees - especially those who have sought medical help. Keep the policy short, but specific. The policy must also apply uniformly throughout the company.

Sample: Scent-Free Policy
<p>Policy:</p> <p>Due to the health concerns arising from exposure to scented products, ABC Company Inc. has instituted this policy to provide a scent-free environment for all employees and visitors.</p>
<p>Definitions:</p> <p>The use of scented products will not be allowed within the building at any time. In addition, all materials used for cleaning will be scent-free (where ever possible).</p> <p>A list of locally available scent-free products is available from the health and safety office.</p>
<p>Procedure:</p> <p>Employees will be informed of this policy through signs posted in buildings, the policy manual, promotional materials and will receive orientation and training.</p> <p>Visitors will be informed of this policy through signs and it will be explained to them by their host.</p> <p>Any violations of this policy will be handled through standard disciplinary procedures.</p> <p>This policy is effective on 01/01/01.</p>

What should the 'posted notice' say?

Signs should be posted near the entrances to company building(s). In addition, statements on business cards, letter head or promotional materials may be helpful if you receive a lot of visitors.

Examples include:

Some people who work at ABC Company report sensitivities to various chemical-based or scented products. We ask for everyone's cooperation in our efforts to accommodate their health concerns.

In response to health concerns, ABC Company has developed a Scent-Free Policy. Scented products such as hair spray, perfume, and deodorant can trigger reactions such as respiratory distress and headaches. Staff and visitors are asked to not use these products when reporting to this office.

ABC Company is a Scent-free environment. Please do not use scented products while at work.

**National Institute of Building Sciences (NIBS)
Indoor Environmental Quality (IEQ) Project
Designated Cleaner Air Rooms Committee**

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No Recent Construction or Remodeling Including Carpet Installation

Cell Phones Turned Off

Ability to turn off or unplug computers and other electrical equipment by occupant or staff

Ability to turn off fluorescent lighting by occupant or staff

Ability to adjust temperature and air flow by occupant or staff, or the availability of operable window(s)

Recommendations for Accommodations

References

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Appendices

California Code Regulations

Southwest Community Health System Policy Guideline

MCS Nursing Protocol

INTRODUCTION AND OVERVIEW

Individuals with multiple chemical and/or electromagnetic sensitivities have identified the availability of designated cleaner air rooms and paths of travel in public and commercial buildings as highly important for improving access. The Designated Cleaner Air Rooms Committee examined the rationale for having Designated Cleaner Air Rooms, the types of

buildings or occupancies that may be appropriate for having such rooms, the minimum criteria for such a designation, and who would benefit from having these rooms.

Promising Practices

In November 2001 the State of California adopted a Cleaner Air Symbol and Conditions of Use in its building code to identify areas in publicly funded or leased facilities owned by the State of California that are accessible to and useable by people who are adversely impacted by airborne chemicals or particulate(s) and/or the use of certain electrical fixtures or devices.(1) The symbol can be used when minimum conditions established in the code are met. Use of the designation is voluntary.

A fact sheet on the California Cleaner Air Symbol and Criteria can be found at:

http://www.documents.dgs.ca.gov/dsa/pubs/cleanerair_factsheet.pdf

See *1117B.5.11 Cleaner air symbol* (page 109) of the California Code of Regulations for the code language: (see Appendix A)

www.documents.dgs.ca.gov/dsa/pubs/regulations_02-16-05.pdf

Recommended Actions

The Committee was charged with

- 1) reviewing the California symbol and criteria and investigating where it has been implemented, how it has worked, and what modifications and improvements, if any, are necessary to recommend broader usage;
- 2) developing and promoting a national Cleaner Air Symbol and Conditions of Use as appropriate; and
- 3) defining the scope of guidelines for creating an ideal zone (room and path of travel) hereafter referred to as a Clean Air Room in buildings for people with chemical and/or electromagnetic sensitivities.

During the project, the scope of work was expanded to include a brief discussion of accommodations for people with multiple chemical and/or electromagnetic sensitivities to address the needs of those individuals for whom a Cleaner Air Room would not provide adequate access or for those situations when such a designation would not be possible or feasible. Resources that address access and accommodations for people with multiple chemical and/or electromagnetic sensitivities at work, at school, at public meetings, and in hospitals are included at the end of this report.

Committee Recommendations

- The Committee highly recommends that the Access Board and/or the National Institute of Building Sciences (NIBS) fund or seek funding for FY2006 to develop specifications for designing and constructing a Clean Air Room and Path of Travel, the ideal or model room. This project is a natural outgrowth of the work of the other three committees.
- The Committee proposes a Pilot Project for FY2006 to implement a national Cleaner Air Symbol, as promulgated by the State of California, and Conditions of Use, as modified in the National Cleaner Air Signage, Conditions of Use section below, in

select public and commercial buildings such as independent living centers, disability organizations, schools and other educational institutions, public meeting places, or other business or government entities. The Committee recommends that one or more committee members in conjunction with the Access Board and/or the National Institute of Building Sciences assist in its implementation, track its use, analyze how well it has worked, and determine whether modifications or improvements are necessary prior to recommending promotion nationally. This same group would also examine implementation of the California Signage which is expected to take place during the same time frame.

- The Committee recommends that the Access Board, or a committee created by the Board, identify, review, summarize, and publish best practices for accommodations for people with multiple chemical and/or electromagnetic sensitivities on the website. Such a project was previously proposed by Access Board officials and discussed with members of this Committee but was not part of the charge of the current project.

NATIONAL CLEANER AIR SIGNAGE

Background:

In November 2001 the State of California adopted the California Cleaner Air Symbol, California Building Code, Title 24, Parts 2 and 12, 1117B.5.11ff., which established a symbol and criteria for conditions of use to identify a room, facility, and paths of travel that are accessible to and useable by people who are adversely impacted by airborne chemicals or particulate(s) and/or the use of electrical fixtures and/or devices. Installation and use of the Cleaner Air Symbol is on a voluntary basis in state buildings. The Committee learned that the Cleaner Air Symbol has yet to be implemented in California although members of our group are aware of individuals in California and in other states who are using the symbol as a means of advocating for or obtaining individual access needs.

The California Cleaner Air Symbol and Conditions of Use were also proposed for adoption at the meeting of the Accredited Standards Committee A117 on Architectural Features and Site Design of Public Buildings and Residential Structures for Persons with Disabilities in December 2001.(2) The Cleaner Air Symbol received a favorable vote. It was later dropped prior to the issuance of the final standard in 2003: International Code Council, American National Standard-Accessible and Useable Buildings and Facilities, ICC/ANSI A117.1-2003. The Cleaner Air Symbol is expected to be reintroduced for consideration during a new standard cycle that will begin shortly. The Standard must be adopted by a state or locality to be enforceable.

The Committee also discussed the identification of state buildings in California that might qualify for the Cleaner Air Symbol either due to a building's unique ability to meet the implementation criteria, or the need to make public meeting rooms accessible for those with chemical and/or electromagnetic sensitivities. Committee members are also aware of the need to encourage residents of California who may need to access state buildings to seek to implement the Cleaner Air Symbol.

Purpose:

To provide voluntary guidelines for a Cleaner Air Symbol that can be used nationally or adapted for state and local use.

Proposed Language:

National Cleaner Air Symbol: The national symbol shall be the standard used to identify a room, facility, and paths of travel that are more accessible to and useable by people who are adversely impacted by airborne pollutants, such as those with chemical sensitivities, asthma, and other respiratory conditions, and/or people who are adversely impacted by electromagnetic fields from electrical fixtures and equipment such as those with electromagnetic sensitivities.

The Symbol will comply with the specifications as described in the California code.

When the Cleaner Air designation symbol is used, the following requirements must be met:

- The symbol and text, "Cleaner Air" is displayed within a minimum 6-inch square;
- The "Cleaner Air" text is located under the symbol, as shown
- The Cleaner Air Symbol is shown as either a negative or positive image.
- The symbol and text are posted in either black and white, or in Federal Blue and white. When blue is used, Federal Blue Color No. 15090, Federal Standard 595B, is used.
- There is at least a 70% color contrast between the backgrounds of the sign and the surface that it is mounted on.

Conditions of Use

The Cleaner Air Symbol may be posted to identify the room and path of travel if there is verification that the room, facility, and path of travel to the room meet all of the Cleaner Air Requirements as indicated below:

- No Smoking
- Fragrance-Free
- Pesticide-Free (Indoors and Outdoors)
- Least Toxic/Risk Cleaning Products
- No Recent Construction or Remodeling Including Carpet Installation
- Cell phones turned off
- Ability to turn off or unplug computers and other electrical equipment by occupant or staff
- Ability to turn off fluorescent lighting by occupant or staff
- Ability to adjust temperature and air flow by occupant or staff, or the availability of operable window(s)

Paths of Travel

Every effort should be made to make the Paths of Travel as accessible as possible for those with multiple chemical and/or electromagnetic sensitivities even though the paths of travel might not meet all of the criteria of the Cleaner Air Room. It is important that the Path of Travel from the building entrance to the Cleaner Air Room be as short as possible. The building entrance should also be fully accessible to those with mobility and other impairments.

Restrooms

If possible, restrooms that are already fully accessible to those with mobility and other impairments should be designated for use by those individuals using the Cleaner Air Room. These restrooms should be located along the path of travel or as close as possible to the Cleaner Air Room. The restrooms should meet as many of the criteria as possible. The restrooms should prohibit smoking and be free of perfumes, fragranced products, air fresheners, deodorizers, and pesticides. Cleaning should be done with the same least toxic products used in the Cleaner Air Room. Cell phones should be turned off along the path of travel and in the restrooms.

Contact Information for the building/facilities manager or the designated agent responsible for maintaining and/or recording activity in the Cleaner Air Room should be posted at the Cleaner Air Room and at the accessible entrance, if possible, and be readily available to anyone seeking additional information by telephone, fax, e-mail, or mail.

Maintaining a Cleaner Air Record Log

A log shall be maintained on site, accessible to the public either in person or by telephone, fax, e-mail, mail or other accessible means as requested. One or more individuals shall be designated to maintain the log. The log shall record any product or practice used in the designated Cleaner Air Room, the path of travel, and accessible restrooms, as well as scheduled activities that may impact the Cleaner Air designation. The log shall also include the product label and Material Safety Data Sheet(s), as available, for any products used. Note, however, that neither the MSDS nor the product label provides complete information on product ingredients or their potential health effects.

Removal of The Symbol

If the path of travel, room and/or facility restrooms identified by the Cleaner Air Symbol should temporarily or permanently cease to meet the minimum conditions as set forth above, the Cleaner Air symbol shall be removed and shall not be replaced until the minimum conditions are again met.

