A Checklist of Guidelines for Avoiding Sick Buildings

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On March 20 and October 20, 1996, 1996 AIA Vermont held workshops on strategies for preventing "Sick Building Syndrome" This topic had gotten lots of sensational headlines, and politicians had even used the subject to attack the corporate carpet and chemical industries. Meanwhile, as architects, we had to keep on specifying materials and mechanical systems to the best information available.

The media and politicians had not been helpful in adding to the body of knowledge about sick buildings. To fill this void, until scientific and medical research and, most importantly, national standards caught up to the problem, AIA VT created a checklist to begin establishing a baseline of strategies to avoid sick building conditions.

Three-dozen owners, users, architects, builders, maintenance and other building specialists met to make sense of these issues. Four teams, facilitated by AIA members, were asked to create a list of environmental problems and strategies to prevent them. Our panel of experts, Bill Bress, State Toxicologist for the Vermont Health Department, Ralph Stuart of the UVM Environmental Safety Facility, Tom Broido of ATC Environmental and Merle Miller of the Vermont Department of State Buildings, answered questions and shared their knowledge with the teams.

This checklist was compiled from the results of these workshops. It is a start and by no means complete, but it can serve as a useful tool for those who create interior environments. Anyone with ideas or questions about this checklist can contact Steven Clark, AIA at 802-223-2097 or in care of the above address.

Areas	**Strategies**	
Design:		
1. Basic Concepts	a)Use holistic approach (i.e. health & productivity as well as initial costs). b)Use life cycle costing (instead of initial cost only). c)Consider ease and cost of maintenance. d)Involve occupants in design stage. e)Determine any special user sensitivities. f) How does a minor renovation affect existing systems? g)Rely on tested and measurable product rating systems and environmental standards that correlate, if they exist. h)Allow adequate time for commissioning.	
2. Adequate Fresh Air	a)Meet min. air requirements-codes (BOCA, ASHRAE). b)Identify areas requiring more than min. requirements. c)Adjust supply levels by occupant load and type. Include maintenance and cleaning air-out requirements.	
3. Adequate Fresh Air Source	a)Identify local pollution sources. b)Locate vehicular and other outside exhaust sources. c)Examine locations of intake vents and interactions with all types of exhaust vents (combustion, moisture).	
4. Adequate Exhaust of "Used" Air	a)Determine which exhaust air can be recirculated. b)Adjust exhaust levels by occupant load and type. c)Provide exhaust for printers, copiers,(see products) d)Identify and treat hazardous exhaust.	
5. Energy Efficiency	a)Adjust supply and exhaust levels by occupant load and type (CO^2, contaminant meters, special cycle for cleaning, etc.). b)Investigate if heat recovery systems are cost effective. c)Filter and reuse exhaust air only where safe. d)Temper fresh air(solar, Trombe walls). e)Build smaller heated spaces. f) Build tighter buildings to control and ensure designed air circulation.	

6. HVAC system	a)Provide individual control of room or space by user. b)Air flow design •Carefully locate supply and return outlets. •Avoid Plenum returns due to poor control of airflow and accumulation of dust and other plenum contaminants. c)Carefully consider filter type. •Chemicals aren't always effectively trapped. •Consider finer filters for special conditions. •Provide required maintenance. •Portable HEPA fan filters can provide spot filtering. d)All filters and concealed spaces must be easy to inspect, clean and maintain. e)Combustion heating systems •Consider locating outside of occupied structure. •Use closed combustion systems to prevent backdrafting. •Provide combustion supply air to furnaces, fireplaces and woodstoves in compliance with codes. •Train maintenance staff about combustion air requirements. f) Consider non-combustion heating systems (geothermal, heat pump, solar).
7. Controls	a)Redirect direct sun with light shelf (reflectors). b)Individual climate control to more efficiently make everyone more comfortable and give individuals control. c)Provide operable windows even if not theoretically required. •Can conflict with central HVAC (use separate zones). •Can provide some individual fresh air when ventilation systems fail. •Can provide some individual fresh air in good weather.
8. Cost	a)More control means higher initial costs and higher maintenance, but may reduce operating costs. b)Passive systems may reduce operating costs.
9. Renovating Occupied Spaces	a)Evaluate renovation's effect on HVAC system and space ventilation requirements. b)Carefully contain and seal off spaces from unrenovated spaces to prevent contamination and dust *with* negative air pressure, especially if occupied.
10. User Involvement & Education...	a)Involve users from early stages. b)Determine actual users(occupant, owner, maintenance staff). c)Determine value to client versus other areas of project.
Products:	
1. User Involvement & Education	a)Try to develop ways for users to test products. b)Study MSDS sheets, etc., to identify sensitivities, allergies, etc.

