HEALTHY SCHOOL DESIGN and CONSTRUCTION

Healthy Schools Construction Committee

Revised July, 2008

ACKNOWLEDGMENTS

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Sam Sorensen, Chemcraft, Dartmouth, Nova Scotia, Canada.
Avis Degaust, Sandra Moser and CASLE's education and research teams, Halifax.

*Special appreciation to **Mr. Paul MacLellan** of the Nova Scotia Department of Education for initiating this part of the project, for his unwavering support and for demonstrating the belief that we must never stop trying to build better schools, healthier schools, and cost effective schools, to serve our school children and province for the long term.*

Many thanks to each of you. Nova Scotia's school children and those who work in our schools will benefit from your generous contributions.

Healthy Schools Construction Committee Members:
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1.0 INTRODUCTION

The Healthy School Construction Committee (HSCC) was struck by the Nova Scotia Department of Education to provide input on healthy school design and construction for the new Halifax West Mainland High School to create a “baseline” Healthy School. Further reflecting the Department's priority and commitment to improving the indoor environment quality of Nova Scotia's new schools, approved information from this process became part of the Design Requirements Manual DC350.

Members of the committee included representatives from the Nova Scotia Department of Education, the Nova Scotia Department of Transportation and Public Works, and CASLE (Canadians for A Safe Learning Environment). Private sector architects, engineers and other professionals generously assisted with committee activities as needed.

The links between indoor environment quality, health and performance lead us to try to build a school with the best environment possible. Schools frequently have problems related to building design, construction or operation. The indoor environment quality can cause various short-term or long-term health or performance effects. These effects can be particularly harmful to students or staff with asthma, allergies or other health conditions. HSCC members recognize that a healthy school is not something that just "happens", rather it comes from good choices and good planning. If certain processes are followed, such as source control (see section 4.0), and attention is paid to specific details through all phases of the project, the result will be a healthier school, with benefits to both health and educational outcomes.

What is needed to produce a healthy school and one that can endure years of use has been a topic of study in many countries, but we found no one source that is all encompassing. Avoiding indoor mold and avoiding chemical exposures are two main focus areas for Healthy School creation and operation, however there are others, as outlined in this document. The HSCC has attempted to pull together a point-by-point general compilation of as much of the current body of knowledge as possible as it applies to northern schools, while recognizing that this is a "living document" that will continue to expand and improve along with the field of healthy school construction.

Sustainability, with its focus on protecting the external environment, largely complements healthy school design, but not entirely. While this document focuses mainly on creating healthy schools, the HSCC has also attempted to enhance the challenge of merging sustainable design with healthy building design to maximize the benefits of both.

Refer to the Procedures for Input into the design and construction processes (see section 2.1 and 2.2) for the steps followed in developing and fine tuning these documents. Briefly, during the conceptual phase, initial lists were circulated for input to several professionals in the field of healthy school design and construction. Written resources including research and existing school construction, and IAQ guidelines from several countries were consulted. As the documents matured, items were classified according to their current status in Nova Scotia's DC350 DRM. Items needing adjustments were identified and altered through further literature research and consultations. At this stage, there had been no review of the technical, temporal, or financial implications of these items. The HSCC expected to be part of the discussions and final decisions.

The healthy schools concept is aimed at producing a healthy school, preventing potential harm while enhancing the education process. Much research and experience have fine tuned many of the items. For others, especially when dealing with schools, we must rely upon the Precautionary Principle: "When evidence suggests that an activity may threaten the environment or human health and well-being, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically." (*p. 303, The Health of Canada's Children, third edition, Canadian Institute of Child Health, 2000.*) We are always learning, and we must expect to learn from this school as well.

The new Halifax West High School, the “benchmark” school for which these guidelines were developed, can be a strong step into this century if we incorporate what we know about how to create, and sustain, a high quality indoor environment, while at the same time take exciting and responsible steps toward making schools energy efficient and less reliant on fossil fuels. We hope this building itself will demonstrate that teachers no longer have to provide information-age education in industrial-age facilities.

It is intended that the Design Requirements Manual (DRM) clearly reflect a priority and commitment to improving the overall indoor environment quality of schools. This can be achieved through making conscious decisions that give priority to healthy building options and by actively seeking the best alternatives from a healthy building perspective. The overall question to be asked for each item in the DRM is, “Will this affect the health or well-being of building occupants over either the short term or the long term?” Healthy Building Design and Construction is an emerging field. If processes such as source control are followed, and if, while keeping in mind the overall educational mandate, health is given priority over other factors, then the result will be a healthier building.

With all of this in mind, the HSCC offers the following lists for consideration for building healthier schools. We challenge design teams to use their resources and expertise to incorporate these HSCC considerations into the design and construction of new schools, and we look forward to the benefits reaching students, staff, and the education process itself.

2.0 PROCEDURES

2.1 Procedures for input into the Design Process

.1 HSCC members establish a draft task list or "wish list".
No evaluation of pros and cons at this point.