Temporary Use of Cleaner Air Symbol

The Cleaner Air Symbol may be used to identify a room, path of travel, and restrooms that meet the conditions of use on a temporary basis.

Further Explanation of the Criteria for Conditions of Use:

No Smoking: Smoking is prohibited in the path of travel, Cleaner Air Room, and restrooms serving the room. To qualify as a Cleaner Air Room, the room, path of travel, restrooms and surrounding area must be free of tobacco residue. Those who smoke, or who have tobacco residue on their person, would be prohibited from using the room. Smoking should be restricted to outdoor, designated smoking areas that are at a minimum of 100 feet from paths of travel, entryways, operable windows, and air intakes. (See No Smoking Policy, Operations and Maintenance Report)

Fragrance-Free: Prohibit fragrance-emitting devices (FEDS), air fresheners, deodorizers, and similar products. Recommend that no fragranced, citrus-and/or pine-based products be used in cleaning or maintaining the room, path of travel, and restrooms. Any persons with perfume, cologne, aftershave, as well as fragranced personal care and laundry products, would be prohibited from using the room. (See Fragrance-Free Policy, Operations and Maintenance Report)

Pesticide-Free Indoors and Outdoors:

Practice Integrated Pest Management. Use least hazardous pest management materials such as non-volatile baits, sticky traps, and boric acid with knowledge and input from those using the path of travel and Cleaner Air Room. The sign should be removed in the event of a least hazardous pesticide application for 24-48 hours because it is likely that the certified pest control applicator is in regular contact with chemical pesticides and could leave residue from clothing or equipment. In addition, some chemically sensitive individuals may be made sick by exposure to even least hazardous pesticides especially when they are first applied.

In the event of a chemical pesticide application made to the building or grounds, other than a least hazardous pesticide such as those listed above, remove the sign and consult with those who use the space and others regarding the length of time that the room would need to be closed to protect affected populations based on the product(s) used. (See Operations and Maintenance for least hazardous pest management materials and cautions in the event that a chemical pesticide application is considered for use in the Cleaner Air Room, Path of Travel, Restrooms, or the building or grounds.)

Least Toxic/Risk Cleaning Products:

Avoid or limit the use of products containing chlorine, ammonia, quaternary ammonium, phenol, isopropyl and other alcohols, formaldehyde, and other petroleum distillates. Do not use fragranced, citrus-and/or pine-based cleaning products as mentioned above. Consult those who plan to use the Cleaner Air Room and Path of Travel for cleaning product recommendations. Follow the recommendations of Operations and Maintenance Report for best practices.

No Recent Construction or Remodeling Including Carpet Installation:

Every effort should be made to avoid remodeling activities in the Cleaner Air Room, path of travel, and restrooms. Any remodeling activity would require removal of the signage. The length of time for removal should be determined by the type of activity, extent of the remodeling, and the products and materials selected for use. It is important to choose the least toxic, least problematic products and practices. Except for minimal touch up painting, for example, it would not be unusual to have the signage removal in effect for a period of 3- 6 months to a year or more depending on the nature and extent of the remodeling activity. Be sure to consult building occupants with existing health problems and those who are using the Cleaner Air Room for their input and to help determine when the Cleaner Air Room may again be safe for use. (See Products and Materials Report and Design and Construction Report for more information)

Cell Phones Turned Off:

Protect those with electromagnetic sensitivities and others who may be adversely affected by electrical equipment.

Ability to turn off or unplug computers and other electrical equipment by occupant or staff:

Protect those with electromagnetic sensitivities and others who may be adversely affected by computers and electrical equipment.

Ability to turn off fluorescent lighting by occupant or staff:

LEED (Leadership in Energy and Environmental Design) recommendations for new construction call for individual control of lighting.(3) Newer fluorescents that contain electronic rather than magnetic ballasts may be less problematic for some people with electromagnetic sensitivities because they do not produce a visible flicker or audible hum. They are also less prone to trigger seizures.

Ability to adjust temperature and air flow by occupant or staff, or the availability of operable window(s):

LEED recommendations for new construction include individual control of temperature and ventilation.(3) Opening an operable window may improve the air quality or air flow in a Cleaner Air Room and compensate for situations when individual control of temperature and air flow is not possible.

The text below is duplicated on the website

RECOMMENDATIONS FOR ACCOMMODATIONS

People with chemical and/or electromagnetic sensitivities can experience debilitating reactions from exposure to extremely low levels of common chemicals such as pesticides, cleaning products, fragrances, and remodeling activities, and from electromagnetic fields emitted by computers, cell phones, and other electrical equipment.

The severity of sensitivities varies among people with chemical and/or electromagnetic sensitivities. Some people can enter certain buildings with minor accommodations while others may be so severely impacted that they are unable to enter these same spaces without debilitating reactions. Furthermore tolerances to specific exposures can vary greatly from one individual to the next. Meanwhile some exposures, such as the application of certain pesticides or extensive remodeling, for example, may be devastating to all chemically sensitive people and make a building or facility inaccessible for a substantial period of time.

According to the Americans with Disabilities Act (ADA) and other disability laws, public and commercial buildings are required to provide reasonable accommodations for those disabled by chemical and/or electromagnetic sensitivities. These accommodations are best achieved on a case-by-case basis.

Reasonable accommodations for a chemically sensitive and/or electromagnetically sensitive individual can include providing a space or meeting area that addresses one or more of the Cleaner Air criteria, upon request, such as

- Remove fragrance-emitting devices (FEDS)
- Delay or postpone indoor or outdoor pesticide applications, carpet cleaning, or other cleaning or remodeling until after the meeting
- Provide room or meeting area near exterior door or with window(s) that can be opened
- Require cell phones and computers be turned off
- Provide incandescent lighting in lieu of fluorescent lighting
- Provide at least one nonsmoking, fragrance-free person per shift to provide services (e.g. nurse, police officer, security guard, clerk)

For individuals who are unable to use or meet in a building or facility, or who are too severely impacted by chemical and/or electromagnetic exposures to use a designated Cleaner Air Room, accommodations may include:

- Meet an individual at the door or outside to conduct business
- Allow a person to wait outside or in car until appointment
- Provide a means, such as a phone, intercom, bell, or buzzer to summon staff to an outside door for assistance
- Permit business to be conducted by phone, fax, mail, or e-mail rather than in person
- Allow participation in a meeting by speakerphone

End duplicated text

SPECIAL ACKNOWLEDGEMENT: The Committee extends a generous thank you to Sharon Toji, Access Communications, for designing the Cleaner Air Symbol and making it available for public use.

REFERENCES

- 1) California Access Compliance Reference Manual, Division of the State Architecture, Chapter 11B Part 2 Title 24, California Code of Regulations 110 November 1, 2002.
- 2) American National Standards Institute (ANSI) Accredited Standards Committee A117, Committee on Architectural Features and Site Design of Public Buildings and Residential Structures for Persons with Disabilities, www.iccsafe.org/cs/standards/a117/index.html
- 3) LEED Green Building Rating System for New Construction & Major Renovation, (LEED-NC), Version 2.1, US Green Building Council, pages 68 and 69. www.usgbc.org
LEED Controllability of Systems:
6.1 Provide at least an average of one operable window and one lighting control zone per 200 SF for all regularly occupied areas within 15 feet of the perimeter wall.
6.2 Provide controls for each individual for airflow, temperature and lighting for at least 50% of the non-perimeter, regularly occupied areas.

RESOURCES FOR ACCESS AND ACCOMMODATIONS

Lamielle, M., Creating an Accessible Indoor Environment, Fact Sheet, National Center for Environmental Health Strategies, 2004.

Lamielle, M., Multiple Chemical Sensitivity and the Workplace, National Center for Environmental Health Strategies, 2004.

Temple, T., Healthier Hospitals, Ohio Network for the Chemically Injured, 1996.

Miller, CS, Ashford, NA, Multiple Chemical Intolerance and Indoor Air Quality. In Indoor Air Quality Handbook, Spengler, J, Samet J and McCarthy J, Eds., New York, McGraw-Hill, Inc., 2000.

Job Accommodations Network, a free service of the Office of Disability Employment Policy, U.S. Department of Labor, www.jan.wvu.edu

University of Minnesota, Disability Services, Internal Guidelines Regarding Multiple Chemical Sensitivity/Environmental Illness (MCS/EI), <http://ds.umn.edu/disabilities/MCSEIPolicy.html>

The Evergreen State College, policy on air quality, www.evergreen.edu/policies/g-air.htm

COMMITTEE

Active

Chair – Michael Mankin, Division of the California State Architect
Libby Kelly, Council on Wireless Technology Impacts
Mary Lamielle, National Center for Environmental Health Strategies
Ann McCampbell, Multiple Chemical Sensitivities Task Force of New Mexico
Susan Molloy, National Coalition for the Chemically Injured
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Mark Jackson, Lennox Industries, Inc.
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APPENDICES

Appendix A - 1117B.5.11 Cleaner air symbol (page 109) of the California Code of Regulations

1117B.5.11 Cleaner air symbol. “STRICTLY FOR PUBLICLY FUNDED FACILITIES OR ANY FACILITIES LEASED OR RENTED BY STATE OF CALIFORNIA. NOT CONCESSIONAIRES”. This symbol shall be the standard used to identify a room, facility and paths of travel that are accessible to and usable by people who are adversely impacted by airborne chemicals or particulate(s) and/or the use of electrical fixtures and/or devices. When used, the symbol shall comply with Figure 11B-40.

1117B.5.11.1 Color and size of symbol. The symbol shall be used when the following minimum conditions are met. The symbol, which shall include the text “Cleaner Air” as shown, shall be displayed either as a negative or positive image within a square that is a minimum of 6 inches on each side. The symbol may be shown in black and white or in color. When color is used, it shall be Federal Blue (Color No. 15090 Federal Standard 595B) on white, or white on Federal Blue. There shall be at least a 70% color contrast between the background of the sign from the surface that it is mounted on.

Strictly for publicly funded public facilities or any facilities leased or rented by State of California. Not concessionaires.