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2. General	a)Understand the risks. b)Know products (may conflict with innovation). •Develop better products, ratings and tests. •Can't always trust ratings or "safe" levels of pollutants. •Look for (develop) "safe product" standards for products. •Require all new products to be tested for interactions with other products, especially cleaners and chemicals. •Develop system for sharing case study and product info. c)Reduce use of risky products. d)Look for alternative products. e)Check "recycled" products carefully for contaminants. f) Use non-toxic cleaners and techniques.
3. Carpet	a)Use safeguards during installation to reduce contamination (dust collection, exhaust systems). b)Check backing and adhesive systems, they change often. c)Protect carpet from other contamination sources.
4. Plywood and other processed wood products	a)Use safeguards during installation to reduce contamination (dust collection, exhaust systems). b)Seal, paint or coat processed wood products.
5. Treated wood(fire, rot, insect)	a)Avoid in interiors. b)Seal, paint or coat where in human contact outdoors.
6. Paints and finishes	a)Minimize absorption of contaminants(seal, cover surfaces).
7. Insulation (glass fiber & foam with formaldehyde, polyurethane)	a)Cover all exposed insulation. b)Seal duct insulation properly.
8. Contract furnishings and systems	a)Get MSDS on products in advance of purchase.
9. Office equipment (photocopiers, diazo printers)	a)Provide exhaust and vapor recovery systems. b)Store and dispose of chemicals properly.
10. Adhesives and sealants	a)Remove or seal exposed adhesives.
11. Exposed materials with high absorption rates(gypsum board, ceiling tiles, carpet) for other contaminates (construction, workplace, biological)	a)Minimize absorption of contaminants(seal, cover surfaces).
12. Materials encountered in renovation (asbestos, lead, mercury)	a)Follow regulatory agency guidelines and rules. b)Recommend owner hire expert to address these issues.
13. Interactions with Other Products	a)Keep finish materials and furnishings out of buildings while problem products are present.
14. Required Products with High Emissions	a)Specify safe methods for handling products. b)Select knowledgeable contractors.
15. Durability	a)Select durable products easy to maintain. b)Control solar gain on fabrics and surfaces that can out-gas and fade.

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Construction:

1. Product Installation	a)Careful quality control. b)Knowledgeable supervisor and clerk of the works. c)Follow manuf. instructions and keep MSDS sheets on site. d)Monitor moisture levels to prevent bacterial growth in ducts, etc. e)Use safeguards during installation to reduce contamination (increased ventilation, dust collection, exhaust systems). • Summer construction may reduce cost of higher ventilation rates.
2. Substitutions and Changes Due to Cost	a)Balance capitol costs vs. operating costs (Life Cycle Costing). b) Maintain compatibility among products and systems.
3. Temporary Constructions and Devices	a)Dust barriers with negative air pressure to contain debris.
4. Occupancy Before Construction Completion	a)Plan for airing-out period, as long as possible(practical).
5. User Involvement & Education	a)Discuss in construction meetings as agenda item.
6. Cleaning	a)Check and clean construction debris, especially ducts and concealed, ventilated spaces(plenums). b)Disinfect ducts and air handling devices, etc., subject to moisture. c)Carefully replace all filters and temporary closures.

Commissioning and Testing:

1. Systems Testing (HVAC, etc.)	a)Suggest testing for site contamination before occupancy to determine existing conditions. b)Suggest testing indoor air quality before occupancy to determine existing conditions. c)Verify compatibility of all systems and products. d)Periodically test, monitor and frequently replace filters (detection technique) early on in occupancy. e)Use air-out period with high ventilation to remove airborne toxins and out-gassing, before and after furnishings. f) "Bake-out" technique to increase out-gassing of materials is not recommended as it may increase contamination. g)Address problems quickly before they become symptoms h)Offer post-occupancy(6 mo.-1 yr.) review services, survey.
2. Controls & Systems Adjustment	a)Obtain and evaluate 3rd party balancing and testing reports. b)Incorporate into documentation as required.
3. Operational and Maintenance Training	a)Provide accurate, specific, simple and clear training and documentation(consider personnel turnover). b)Encourage owner to log building and operational changes for updating documentation(ie. Use electronic format for easy updating). Include occupant complaints. c)Consider commissioning procedures for cleaning, etc.
4. User Involvement & Education	a)Involve occupants and owner in Indoor Air Quality issues. b)Log & establish resolution procedure for occupant complaints. c)Train occupants in how building functions.