.2 Divide the draft list into approved categories:
- Architectural
- Mechanical
- Electrical
- Site
- Program Technology - Subcategories: Technology, Operations and FF& E.
- Contract

.3 Distribute draft lists for input and qualifications:
a) Healthy School information sources.
b) Department of Education
c) Department of Transportation and Public Works. This will include identification of items already in the DC350 Design Requirements manual.

.4 Revised draft to school board Maintenance and Operations staff for comments/qualifications.

.5 Revised draft list to School Steering Team (SST)
a) for input
b) endorsement in principle of draft list

.6 Final list to Design Team for feedback. Request written reply within a time frame agreed upon.

.7 Feedback to HSCC.

.8 Meet with Design Team to finalize task list.

.9 Meet with Design Team and Department of Education officials if there are unresolved issues.

.10 Monitor for compliance throughout the design and construction phases through the Design Team, the Design Review Team and inspectors.

.11 Similar procedures for inclusion of HSCC information in FF&E, construction, and commissioning/opening phases will be developed.

2.2 Procedures for Input into the Construction Process

.1 HSCC members establish a draft task list or "wish list”.
No evaluation of pros & cons at this point.

.2 Distribute draft list for input and qualifications to TPW & Department of Education decision makers

.3 HSCC meet with inspectors, contractors, TPW, board & Department of Education decision makers to discuss items.

.4 Feedback to HSCC.

.5 Meet with the team and department officials if there are unresolved issues.

.6 Monitor for compliance throughout the construction and commissioning phases through the departments and inspectors.

2.3 Procedures for Input into the Furniture, Fixtures and Equipment (FF&E) Process

.1 HSCC members establish a draft task list or "wish list”.
No evaluation of pros & cons at this point.

.2 Distribute draft list for input and qualifications to:
FF&E staff, TPW, board & Department of Education decision makers

.3 Hire professional, if possible, to further develop list and other details such as alternatives, source control, offgassing issues, and assisting Department decisions.

.4 HSCC & professional meet with FF&E staff, TPW, board & Department of Education decision makers to discuss items.

.5 Feedback to HSCC.

.6 Meet with the FF&E team and Department of Education officials if there are unresolved issues.

.7 Monitor for compliance throughout the construction and commissioning phases through the departments, FF&E team and inspectors.

3.0 DEFINITIONS

Volatile Organic Compound (VOC): One of a class of chemical compounds that contains one or more carbon atoms, and usually is defined as tending to evaporate at room temperature and at normal atmospheric pressure. Semi-volatile and non-volatile organic compounds can also contribute to indoor air pollution, and are included in this document's broad definition of VOC. In indoor air, VOCs are emitted by such things as cleaning materials, tobacco smoke, combustion, building materials, furnishings, plastics, office supplies, and solvents. Some are suspected carcinogens, but others can cause symptoms such as headaches, eye, nose and throat irritation, dizziness, neurological effects, and more.

Some sources limit the definition of VOCs to solvents only, and as compounds that contribute to ground-level ozone. Some sources include mold toxins as natural VOCs. This document uses the wide definition of “VOC” that includes all of these volatiles. Research on health impacts from VOCs is ongoing, but health impacts can result from high exposures, from long term low-level exposures, or when individuals have preexisting sensitivity to the material.

Semi-volatile organic compound: A subset of VOCs that can be in solid or gaseous form at room temperature and normal air pressure.

Toxicant: A substance that may cause tissue or organ damage in the body. Some damage may be temporary, while some can be lasting.

Non-Toxic, Less-Toxic and Least-Toxic: These are terms used to describe a product's potential risk of doing harm to the body. Sometimes "Non-Toxic" products are not available or else they do not perform up to project requirements. The Less or Least-Toxic alternatives may in fact have harmful characteristics, but carry less risk than other alternatives if used properly. Isolation and other controls may be used to minimize potential harm from the necessary use of Less and Least-Toxic alternatives. A "Least-Toxic" product is seen to have the lowest risk available to do the job at hand.

4.0 SOURCE CONTROL FOR BUILDING CONSTRUCTION

Statement of Intent: *To use Best Practices to achieve a healthier building. The goal is to be very careful about the products used and how they are used.*

4.1 Best Practices

4.1.1 Using Best Practices, specify least toxic/least hazardous products for use during construction to protect workers, and to protect building users after completion. When using potentially harmful materials is unavoidable, use safe work practices to minimize risk.

4.1.2 Materials specification is the responsibility of the architectural firm. Hire professional assistance if necessary; with a broad-based background in environmental building science. Chemistry background could also be useful for materials choices. (See Appendix.)

4.1.3 Evaluate emitting and retention properties as well as cross-contamination, sink characteristics, adsorption, absorption, and desorption properties.

4.1.4 Include chemical makeup, particulate and other potential risks to health in decision making. (Some acceptable materials emit higher levels in first several days, but have low emission rates after that.)

4.1.5 Request manufacturers for full ingredient disclosure and an MSDS for every category for which one exists. (16 category MSDS preferred. Also, refer to Appendix.)