* In 1117B.5.8.1 (Symbols of Accessibility) the title of this section is incorrectly worded, which is causing misunderstanding regarding proper standard reference. Change title to read ‘International Symbol of Accessibility.’ This will be submitted for correction in Rulemaking.
CALIFORNIA ACCESS COMPLIANCE REFERENCE MANUAL . DIVISION OF THE
STATE ARCHITECT

1117B.5.11.2 Conditions of use. *Use of the cleaner air symbol is voluntary. The cleaner air symbol shall be permitted for use to identify a path of travel, and a room or a facility when the following is met.*

- 1. Floor or wall coverings, floor or wall covering adhesives, carpets, formaldehyde-emitting particleboard cabinetry, cupboards or doors have not been installed or replaced in the previous 12 months.*
- 2. Incandescent lighting provided in lieu of fluorescent or halogen lighting, and electrical systems and equipment shall be operable by or on behalf of the occupant or user of the room, facility or path of travel.*
- 3. Heating, ventilation, air conditioning and their controls shall be operable by or on behalf of the occupant or user.*
- 4. To maintain "cleaner-air" designation only nonirritating, nontoxic products will be used in cleaning, maintenance, disinfection, pest management or for any minimal touch-ups that are essential for occupancy of the area. Deodorizers or Fragrance Emission Devices and Systems (FEDS) shall not be used in the designated area. Pest control practices for cleaner-air areas shall include the use of bait stations using boric acid, sticky traps and silicon caulk for sealing cracks and crevices. Areas shall be routinely monitored for pest problems. Additional nontoxic treatment methods, such as temperature extremes for termites, may be employed in the event of more urgent problems. These pest control practices shall not be used 48 hours prior to placement of the sign, and the facility shall be ventilated with outside air for a minimum of 24 hours following use or application.*
- 5. Signage shall be posted requesting occupants or users not to smoke or wear perfumes, colognes or scented personal care products. Fragranced products shall not be used in the designated cleaner-air room, facility or path of travel.*
- 6. A log shall be maintained on site, accessible to the public either in person or by telephone, e-mail, fax or other accessible means as requested. One or more individuals shall be designated to maintain the log. The log shall record any product or practice used in the cleaner-air designated room, facility or path of travel, as well as scheduled activities, that may impact the Cleaner-Air designation. The log shall also include the product label as well as the *Material Safety Data Sheets (MSDS).*

1117B.5.11.3 Removal of symbol. *If the path of travel, room and/or facility identified by the cleaner air symbol should temporarily or permanently cease to meet the minimum conditions as set forth above, the cleaner air symbol shall be removed and shall not be replaced until the minimum conditions are again met.*

Appendix B – SOUTHWEST COMMUNITY HEALTH SYSTEM POLICY GUIDELINE

Southwest General Health Center (SWGHC)

Middleburg Heights, OH

EFFECTIVE DATE: July, 2002

POLICY 742

Revision Dates:

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POLICY NAME: MULTIPLE CHEMICAL SENSITIVITY SYNDROME (MCS)

POLICY:

Southwest General Health Center will provide guidelines to ensure optimal care of the patient experiencing Multiple Chemical Sensitivity (MCS) which is mutually established with the patient, family/significant other and health care team.

I. INTERPRETATION:

Multiple Chemical Sensitivity (MCS), also referred to as environmental illness or chemical injury is a medical condition in which individuals develop symptoms from exposure to very low level of chemicals in the environment. The interdisciplinary team at SWGHC uses a collaborative process with the patient, physician, family/significant other and the health care associates to establish a safe environment, to promote healing and ensure comfort.

II. OBJECTIVES:

An organizational approach to patient management with multiple chemical sensitivities includes:

- A. Method to ensure patient is placed in a safe environment.
- B. Method to facilitate identification of a MCS patient.
- C. Method to verify competency of all associates providing direct and supportive care to the patient with MCS
- D. Method to ensure patient's participation in developing their care plan.
- E. Method to ensure patient/their families/significant others are educated about the need to communicate about any special care required.

III. OVERSIGHT AND RESPONSIBILITY

A coordinated organizational program to care for MCS patients will be developed by an interdisciplinary team. This committee will have the responsibility for assuring that all provisions of this policy are adhered to throughout the organization. The team will have representatives from:

- A. Medical Staff
- B. Nursing Services
- C. Central Sterile Supply
- D. Protection Services

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- E. Nutritional Services
- F. Plant Operations
- G. Environmental Services
- H. SSA's
- I. Pharmacy
- J. Social Services
- K. Administration

IV. SPECIFIC ROLES AND RESPONSIBILITIES OF INTERDISCIPLINARY TEAM

- A. Medical Staff -Physician: Provides special instructions, treatments, diagnostic tests and medication orders. No treatments/medications should be administered to an MCS patient without prior approval of patient's private physician unless a life threatening emergency exists.
- B. Nursing Services
Role and responsibilities:
 - 1. Identify the patient with MCS
 - 2. Provide a safe patient care environment.
 - 3. Develop an awareness, sensitivity and respect of patients' physical and emotional needs.
 - 4. Develop a plan of care on daily basis with minimum of one staff member per each shift to attend medical needs of the patient.
 - 5. Comply with the following when caring for the MCS patient:
 - a) be perfume and scent free (ie., no hair spray, no mousse gels, lotions, cigarette/smoking smells).
 - b) Do not use aerosol products (ie hair spray, deodorants). Non-scented, potassium salts, pump deodorant is acceptable. Baking soda (dry).
 - c) Do not wear new clothing which has not been laundered.
 - d) Do not wear clothing which has been freshly dry-cleaned.
 - e) Use only latex free gloves
 - f) Wash hands and apply gloves before entering the patient's room.
 - g) Be alert for any environmental triggers when following normal hospital procedures.
- C. Central Sterile: Provides and ensures the unit with
 - 1. Latex free products
 - 2. Adequate supply of sterile linens

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3. Adequate supply of other medical core items (ie. Sponges, dressings, securing devices).
4. Patient can provide their own linens if other methods are not satisfactory.

D. Protection Services: Provides assistance from the vehicle to hospital in a safe manner. (Turn vehicle engines off)

E. Nutritional Services: Recognizes different food sensitivities and follows certain guidelines to accommodate and meet individualized needs of the MCS patient.

Special provisions may include but will not necessarily be limited to the following:

1. No processed foods of any kind including instant oatmeal, instant potatoes, and other

prepackaged mixes, ie., gravies, sauces, and flavor packets as they may contain many

additives.

2. Use no dyes, preservatives, sulfites, artificial flavoring or MSG.
3. Use no aerosol cooking sprays.
4. Use no artificial sweeteners.
5. Distilled water in glass containers to be provided by Nutrition Services, or patient may supply his/her own tolerated water for drinking.
6. Serve beverages which have not been processed with chemicals.
7. Nutrition Services will provide lactose free milk or a substitute such as soy or rice milk to those who require it.
8. Rigidly follow physician's orders regarding food restrictions.
9. Review food allergies within the food service to avoid allergic reactions.
10. Permit patient to supply his/her own tolerated food products. Nursing will provide a proper storage area for them.
11. Do not serve food or liquids in plastic or Styrofoam. Use only glass or ceramic dishes and cups which have been well rinsed to remove all traces of soap and chemical residues. Cellophane or plastic wrap packaging on room temperature food (i.e., crackers) is typically not a problem, however, caution must be used if toxic inks are used. Anything noticeably odorous can be a problem.
12. Remove treated i.d. menu paper from the tray and replace tray liners that may have become wet during transport.

F. Plant Operations: Plant Operations will not perform remodeling or painting within close proximity to MCS patient's room. These activities can be coordinated with the leadership of patient care area.

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- G. Environmental Services: will perform terminal cleaning.
1. Refer to Environmental Services Policy for MCS room cleaning.
 2. Staff will check with the floor nurse before entering the patients room.
 3. Environmental Services will coordinate with the patient's nurse for cleaning of the patient's room or performing any special cleaning tasks in the general area (i.e., floor waxing or floor wax removal in the halls). Whenever there is a question of what may affect the health of an MCS patient, the floor nurse must be consulted.
 4. Scented products, air fresheners, deodorizers or other additives should not be placed in any vacuum cleaner bag used anywhere in the health center. Use only unscented vacuum cleaner bags.
 5. Do not use any other housekeeping products (garbage bags, paper towels, cleaning solutions) which contain fragrances or pesticides. These products should be stored in an area separate from disinfectants, soaps and other cleaning products. Do not store toilet paper, facial tissues or other patient items near fragranced or pesticide products.
- H. SSA's: Will perform daily cleaning of the patient's room by using the following guidelines.
1. SSA's must wear clean gowns and caps when cleaning the room of MCS patient when patient is in the room.
 2. Do not use any other housekeeping products (any plastic bags, paper towels, cleaning solutions which contain fragrances or pesticides). Do not use any air fresheners or deodorizers in patient's room.
 3. Dust with a clean cotton cloth moistened with only water.
 4. Use baking soda or Bon Ami cleanser for tubs, sinks and toilet.
 5. Remove trash at least twice daily. Do not use plastic liners.
 6. Do not leave patient trays in the room after meals.

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I. Pharmacy

Provides pharmaceutical care guidelines to patient, family and health care team members. The following guidelines are helpful in providing medications to patients with MCS:

1. Have patient bring medications to the hospital that he/she is currently using. If the physician desires the patient to continue using these medications, an order shall be written to state such.
2. Use glass bottles for IV solutions and any prescription medications that are to be administered intravenously.
3. Do not use any substitutions or generic drugs for medications ordered without patient or MD approval.
4. Be alert for standard ingredients MCS patients typically react to including but not limited to dyes, preservatives, artificial sweeteners and flavoring. Consider capsules instead of tablets.
5. Monitor medication by listing the patient's specific allergies on the patient's medication profiles.

J. Social Services

Provides psychological support and interventions, assists patient and family with community resources and discharge planning.

K. Administration

Provides support and assistance in developing a safe environment for MCS patient.

PROCEDURE:

- A. Admitting will adhere to the following to assist all health care center personnel in caring for the patient:
- 1) Flag patient's chart clearly and boldly with MCS under the allergies.
 - 2) Flag patient's chart to notify all other health center departments in advance of treating the patient so proper precautions can be made for necessary equipment and special supplies.
 - 3) Indicate "MCS" on patient's allergy band.

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B. Emergency Department:

Will assist health care center personnel in diminishing any unnecessary discomfort and possible risks when MCS patient is brought into the Emergency Room. The following is initiated:

- 1) Immediately contact patient's physician for special instructions.
- 2) Immediately isolate patient from all other patients and visitors.
- 3) Place patient in an area which is not used to store any medical supplies or medications.
- 4) Keep a supply of sterile linens and gowns in the emergency room area.
- 5) Provide the least toxic pharmaceutical supplies and equipment.
- 6) Coordinate with all other health center departments to meet patients' needs.
- 7) Monitor the general environment the patient is placed in.

C. Patient's Room

Staff will implement numerous measures to prevent unnecessary exposure.

Prior to patient's occupancy:

- Contact Environmental Services for terminal cleaning of the room.
- Place new sharps container in the room
- Contact CSS for sterile linen.

During Patient's Occupancy:

- Patient should be isolated from other patients and their visitors at all times to prevent reactions to products these people are wearing or using.
- Place sign on patient's door stating: "Check at the nurses station before entering room".
- Keep patient's door closed at all times and if necessary provide a clean cloth to seal bottom of door from hall odors.
- Health care center personnel must wash their hands and apply hypo allergenic, non-latex gloves prior to entering the room of the MCS patient as these activities can trigger reactions in the patient.

SOUTHWEST GENERAL HEALTH CENTER
STANDARD OF PRACTICE

PAGE 7 OF 7	MULTIPLE CHEMICAL SENSITIVITY SYNDROME	POLICY 742
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- No live plants or flowers permitted in the patient's room (mold and pesticides trigger MCS reactions).
- No newspapers or treated paper permitted in patient's room. (3-part copy papers or chlorinated papers can be highly toxic and may affect breathing).

APPROVED:

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Appendix C – MULTIPLE CHEMICAL SENSITIVITY (MCS) PROTOCOL
 Southwest General Health Center (SWGHC)
 Middleburg Heights, OH

INITIATED	DISCONTINUED
Date	Date
Time	Time
RN	RN

SOUTHWEST GENERAL HEALTH CENTER
 NURSING SERVICES

MULTIPLE CHEMICAL SENSITIVITY (MCS) PROTOCOL

- PURPOSE:** To outline the management and nursing responsibilities caring for a patient experiencing multiple chemical sensitivity (MCS).
- LEVEL:** Independent
- SUPPORTIVE DATA:** MCS is an acquired chronic disorder characterized by recurrent symptoms occurring in response to low levels of exposure to multiple unrelated chemicals. The symptoms generally occur in one of four categories: central nervous system, circulatory, respiratory and mucous irritation or metabolic that would include enzymes, blood, kidneys, GI tract, etc.. Patient with a history of maladaptive reactions to chemicals found in perfumes pesticides, detergents, household cleaners, etc. may have or develop multiple chemical sensitivities. Approximately 75% of those affected are women, possibly due to endocrine disruption. People in their 30s and 40s are most strongly affected as well as children and others who are more susceptible to the effects of pesticides and products containing toxic chemicals. The population most strongly identified with this condition include: industrial workers, teachers, nurses, sick building occupants and those living in chemically contaminated communities. Refer to *Latex Sensitivity/Allergy Protocol* and *Hospital Policy #742 Multiple Chemical Sensitivity (MCS) Patient*.
- CONTENT:**
1. Identify individuals at risk on admission in Emergency Room or Admitting.
 - Prior to Admission* 2. Assign the patient to private room.
 3. Contact CSR for free tote (or nursing supervisor during night shift).
 4. Notify Environmental Services, Central Sterile, Pharmacy, Nutritional Services, and SSA of MCS patient admission.
 - Admission Assessment* 5. Assess all patients on admission for allergies and maladaptive reactions.
 6. Place green allergy band on patient; mark Multiple Chemical Sensitivity (MCS).
 7. Place sign on patient’s door stating:

“Check at the nurses station before entering patient’s room.”

***Admission
Assessment (cont’d)***

8. Enter Multiple Chemical Sensitivity on all the orders sent in Cerner in Comments Box.
9. Observe patient for following symptoms.
 - Fatigue
 - Memory loss
 - Depression
 - Nervousness
 - Lack of motivation
 - Visual problems
 - Hearing problems
 - Dizziness
 - Sleep disorders
 - Edema
 - Disorientation
 - Confusion
 - Irritability
 - Loss of logic sequencing ability
 - Loss of coordination
 - Hoarseness
 - SOB
 - Headache
 - Chest pain
 - Joint pain
 - Digestive difficulties
 - Sun or other rashes
 - Cold or heat sensitivity
 - Nausea
 - Tingling or numbness of extremities
 - Sinusitis
 - Pallor
 - Anemia
 - Salivation (usually from pesticides)

10. Refer to Latex Sensitivity/Allergy Protocol

Patient Care

11. Report signs and symptoms exhibited by patient to physician.
12. Obtain physician order for a special diet.
13. Encourage patient to select their own menu.
14. Allow patient to supply his/her own tolerated food products and dietary supplements.
15. Retain patients dietary requirements in the patient’s medical record for future reference.
16. Encourage use of personal respirator and other protection methods while in Health Care Center.

Patient Safety

17. Reinforce all hospital employees and visitors to check with patient’s nurse prior to entering patient’s room.
18. Maintain patient isolation from other patients and their visitors at all times.
19. Transport patient with R-95 mask or personal respirator.

***Patient Safety
(cont'd)***

20. Refrain staff caring for patient from wearing perfumes, scented lotions, hair spray, deodorants or other scented products.
21. Educate hospital staff to wash their hands with unscented soap.
22. Apply hypo-allergenic, non-latex gloves prior to entering the room.
23. Instruct patient's family not to bring plants or flowers to the patient's room.
24. Restrict newspaper in patient's room.

Patient Education

25. Discuss with patient/family Multiple Chemical Sensitivity if newly diagnosed patient.
26. Reassure the patient with understanding of their chemically sensitive condition.
27. Refer patient to Social Services to provide list of Community Services.

Documentation

28. Document Multiple Chemical Sensitivity in the patient's medical record, in the front of the chart, medication record and computer system.
29. Record implementation/modification/discontinuation of protocols.
30. Document vital signs and assessment findings on appropriate flow sheet.
31. Document evaluative statement of the patient's response to interventions and lack of complications.

***Emergency
Interventions***

32. If known, remove the offending object or person from patient's room.
33. If necessary, remove patient from room to fresh air outside the building.
34. Utilize charcoal and baking soda to absorb and remove odors from the room. Open windows if possible.
35. Refer to patient's personal emergency protocol for reducing and diluting chemical reactions (water, food, baking soda, tri-salts, etc.)

***Emergency
Interventions
(cont'd)***

36. Communicate and cooperate with the patient whenever possible as the patient generally knows what will help.

REFERENCES: Multiple Chemical Sensitivity Syndrome, September 1, 2000, American Academy of Fa.
Mental Health Network, Editorial: April 2000.
SWGHC Pharmacy
Temple, Toni, Healthier Hospitals, 1996.

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**National Institute of Building Sciences (NIBS)
Indoor Environmental Quality (IEQ) Project
Design & Construction Committee**

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INTRODUCTION

The Building Design & Construction Committee was charged with making recommendations for designing commercial and public buildings that would be more accessible for people with multiple chemical and/or electromagnetic sensitivities and provide healthier environments for all occupants.

The Committee found that major access barriers for chemically sensitive individuals are factors that contribute to poor air quality, such as pesticides, new carpets, tobacco smoke, inadequate ventilation, mold, certain building materials, and building activities that generate air pollutants. For electromagnetically sensitive individuals, access barriers include fluorescent lighting, unshielded transformers and wiring, security and scanning equipment and numerous other electrical appliances.

The recommendations that follow, therefore, focus on minimizing or eliminating these barriers through designing

- for pest prevention to reduce the need for or the use of pesticides,
- for preventing moisture and mold growth,
- for optimum ventilation via HVAC systems and operable windows,
- for exhausting air contaminants,
- for minimizing use of carpet and other flooring that emit volatiles, and
- for shielding occupants from electromagnetic fields.

Although many building materials can be problematic for chemically sensitive people, the Committee made minimal suggestions regarding product choices as this was the charge of the Building Products and Materials Committee.

Recommendations for Future Actions

The Committee recommends that the Access Board, NIBS, or other entity create a Design Manual using the outline in this report. This Manual would provide more detailed guidance than is provided here.

The Committee acknowledges that while the scientific evidence may be inconclusive about whether ambient electromagnetic fields pose a substantial health risk to the general population, the presence of EMF is an access barrier for people who are electromagnetically sensitive. Therefore, the Committee recommends that measures be taken to reduce EMF whenever possible in order to increase access for these individuals as well as taking a precautionary approach to protecting the health of all.

RECOMMENDATIONS

Site and General Building Design

Select site to minimize potential exposure to air and soil pollutants and electromagnetic fields (EMF). (Appendix 1)

Visit the site on several occasions to assess site criteria.

Note microclimate: wind direction, sun exposure.

Avoid sites near wetlands/stagnant water, low lying areas; sites should be well above 100 year flood plain.

To minimize moisture infiltration at the foundation, avoid earth berm construction and provide positive drainage from building.

Avoid below-grade occupied space.

Avoid tuck-under parking and indoor parking.

Roof gardens should be avoided because soil and water can foster mold growth. (Appendix 2)

Arrange drop-offs, loading docks, helicopter pads, and other vehicular access points to eliminate or minimize exhaust fumes from entering building directly or being drawn into the HVAC system.

Avoid the use of indoor plants because they can attract pests, stimulate pesticide use, trigger allergies, and foster mold growth.

If smoking on site is permitted, dedicate an outdoor location that is remote from entries, main pedestrian paths and air intakes.

Group and isolate uses within a building that emit contaminants and could affect air quality.

High ceilings are preferred in order to dilute contaminants.

Avoid decorative indoor fountains.

Enclosure

Design for a tight building envelope to maximize the performance of the HVAC system. Meet or exceed Energy Star leakage area (less than 1.25 s.i./100 sf. (Reference 1)

- Building should be able to be sealed off from exterior events that would raise outdoor pollutant levels such as, toxic spills, pesticide spraying, fires, traffic accidents, and rush hour traffic.

- Operable windows are preferred. Being able to open windows is an important access issue for chemically sensitive individuals and can be beneficial for other occupants in certain situations. Operable windows should be detailed to minimize air infiltration.

Design to prevent pest problems. (Appendix 3)

- Use inert pest resistant materials. When treatment of wood is required, treating with disodium octaborate tetrahydrate may be among the safer options.
- Incorporate pest barriers such as termite shields, window screens, and bird screens in construction details. Bird and bat droppings pose great IAQ risks.
- Some pesticides such as boric acid are considered environmentally safe. If used, granular or gel forms are preferred. Care should be taken to ensure that particles do not infiltrate interior habitable space.

Shield occupants from external sources of EMF. Windows with low e glazing, metal roof, and siding components may reduce certain interior EMF. (Reference 2)

Roof Design

- Pitched roofs are preferred, because they shed water quickly, clean the roof of pollutants and potential toxins, and are less prone to leakage.
- Inert roofing materials, such as coated metal or clay tile, are ideal. Note that galvanized metal presents a rust hazard and should be avoided.
- Flat roofs are not preferred. If used, membrane and high albedo (highly reflective to heat) type are recommended. Asphalt or modified bitumen built-up roofs are less preferable. (Reference 3)

Wall Design

- Use best design practices to prevent moisture and condensation within walls. Calculate dew points for each exterior wall (and roof) type to verify performance at each condition. Provide detail for all flashing and counter-flashing locations.

Foundation Design

- Provide under-slab vapor barriers, insulation, and damp-proofing to prevent moisture infiltration and condensation.

Protect stored building materials from water damage and mold growth.

Avoid use of water-damaged or mold-affected materials.

Plumbing, Mechanical and Electrical Equipment

Properly insulate pipes to prevent condensation, especially within walls.

Use modeling software to determine airflow and to ensure isolation of pollutant sources and adequate ventilation.

Ventilate areas occupied by people with chemical sensitivities with goal of eliminating odors (ideally entire building). These ventilation rates meet or exceed all worldwide standards. (Reference 4)

Provide local control of temperature and airflow (ideally for every occupant). (Reference 5)

Utilize Displacement Air Distribution method to move pollutants away from occupants.

Dedicate building as Smoke-Free. (Reference 6)

Isolate mechanical equipment from occupied areas.

Provide direct exhaust from rooms and areas that have pollutant-generating sources or activities. These include but are not limited to: (see Appendix 5)

- Bathrooms (code requirement).
- Kitchens or office kitchenettes (this is in addition to code-required hoods or stove exhausts).
- Copy and print rooms.
- Computer rooms.

Ductwork

- Avoid insulation inside ductwork. Use external insulation wrap of non-friable (airborne particle creating) material.
- Oil coatings used in fabrication of sheet metal stock can affect air quality. Prior to installation, thoroughly clean ductwork with a low VOC product. Use methods that do not leave residue or cause oxidation. (Reference 7)

Prohibit the use of fragrances and disinfectants in air distribution systems.

Maintain relative humidity between 30%-50%.

Locate outside air louvers away from pollutant sources.

Filtration (Reference 8)

- Carbon and HEPA filters are preferred.
- Avoid ozone generating air-purification systems.
- Avoid electrostatic air cleaning due to ozone.

In renovation work, re-evaluate HVAC system performance to ensure that original design standards are met.

Shield occupants from internal EMF. Design electrical systems to minimize EMF. Maximum recommended magnetic field levels of 2.5 milligauss (preferably 1 milligauss in occupied areas) and as low as technically achievable in areas to be occupied by people with sensitivities.

Finishes and Furnishings

Refer to Products and Materials Group report for specific recommendations on materials.

Floor Coverings

- Use inert materials wherever possible, such as, but not limited to:
 - Stone, tile, terra-cotta, brick, ceramic tiles,
 - Terrazzo,

- Sealed concrete.
- Minimize the use of carpeting. Note that carpet that meets Carpet and Rug Institute Green Label Plus standards can still be problematic for chemically sensitive people. (Appendix 4)
- Use carpet systems that allow for small area replacement, such as certain of the self-adhesive backing carpet squares.
- Avoid glue-down carpet installations or use low-VOC adhesives. (see Products & Materials Committee recommendations)
- Cork and linoleum may contain linseed oil and should be avoided. Rubber flooring can also pose problems for chemically sensitive individuals and should be avoided.
- Use low-or no VOC materials for all flooring. (Appendix 4)

Construction Related Activities for Renovations

Provide advance notice to all occupants of any upcoming renovation work.

Post signs to alert occupants of renovation work.

Provide alternate accessible locations for affected individuals when occupied space will be rendered inaccessible due to the renovation.

Physically isolate renovation work areas from occupied portions of building.

Isolate the HVAC system from renovation work.

Implement a dust-control plan that identifies work methods and cleanup procedures.

Provide negative pressure in area of renovation work.

Occupancy

Establish policies for renovation and chemical usage in lease agreements.

Designate a Smoke-Free building.

Leases should include language to ensure that occupant activity does not degrade original design standards and building performance.

Provide a list of areas and uses requiring separate exhaust air systems.

Designate areas free from use of cell phones, two-way radios, and wireless equipment.

Commissioning

Develop a commissioning plan that includes the items listed above.

After construction or renovation provide a minimum flush-out period of two weeks prior to occupancy.

Re-commission buildings periodically. Building use shall be taken into account when determining the re-commissioning schedule.

Exterior Landscaping

- Gardens (see Appendix 6)
 - Design gardens that can be maintained organically without pesticides.
 - Avoid plants with fragrances that may provoke allergies.
 - Exterior gardens and landscape should be free of all plantings that require pesticides, synthetic fertilizers, lime, or other chemical applications.
 - Use indigenous plant materials that are hardy, naturally pest-resistant, require minimal maintenance, and low water use.
 - Use xeriscaping principles.

APPENDICES

Appendix 1 - Site Selection: Potential Sources of Pollutants and EMF.

The Committee recognizes that few, if any, building sites are likely to be free of all the pollutant sources listed below. The recommendation is to minimize proximity to as many of these sources as possible in order to maximize outdoor environmental quality and hence indoor environmental quality.

Table A-1 Potential Sources of Pollutants and EMF

General (Air, Soil)	Engine Exhaust	Pesticides	Industrial/Commercial	EMF
Recognized area of poor air quality Smog Smoke (chimney, industrial, etc.) Superfund Sites Brownfields Landfills Hazardous waste sites Compost sites Underground storage tanks Floodplains Wetlands Filled-in wetlands Military bases	Heavy traffic Highways Interstates Diesel exhaust Airports	Agriculture (unless organic) Golf courses Mosquito spraying Parks & Forests Roadside spraying Dairies Chicken & hog farms Other intensive livestock operations	Refineries Mines Chemical plants Cement plants Power plants Manufacturing Logging/Pulp mills Incinerators Sewage treatment plants Gas stations Dry cleaners Other commercial sources that emit air pollutants (See Appendix 5 on Use and Occupancy)	Substations Cell phone towers Radio towers Transponders Transformers High tension lines Electrical distribution lines Radar installations Military bases Airports Electrical Transportation Power-generating dams

Appendix 2 - Roof Gardens

Roof gardens involve a range of potential issues related to moisture penetration and mold growth. Flat roofs are prone to pooling water and leaking. Foot traffic can cause or accelerate deterioration leading to leaking. Roof repair is more difficult under gardens. Plants may attract pests that subsequently encourage pesticide use. Planting soils can create dust. Plants can emit volatile fumes and pollen. Plants can drop leaves and fruit that rot and become moldy. Selected plants should be low allergen plants without strong fragrance (See Exterior Landscaping above). If used, roof gardens should be located away from air intakes, operable windows, and doors. Design should ensure that moisture will not penetrate the roof membrane or cause conditions of standing water.

Appendix 3 - Pest Prevention

Exterior Design:

Remove lights on or near building that may attract night-flying insects.

Maintain a plant-free zone of about 12 inches around buildings to discourage insects from entering.

Design weep-holes in window frames to prevent access by paper wasps. Design windows to prevent harborage and access for pests, without clear passageways to inside.

Correct structural features that provide opportunities for bird roosting and nesting.

Avoid locating decorative lattices over entrances to food services facilities that may inadvertently serve as bird roosts.

Install bird-proof barriers that are designed to prevent both pigeon and sparrow access to preferred nesting sites.

Design exterior light fixtures so that birds cannot roost or nest on or in them.

Fit eave roof tiles with bird stops (that will also exclude bats, bees and wasps).

Correct structural features that provide opportunities for rodent harborage and burrowing.

Screen or otherwise eliminate animal access under decks, porches, stairways. Seal porches and ramps to the building foundation with ¼-inch hardware cloth screen mesh to form a barrier to digging pests such as rats and skunks. This screen must extend 12 inches into the ground and must have a right-angled, 6 inches wide, outward extending shelf to prevent burrowing under the screen.

Screen ventilation louvers with ¼-inch hardware cloth screen mesh to exclude birds, rodents, cats, etc., (coordinate with mechanical requirements).

Maintain a 2-foot pea gravel strip around buildings to prevent rodent burrowing.

Use a 3" layer of sand barrier underneath slab construction. Use 1-3 mm particle size in place of unsifted sand to provide a permanent sand barrier to termites (both western subterranean and Formosan termites). This will prevent termites from penetrating cracks in slab construction.

For wood not in contact with the ground or concrete, use wood pre-soaked in disodium octoborate tetrahydrate.

Refuse and Recycling Areas:

Place outdoor garbage containers, dumpsters, and compactors on hard, cleanable surfaces and away from building entrances (at least 50 feet from doorways). Design site with properly graded concrete or asphalt pads to help prevent rats from establishing burrows beneath them.

Design site with solid enclosure that extends all the way to the ground. Use metal or synthetic materials, as opposed to chain-link, wood, etc. to prevent rodents from gnawing and climbing the enclosure.

Design trash storage areas that can be closed off from the rest of the building.

Locate storage areas for boxes, paper supplies, and other materials in areas separate from where food or trash is stored. When stored together, these materials put food and shelter together, attracting pests.

Landscaped Areas

Choose proven performers, plants known to do well in the intended planting area. Avoid plants with history of pest problems. Use resistant plant species and cultivars when available. Check with your university or cooperative extension service for recommendations.

Give preference to plants that shed a minimum of seeds and fruits, that may attract and support insects, rodents, and undesired birds.

Design with diversity. Include a wide variety of plants in the landscape to reduce the pest damage potential.

Provide a properly prepared site. Site selection is critical; the site must be compatible with the plants' requirements.

Design landscaped areas with flexibility to allow for campus additions, which may change drainage, exposure to sunlight, ventilation, or other plant requirements.

Avoid crowding of landscape plantings.

Group plantings with similar cultural requirements.

Install or retrofit fence lines and other turf or landscape borders with concrete mowing strips.

Avoid planting vegetation directly against buildings as this provides shelter and sheltered runways for rodents. For the same reason, avoid planting dense vegetation that completely covers the ground.

Do not plant vines which climb building walls, as these create runways for rodents and harborage for undesired bird species.

Plant trees away from buildings to prevent easy access to buildings for insects and rodents.

Give careful consideration to placement of deciduous trees. Leaves which accumulate along foundations provide harborage and sheltered runways for rodents.

Interior

Food Preparation and Serving Areas (main kitchen, dining room, teachers' lounge, snack area, vending machines, and food storage rooms):

- Ensure that new kitchen appliances and fixtures are of pest-resistant design, i.e., open design, few or no hiding places for roaches, freestanding and on casters for easy, thorough cleaning.
- Provide space under and around appliances and equipment in kitchen areas to allow maximum ventilation and ease of (steam) cleaning.
- Use coving at floor-to-wall junctures to minimize build-up of debris and to facilitate cleaning.
- Slope floors in kitchen areas to provide good drainage after cleaning.
- Do not install pegboard in kitchens, animal rooms, or laboratories.
- Insure that all pipe insulation has a smooth surface and that there are no gaps between pieces.
- Refrigerate trash/recycling storage rooms.

Classrooms and Offices

Ensure that new office and classroom furniture that is rarely moved (e.g., staff desks, bookcases, filing cabinets) is designed to permit complete cleaning under and around the furniture, or to allow ready movement for cleaning purposes.

Design or retrofit construction to provide adequate ventilation, preventing trapped moisture and condensation.

Storage Areas

Equip area with self-closing doors.

Building Perimeter

Seal all plumbing and electrical service entrances.

Keep doors closed tightly; equip doors with self-closures and door sweeps.

Appendix 4 - Carpet

Stone, terra cotta, granite, marble, terrazzo, ceramic, brick, or sealed concrete flooring is best tolerated by individuals with chemical sensitivities. Wood flooring that has not been recently stripped or refinished is also often well tolerated by people with chemical sensitivities.

Carpet systems contain a myriad of chemicals in their fiber, dyes, backing, padding, bonding agents, adhesives, antimicrobials, flame retardants, and stain resistance, anti-static, and color fast agents. They also are reservoirs for tracked-in pesticides, dust, dust mites; foster mold growth; and absorb and reemit volatile organic chemicals like fragrances and

paint fumes. In addition, many solvent-based agents used to clean carpets emit toxic fumes.

The Carpet and Rug Institute (CRI) has established a rating system and testing program (Green Label Plus) that may be used in lieu of the emissions testing criteria of California's Collaborative for High Performance School (CHPS) Section 01350 (See Products & Materials Committee).

Some people with chemical sensitivities have found that carpet squares with self-adhesive backing have been the best tolerated new carpeting. Others have reacted adversely to such products. More research is necessary to determine what factors in these carpets and/or which brands are best tolerated.

Older carpets are usually better tolerated by people with chemical sensitivities than new ones, as long as they have not become moldy.

Recommendations regarding carpeting (design, materials, and O&M issues):

- Minimize the use of carpeting.
- Use area rugs in place of carpeting whenever possible.
- Consider using self-adhesive carpet squares.
- Tack rather than glue down (unless using self-adhesive carpet).
- If glue down, use low or no VOC adhesive.
- Air out carpet for at least two weeks prior to installation.
- Exceed building flush-out of two weeks if possible.
- Reduce the need for and the frequency of carpet replacement through good maintenance (e.g., thorough vacuuming and frequent cleaning with low toxic products and procedures -- see recommendations by O&M).
- Minimize amount of carpet that is replaced, limit replacement to damaged areas. (A major advantage of carpet square systems is that smaller sections can be replaced).

Appendix - 5 Use and Occupancy

Non industrial businesses/activities that may generate chemical pollutants include, but are not limited to:

Hair and Nail Salons	Dry Cleaners	Labs (eyeglasses, medical, etc.)
Spas	Laundromats	Dental offices
Restaurants	Nurseries (Plants)	Dialysis Centers
Grills & BBQ	Landscaping, Pest Control	

Furniture stores	Florists	
Woodworking and crafts shops	Candle/Soap/bath shops	
Art/Pottery studios	Pet Shops	
Auto Parts	Photo/Printing/Copy shops	
Taverns/Bars	Specialty foods stores	
Tobacco Shops	Leather goods stores	
Tattoo Parlors	Perfume shops or departments	

Areas that should be vented directly to the outside include: kitchens, labs, computer rooms, copy/fax areas, printer or blueprint rooms, storage areas for toxic materials, showers, locker rooms, and areas where animals are present.

Appendix 6 - Landscaping

Use low allergen plants (See Ogren Plant Allergy Scale).

Plant female trees and shrubs (they do not produce pollen).

Avoid the use of plants that have strong fragrances, such as jasmine, lavender, peppermint, and roses.

Avoid or minimize lawn/turf areas to reduce mowing emissions and chemical usage.

Use low growing fine fescue, buffalo grass, or other turf grass which requires little or no mowing.

Use a wide variety of plant materials.

Group plants with similar water and cultural needs.

Do not crowd plants.

Leave gaps in groundcover to create less hospitable habitat for pests.

Plant deciduous shade trees on the south and west sides of buildings. The shade reduces interior temperatures and reduces A/C usage during summer months.

Use low or no VOC paints, stains and finishes on outside equipment including benches, poles, decks, and other outdoor equipment (See recommendations from Building Products & Materials group.)

Avoid organic mulches (cocoa beans, peat moss, bark, wood chips) as they emit volatile fumes and may harbor mold.

Avoid railroad ties as they contain creosote.

Utilize stone, clay, concrete, and other hard, non-volatile materials to create borders and frame gardens.

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Reference 1

ASHRAE Fundamentals Handbook, 2001, 25.19:

<http://www.infiltec.com/inf-larg.htm>

<http://www.argonair.com/pdf/Myth%20About%20Bldg%20Env.pdf>

Reference 2

P.Levallois, et al., “Prevalence and Risk Factors of Self-Reported Hypersensitivity to Electromagnetic Fields in California” and “An Evaluation of the Possible Risks from Electric and Magnetic Fields (EMF) From Power Lines, Internal Wiring, Electrical Occupations and Appliances.”

<http://www.dhs.ca.gov/ps/deodc/ehib/emf/RiskEvaluation/Appendix3.pdf>

Case study for EMF control (Research Triangle)

http://www.ncgreenbuilding.org/site/ncg/public/show_project.cfm?project_id=120

“EMF reduction: The team reviewed available literature on EMF and their threat to health and determined that while EMF radiation could be measured, its threat to humans had not yet been proven or disproved. Nevertheless, the team recommended adopting a philosophy of prudent avoidance toward EMF risks and undertook modifications of the building design to reduce occupant exposure. EMF radiation can be mitigated by distance and by shielding. Distance offers maximum protection and is “low-tech,” while the costs associated with shielding are high and the results are difficult to measure. Consequently, the design team chose to create “buffer zones” to reduce prolonged exposures in portions of the building that are occupied for long periods of time, such as the laboratories and offices. The largest sources of EMF were identified as the building’s transformers, the electrical rooms with their many cables, and the electrical conduit that was routed under the building atria. As a first step circulation and utility spaces were used to maximize the separation between a source and any potential receptors.”

Reference 3

Fumes from activities involving the installation and repair of modified bitumen roofs.

<http://environmentalchemistry.com/yogi/chemicals/cn/Asphalt%20fumes.html>

Reference 4

Chapter 59, Indoor Air Quality Handbook CFD (Computational Fluid Dynamics) Method for indoor Air Quality Studies. Qingyan Chen, Leon Glicksman, MIT

Reference 4

Ventilation rate to remove odors falls between 14-50 (l*s)/person or 28-100 cfm depending upon the type of odors to be removed. Ventilating to remove odor will exceed all requirements for Ventilation rates for human comfort.

(Levin, *Indoor Air Quality Handbook*, McGraw-Hill table 60.2)

ASHRAE 62.1-2004 Ventilation for Acceptable Indoor Air Quality

Reference 5

LEED™ 6.1, 6.2 Controllability of Systems

- Provide one operable window and one lighting control zone per 200sf of area within 15' of an exterior wall.
- Provide controls for each individual for airflow, temperature, & lighting

ASHRAE 55-1992 Addenda 1995 Thermal Environmental Conditions for Human Occupancy

Recommend maximum of 60% RH

ASHRAE 55-2004 Thermal Environmental Conditions for Human Occupancy

(based on satisfactory thermal comfort for 80% of people. 71d in winter, 76d in summer.)

Reference 6

LEED™ Prerequisite 2.0 ETS (Environmental Tobacco Smoke) control

www.epa.gov/iaq/pubs/etsbro.html

Reference 7

LEED™ Credit 3.1 SMACNA (Sheet metal and air conditioning National Contractors Association) IAQ Guidelines for Occupied Buildings under Construction.

Reference 8

Air Filtration

<http://www.epa.gov/etv/centers/center10.html>

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ATSDR Toxicological Profiles Agency for Toxic Substances and Disease Registry
<http://www.atsdr.cdc.gov>

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EMF

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http://vitatech.net/q_a.html

<http://www.emf-meter.com/emf-exposure-limits.htm>

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Terry Brennan, Camroden Associates, Inc.

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**National Institute of Building Sciences (NIBS)
Indoor Environmental Quality (IEQ) Project
Building Products & Materials Committee**

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Introduction

The goal of the NIBS – IEQ Products & Materials Committee was to develop procedures and guidelines to aid persons in making informed material selections in order to construct a building that will be accessible to persons with multiple chemical sensitivities (MCS) and/or electromagnetic sensitivities (EMS). The NIBS IEQ-Materials Committee has reviewed existing standards and guidance for materials selection in building construction. The group has determined that certain features of the existing standards offer a reasonable starting point for the selection of building materials, and in some respects can offer a more accessible environment to persons with MCS and/or EMS. These existing standards are designed to create healthier indoor air quality by making appropriate building material selections, among other things. Though the existing standards may not result in material selections that will make a building accessible to the majority of persons with MCS and/or EMS, they will produce a healthier building, than one constructed without regard to these standards. Healthier buildings would be useable by people with other health conditions such as asthma and other respiratory conditions, allergies and migraine headaches.

The NIBS IEQ Materials Committee has attempted to take the best ideas or practices from the existing standards and guidelines to recommend material selections that will provide for healthier, more accessible buildings. If a designer follows the suggestions provided herein, it will result in a building that has the lowest chance of IEQ problems stemming from the materials and that has the best likelihood of being accessible to persons with MCS and/or EMS.

The standards reviewed by the Materials Group include:

- Collaborative for High Performance Schools (CHPS) Section 01350
- Green Guard Environmental Institute - Certification Standards for Low Emitting Products for the Indoor Environment
- Green Seal – Environmental Standards
- Green Guidelines for Healthcare – Materials and Resources
- Reducing Occupant Exposure to Volatile Organic Compounds (VOCs) from Office Building Construction Materials: Non-Binding Guidelines - California Department of Health Services

Two of the key elements involved in the materials selection process are a component content screening (what chemicals and compounds are known to be a part of the material) and an emissions testing protocol. Both the California Section 1350 Specification and the Green Guard Standards recommend emissions testing based on the ASTM Method ASTM standards D-5116-97 and D- 6670-01. The Committee believes that both of these elements must be involved in making appropriate building material selections.

Overview - Design

The Products & Materials Committee believes that particular attention is critical during building design to assure that the needs of chemically and electromagnetically sensitive people are accommodated to the greatest extent possible. In general, this means selection of construction materials that are low-emitting or non-emitting and selection of finishes that do not absorb or react with chemicals emitted by other materials or products in the building. To begin to address some of the concerns of electromagnetically sensitive persons, areas of the building can be designed to have reduced electromagnetic fields. By making indoor environments that are safer for the most vulnerable among us, we can create indoor environments that are healthier for everyone, especially children.

Generally, this means selection of materials that are “hard” or non-porous where possible so that any chemicals that contact these materials are not retained in and re-emitted from them. Also, particular attention should be paid to selection of materials that will not require VOC-emitting chemicals later as part of maintenance. For instance, in designing building foundations and structures, particular attention should be paid to the need for preventing termite problems, since the pesticides commonly used to control termites can have a deleterious effect on humans, especially persons with multiple chemical sensitivities. So, even though the material itself might be low-emitting, the use of products meant to “preserve, protect, or maintain” the material selected might emit volatile fumes that degrade indoor environmental quality and result in a building that is not suitable for persons with MCS.

In addition, during building design particular attention must be paid to choice of electrical appliances, equipment and products that may produce higher than necessary electromagnetic fields. The NIBS-IEQ Materials Committee recognizes that there are selections that can be made during building design and construction that can provide a more healthful environment for persons with electromagnetic sensitivities. A few of these considerations are:

- Incorporation of a foil vapor barrier or other metal shielding feature into the walls around electric equipment can reduce certain electromagnetic fields.

- Wireless (“bluetooth” type) connections should be avoided, or areas of their use should be "contained" by using foil-backed drywall or other incorporation of a foil or metal barrier.
- New construction should use twisted metal clad wiring and/or twisted wire placed in metal conduit.
- Fiber optic connectivity is preferred for computer networks communication because these data lines may be run without concern for stray emissions.

Overview – Building Operations and Maintenance

Vigilance is required to assure that materials brought into the building throughout the course of its life are consistent with the standards provided herein, and are consistent with the design intent of the building.

For example, the Products & Materials Committee realizes that building operations and maintenance products might introduce materials that are not consistent with the initial design for an accessible, healthy building.

Building managers must also pay close attention to materials brought into the building environment by tenants or others to assure that these materials are consistent with provision of an accessible, healthy building for persons with multiple chemical sensitivities, electromagnetic sensitivities, and/or other health disorders. For instance, a tenant may bring furniture in that does not meet the design criteria presented in this document, and these materials could have detrimental effects on air quality within the entire building, depending on the design of the HVAC system. In addition, the chemicals and compounds used for maintenance can degrade environmental quality and seriously affect persons with multiple chemical sensitivities. Other products that can have detrimental effects on IEQ and/or certain individuals include paints and other finishes, carpeting, appliances and other electrical equipment, and others.

CHPS Section 01350 Part 1.3B and 1.4D and GREENGUARD Allowable Emission Levels

The NIBS – IEQ Products & Materials Committee believes that the CHPS Indoor Air Quality Emissions Testing Standards and the Green Guard Allowable Emission Levels offer tested and reviewed approaches to material and product selection for buildings. Given the range of guidance and standards available for material selection, these two standards provide the most widely accepted processes for making material selections to construct buildings that are healthier for the general public. It should be noted that the NIBS –IEQ Products & Materials Committee does not believe that either of these standards offers an entirely acceptable solution for persons with MCS and EMS. However, they provide a starting point in making material selections, and they provide the best available guidance on component screening and materials emission limits. Making materials selections that meet either the CHPS or the Green Guard allowable emission levels should be considered an absolute minimum requirement in creating a building or environment that is accessible to persons with MCS and EMS. No designer or other person making material selections should choose any materials that do not at least meet these standards. Even then, the other considerations discussed herein should be a part of the selection process to provide the best

opportunity that the building will provide an environment accessible to persons with MCS and EMS.

The Green Guard Certification Standards list allowable emissions for a range of building products. A designer or other individual making a material selection must investigate product literature, for the material under consideration, to determine if the product meets at least the Green Guard standards. The Green Guard web site lists products that have been tested and have met their standards. However, it is possible that a product manufacturer has not submitted their product for certification to either Green Guard or CHPS. In this case, the person making a material selection must seek any published emissions testing data and product component data available from the manufacturer. Some manufacturers publish data on emissions from their products, and other manufacturers are moving quickly to provide such data. If such data is not currently published, the manufacturer must have the product or material tested in accordance with the testing regimen specified in the Green Guard or CHPS 01350 Certification Standards.

The CHPS Section 01350 protocols and the Green Guard Certification for IAQ data require the same chamber testing. The CHPS protocols and calculations go further than the Green Guard Certification Standards in that the designer is required to take published emissions rates and perform calculations based on the amount of material to be installed in the building and the zones and air handling capabilities of the HVAC systems in those zones. Also, the allowable emission level for formaldehyde is lower in the CHPS standard than the Green Guard standard. See the discussion below for more information on formaldehyde.

For both standards, all building materials are required to be tested in dynamic environmental chambers following ASTM standards D-5116-97 and D-6670-01, the U.S. Environmental Protection Agency's testing protocol for furniture and the State of Washington's protocol for interior furnishings and construction materials. Products are measured for emission levels according to the parameters set forth in the ASTM Standard for emissions testing.

California - Practice for Testing of VOC's from Building Materials Using Small Chambers

<http://www.dhs.ca.gov/ps/deodc/ehlb/iaq/VOCS/Practice.htm>

The allowable emission levels of both standards can be found by clicking on the links below. In some cases, the Green Guard standards may appear to have lower standards for emissions of some VOCs than the CHPS Section 1350 standards. However, the person selecting materials for the building must bear in mind that the CHPS standard requires a detailed calculation for the building, the amount of material to be installed and the air change rate of the HVAC systems. Green Guard emissions standards are based on a "standard" model of a building, and a "standard" exchange rate of fresh air in the building.

CHPS Section 01350 http://www.chps.net/manual/documents/Sec_01350.doc

CHPS Compliant Materials Table http://www.chps.net/manual/lem_table.htm

Green Guard Allowable Emission Levels

<http://www.greenguard.org/DesktopDefault.aspx?tabindex=3&tabid=16>

Green Guard Certified Product Guide

<http://www.greenguard.org/DesktopDefault.aspx?tabindex=1&tabid=12>

Additional Resources

California Department of Health Services IAQ Program Voluntary Guidelines for Reducing Occupant Exposure to VOCs

http://www.dhs.ca.gov/iaq/VOCS/VOC_guidelines_1996.html

California Materials Emissions Study

<http://www.ciwmb.ca.gov/Publications/default.asp?pubid=1027>

U.S. EPA Indoor Environment Program web site -- VOCs

<http://www.epa.gov/iaq/voc.html>

Formaldehyde

Formaldehyde is widely used by industry to manufacture building materials and numerous consumer products. It is also a by-product of combustion and certain other natural processes. Formaldehyde, by itself or in combination with other chemicals, serves a number of purposes in manufactured products. For example, it is used to add permanent-press qualities to clothing and draperies, as a component of glues and adhesives, and as a preservative in some paints and coating products.

In building materials, the most significant sources of formaldehyde are likely to be pressed wood products made using adhesives that contain urea-formaldehyde (UF) resins. Pressed wood products include: particleboard (used as sub-flooring and shelving and in cabinetry and furniture); hardwood-veneer plywood paneling (used for decorative wall covering and used in cabinets and furniture); and medium density fiberboard (used for drawer fronts, cabinets, and furniture tops). Medium density fiberboard contains a higher resin-to-wood ratio than any other UF pressed wood product and is generally recognized as being the highest formaldehyde-emitting pressed wood product.

Other pressed wood products, such as softwood plywood and flake or oriented strandboard, are produced for exterior construction use and contain the dark, or red/black-colored phenol-formaldehyde (PF) resin. Although formaldehyde is present in both types of resins, pressed woods that contain PF resin generally emit formaldehyde at considerably lower rates than those containing UF resin.

The NIBS – IEQ Products & Materials Committee is concerned about human exposure to formaldehyde, especially for individuals with multiple chemical sensitivities. The widespread use of formaldehyde, its known health effects, and the hyper-sensitivities of certain individuals create this concern. It may not be possible to make material selections that are completely free of formaldehyde, but where possible, the individual making material selections should make every effort to avoid products manufactured with formaldehyde. New soy-based adhesives are coming on to the market to replace formaldehyde resins used in many manufactured wood products. It may soon be possible to choose alternative products that are not formulated with this volatile organic compound (VOC).

The California Office of Environmental Health Hazard Assessment has determined that the lowest, reasonably achievable level of formaldehyde (because it is equal to ambient air

concentrations) is 33 (milligrams per cubic meter) ug/m^3 , or 23 (parts per billion) ppb. Thus, the CHPS 01350 standard requires that a material must not emit a level of formaldehyde that results in a concentration of $\frac{1}{2}$ of this level, or $16 \text{ ug}/\text{m}^3$ (11 ppb). This limit is lower than the allowable emission level of the Green Guard standard. The NIBS – IEQ Products & Materials Committee believes that the $16 \text{ ug}/\text{m}^3$ (11 ppb) level is a minimum requirement for formaldehyde emissions from building materials.

Following is a list of typical building materials and some considerations for selection. Note that the considerations listed below are in addition to the recommended emissions standards from CHPS 1350 and Green Guard.

Adhesives and Sealants

One objective of the IEQ-Products & Materials Committee is to reduce the quantity of indoor air contaminants created by adhesives and sealants that are potentially irritating and/or harmful to occupants of buildings. The use of VOC-emitting adhesives and/or sealants should be minimized to the greatest extent possible in order to create an accessible, comfortable environment for the greatest numbers of people.

The designer should specify application of only the minimum amounts of these materials necessary for satisfactory completion of each installation task. Additionally, the designer should select products that have the lowest possible VOC emissions, according to the emissions testing information provided, while still meeting other performance requirements. Caution should be exercised when interpreting adhesive emission data because such data are usually provided without the associated installed products (e.g., flooring materials) and emissions from installed assemblies may differ from manufacturers' reported adhesive emission rates. If possible, adhesives that contain formaldehyde should be avoided.

The Committee also recommends that paints and finishes be selected that do not contain biocides.

In any building where adhesive use is necessary, it is a good practice to ensure that maximum ventilation is supplied during and after application of these products.

Appliances

Appliances can emit volatile fumes as well as create electromagnetic fields.

Electromagnetic fields and radiofrequencies can jeopardize the functioning and safe access of electromagnetically sensitive individuals. Examples of indoor appliances which can provoke health problems include:

- cell and portable telephones,
- fluorescent lights,
- unshielded transformers and wiring,
- battery re-chargers,

- wireless devices including computers and personal communication services (“PCS”),
- security and scanning equipment,
- numerous common work place and household electronic appliances.

Many electrical appliances and equipment can be improved to varying degrees by appropriate shielding, and/or by being located in areas remote from vulnerable individuals.

It is not recommended that such equipment be eliminated from the built environment, but that exposure of vulnerable individuals to such equipment be voluntary or easily avoidable.

Ceilings

Of particular concern to the NIBS-IEQ Products & Materials Committee are T-bar suspended ceilings used as return air plenums in buildings, because both sides of the panels come in contact with indoor air. In addition, penetrations for sprinklers, alarms, and smoke detectors may significantly increase the area exposed to emissions. Temperatures near ceiling surfaces and in return air plenums are usually higher than those in occupied zones and, as a result, increased emissions from ceiling materials may occur. The individual selecting ceiling materials should carefully consider the acoustic, fire, and aesthetic requirements for each space prior to material selection. Nonporous materials are now available that combine aesthetic, acoustical, and fire code requirements.

Ceiling materials that contain organic materials present the possibility of mold contamination if the ceiling system becomes wet. Porous ceilings and ceiling finishes can also act as receptors for toxins and VOCs that are brought into the building and later re-emit them. Many ceiling tile products are made using urea formaldehyde. No products using urea formaldehyde should be allowed.

Composite Wood Products (plywood, particle board, OSB, paneling, etc.)

Because they emit formaldehyde and other VOCs, use of composite wood products should be minimized, if not eliminated. If it is absolutely necessary to use such products, the designer should select materials that meet the specified building criteria and are the lowest emitting products available according to emissions testing data. Formaldehyde emissions are of particular concern in composite wood products. Note that VOC-emitting wood preservatives may be used in some of these products. There are a number of manufacturers that are replacing formaldehyde adhesives in composite wood products with non-emitting adhesives and the Committee recommends using these alternative products whenever possible.

Fireproofing

The use of fireproofing chemicals should be minimized when possible. Spray-on fireproofing can cause indoor air quality problems when chemical components are released into the air as a result of mechanical damage, air erosion, or deterioration of the binder. Also because spray-on materials have large, porous surface areas, they can act as sinks for adsorption and re-emittance of VOCs. If possible, seal the surface of spray-on fireproofing to reduce adsorption of VOCs. Ensure that the sealer: (a) will not change fire characteristics of the original fireproofing material; and (b) is not a high-VOC emitter. Also seal any

penetrations of surfaces sprayed with fireproofing material to prevent damage of the material in the vicinity of penetrations.

Flooring and Floor Systems

The NIBS-IEQ Products & Materials committee recommends use of flooring products that are low or non-emitting and are non-porous. Consideration should also be given to maintenance products that will be necessary for the type of flooring selected. For instance, stripping and refinishing of wood flooring introduces hazardous chemicals into the air and are intolerable for persons with multiple chemical sensitivities. When selecting a floor system, the type of adhesives used with the flooring system must also be considered.

Stone, terra cotta, granite, marble, terrazzo, ceramic, brick, or sealed concrete flooring are best tolerated by individuals with chemical sensitivities, and provide a healthy, comfortable environment for the greatest number of people.

Wood flooring that has not been recently stripped or refinished and older vinyl flooring is also often well tolerated by people with chemical sensitivities.

Rubber, linoleum, and cork flooring are not recommended.

The Resilient Floor Covering Institute (RFCI) has recently introduced a new certification program for low emitting flooring products called the FloorScore™ program. The FloorScore program is a building materials emissions testing program that requires both independent laboratory testing and third-party certification to show compliance with CCHPS 01350 VOC emissions limits and includes certified site audit and documented control system requirements. The third-party certifier, Scientific Certification Systems, Inc. (SCS), not only reviews the results of the product VOC emissions report but also reviews raw material inputs and manufacturing processes to ensure that a product is consistently manufactured. SCS conducts site audits of manufacturing plants to ensure a quality management plan exists for continuing compliance of the product as defined in SCS-EC-10-2004 Environmental Certification Program – Indoor Air Quality Performance.

Resilient Floor Covering Institute – “Floor Score” Program

http://www.rfci.com/int_FloorScore.htm

Floor Score List of Certified Products

http://www.rfci.com/int_FS-ProdCert.htm

Carpet systems contain a myriad of chemicals in their fiber, dyes, backing, padding, bonding agents, adhesives, antimicrobials, flame retardants, and stain resistance, anti-static, and color fast agents. They are reservoirs for tracked-in pesticides, dust, dust mites; foster mold growth; and absorb and re-emit volatile organic chemicals like fragrances and paint fumes. In addition, many solvent-based agents used to clean carpets emit toxic fumes.

The Carpet and Rug Institute (CRI) has established a rating system that involves emission testing that is based on CHPS Section 01350, and includes additional requirements. Carpets labeled with the CRI Green Label Plus are expected to have lower emissions than most

carpets. However, even carpets emitting low levels of volatile organic chemicals (VOC's) can cause adverse health effects in certain individuals.

CRI Green Label Plus link

http://www.carpet-rug.org/drill_down_2.cfm?page=8&sub=3&requesttimeout=350

Some people with multiple chemical sensitivities have found that carpet squares with self-adhesive backing have been the best tolerated new carpeting. Others have reacted adversely to such products. More research is necessary to determine what factors in these carpets and/or which brands are best tolerated.

Older carpets are usually better tolerated by people with chemical sensitivities than new ones, as long as they have not become moldy.

Recommendations regarding carpeting (design, materials, and O&M issues):

1. Minimize the use of carpeting
2. Use area rugs in place of carpeting whenever possible
3. Consider using self-adhesive carpet squares
4. Tack rather than glue down (unless using self-adhesive carpet)
5. If glue down, use low or no VOC adhesive
6. Air out carpet for at least two weeks prior to installation
7. Ventilate building with 100% outside (or fresh) air for as long as possible after installation
8. Reduce the frequency of carpet replacement by maintaining them well (e.g., vacuum thoroughly and frequently and clean with low toxic products and procedures – (see recommendations by Operations & Maintenance Committee).
9. Minimize amount of carpet that is replaced, limit replacement to damaged areas (an advantage of carpet square systems is that smaller sections can be more easily replaced).

Insulation

The NIBS-IEQ Products & Materials committee realizes that insulation is an essential component in building systems to assure a comfortable environment. Insulation and insulating materials are generally hidden or covered, however emissions can still be encountered by building occupants. The Committee believes that polystyrene foam insulation is best tolerated by persons with multiple chemical sensitivities. Other insulating products, such as fiberglass, cellulose, or cotton/polyester blend insulating products may produce particulates, harbor mold, or emit problematic volatile fumes, depending on the product and the manufacturing techniques used.

The Committee has particular concerns about interior lined ductwork, due to the insulation's ability to collect and trap chemical contaminants, dusts, microbes and fungi, as well as emissions from the adhesives used to secure the insulation. It is recommended that no interior-lined ductwork be used in the construction of buildings meant to be accessible to persons with MCS.

Lastly, insulation used anywhere in buildings must not contain urea-formaldehyde resins.

Paint

The NIBS-IEQ Products & Materials Committee determined that for some individuals, 100% acrylic paint and paints containing low-VOC emissions can be acceptable. Paints containing styrene-butadiene latex combinations, enamels, strippers and paint thinners are all problematic and should be avoided or their use minimized.

For some individuals, well-hardened enamel paint, baked-on enamel finish, or porcelainized steel provide optimum safety. These products provide a hard, durable surface that can be easily cleaned using non-toxic products.

Paints with biocides or biocide additives (mold/mildew resistant) should not be selected.

Textiles

The NIBS-IEQ Products & Materials committee recommends sparing or no use of textiles in buildings. Though it may be possible to introduce textiles with no emissions, textiles provide a porous medium to trap chemical contaminants, dusts and microbes that can create an unhealthy environment. In addition, the dry cleaning and laundering of textiles pose additional problems due to the cleaning products.

Walls

Gypsum wallboard: Gypsum may be reasonably inert and extremely low in VOC emissions. However, additives used to produce mold-proof gypsum wallboard (i.e., "green board"), fire-resistant gypsum wallboard, or to improve the workability of the slurry during manufacture may include compounds that emit VOCs. Careful product selection and review of emissions testing data is necessary to assure that appropriate materials are chosen. Recycled paper covering both sides of gypsum wallboard may contain chemicals from previous uses, and additives or chemicals used in the production of the paper itself. Note that VOC emissions from gypsum wallboard can sometimes be significantly reduced by "painting" or laminating the surfaces. The more impervious the coating or covering, the greater will be the reduction in VOC emissions from gypsum wallboard. However, VOC emissions from surface treatment materials must be considered.

Gypsum wallboard can act as a sink for other VOCs in indoor air. Avoid exposing unpainted gypsum wallboard to indoor environments where emissions from other VOC sources exist. Taping and topping compounds can contain considerable quantities of VOCs, so emissions testing data for these products are also critically important. Use ventilation and heat to accelerate the drying process of these materials. Protect wallboard from exposure to contaminants and excessive moisture prior to installation.

Where possible, select material to reduce the need for paints, wallcoverings, or porous wall finishes in buildings. Most commercial structures are built using metal studs, a good selection for persons with MCS. Wood studs can emit terpenes and pinenes

Wallcovering

Wallpapers may contain vinyl, plasticizers, styrene-butadiene latex combinations and other chemicals that can seal and trap moisture between the wallpaper and the wall fostering mold growth. The water-based pastes and glues used to adhere the wallpaper to the wall may

contain mold retardants and pesticides. Adhesives can emit volatile fumes. For these reasons we recommend that wallpapers not be used.

Conclusion & Recommendations

In order to minimize the level of air pollutants emitted from building materials and create healthier indoor environments, the NIBS Products & Materials Committee recommends that inert, non-porous materials be used to the greatest extent possible. This will increase access for the greatest number of chemically sensitive individuals. Choosing appliances and other equipment that create the lowest level of electromagnetic fields will increase access for those with electromagnetic sensitivities.

If materials are used that emit volatile fumes, the Committee recommends that these materials meet or exceed the CHPS Indoor Air Quality Emissions Testing Standards or Green Guard Allowable Emission Levels, as well as contain no formaldehyde or biocides. The Committee also recommends that, whenever possible, products and materials be aired out (preferably outside or in a separate well-ventilated space) for two weeks prior to being installed in a building.

While the Committee acknowledges that the CHPS Indoor Air Quality Emissions Testing Standards and Green Guard Allowable Emission Levels are the best current standards for selecting building materials that create healthier buildings, the Committee is concerned that these standards may not sufficiently protect the health of building occupants, especially those with chemical sensitivities and other vulnerable individuals.

Therefore, the Committee supports:

- 1) Creation of more stringent emission standards and development of a wider range of less volatile and less hazardous building materials, especially in the areas of resilient flooring and carpeting.
- 2) Full disclosure of product ingredients (on product labels or available upon request) to enable builders to make more informed decisions regarding selection of building materials.
- 3) Consulting with chemically and electromagnetically sensitive individuals or organizations, especially employees and others who frequently use a building, prior to making final decisions regarding product selection.

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