4.1.6 Also look for materials that are able to retain their less toxic/less harmful characteristics through time and use.

4.1.7 For products under consideration, request typical/specified installation procedures, clean up procedures, and recommended cleaning and maintenance chemicals.

4.1.8 Contractors, trades and suppliers will be required to use the materials in the specifications. Any substitutions must be approved by the architect and air quality consultant.

4.1.9 Contractors, trades and suppliers must adhere to least-toxic cleaners in cleaning of the site.

4.1.10 Contractors, trades and suppliers must not permit tobacco smoking, alcohol or substance abuse on the site.

4.1.11 Any spills of VOCs and SVOCs, fuels, etc. must be immediately removed from the site with appropriate precautions.

4.2 Chemical Emissions

4.2.1 In order to minimize exposure to VOC's, and avoid potential health risks, require full ingredient disclosure and choose the lowest chemical emitting building materials possible to complete the task. When using potentially harmful materials is unavoidable, use safe work practices to minimize risk.

4.2.2 Evaluate contaminant-emitting and retention potential of furnishings, floor and wall coverings and casework.

4.2.3 Evaluate emissions data from manufacturers, but exercise caution as MSDS often do not contain all ingredient information.

4.2.4 Request Chemical Abstract Number and any known pseudonyms since many chemicals are only identified by trade names. Request limits of detection. e.g. parts per million.

4.2.5 Require building contractors and suppliers to disclose in writing any detectable amounts of carcinogens, mutagens and teratogens in materials, finishes, and furnishings they propose to install.

4.2.6 Envirodesic's standards demand that individual materials contribute less than 0.16 mg/m3 total VOC's to a room. In addition those VOC's must be free of other potentially hazardous substances (see Envirodesic contact info in Appendix) and substances that are particularly problematic for chemically sensitive individuals. (The US EPA suggests no product's emissions should increase airborne concentrations total VOCs by more than 0.5 mg/m3. However, they state this is inadequate for some products.)

4.2.7 Goal of zero tolerance for formaldehyde and formaldehyde producers/mimickers.

4.2.8 Evaluate emissions from products like acoustic and thermal insulation that may be in concealed spaces.

4.3 Specify and use materials that will not support microbial growth and without using biocides or other harmful chemicals.

4.4 Avoid the use of fleecy or porous materials.

4.5 In cases where least toxic materials do have some emissions, precondition/offgas before installation to reduce emissions.

4.6 Consider the projected life cycles and recycling potential of materials.

4.7 Specify and use materials and equipment that can be easily cleaned with least toxic cleaning supplies.

4.8 Properly store and protect building materials to prevent water damage or other contamination during construction, prior to and during installation. (Require in contracts that contractors remove and replace any damaged or contaminated materials, such as moisture-wicked drywall, at the contractor's expense.)

4.9 Encourage manufacturers to modify their products to use Best Practice to achieve a healthier building.

4.10 Use caulks and adhesives as necessary but select low-VOC products or hard fasteners. Some tack-on adhesive backed products are preferable. Do not use acoustical type caulking as it continues to offgass for a very long time. (Silicone is acceptable.)

4.11 Install dry furnishings after wet materials (caulks, paints, etc.) have off-gassed. Isolate and ventilate unavoidable emissions to avoid contaminating more porous materials.

4.12 Refer to HSCC's Preoccupancy Guidelines (See Appendix), and:

4.12.1 Keep building's main ventilation system off until after final cleanup or use delivery side only but with filters, and pressurized at all times to avoid ingestion.
4.12.2 Provide local adequate ventilation to control construction emissions.
4.12.3 Cleanup must be thorough after construction.
4.12.4 After final cleanup, prior to occupancy, install new filters, and allow six to eight weeks minimum of flush out with main ventilation system on full.
4.12.5 Open all doors, drawers, cabinets during flush out period. (See Appendix.)

Note: Off-gassing and exposure are influenced by amount of surface area. For example, the affects of small amounts of caulk would be potentially less than the effects of the bulk of plastic furniture, even though the caulk may contain more toxic ingredients. **The more the surface area, the higher the emission and/or potential for adsorption and re-emission of VOCs from other porous sources.**

For more information on source control and companies that specialize in least toxic materials selection see the Appendix.

5.0 TASK LISTS

5.1 Architectural Task List

This is a "living document". Items are actions considered advisable for producing a healthier school. Some items indicate an issue still needing a solution. The Healthy Schools Construction Committee's Procedures for input into the Design and Building Process, as approved by the Department of Education, and Procedures for Input into the Construction and FF&E Processes provide for HSCC participation in discussions and final decisions on items. (Some of the following items are relevant to two categories and are therefore repeated on the other appropriate task list.)

General Conditions:

These are some of the items which designers/builders always strive for, but which are of particular significance in attaining a healthy building.

.1 Full time, highly qualified construction inspector(s) on site throughout process to represent client and to oversee activities and products with potential impacts on present and future Healthy School issues including indoor environment quality (IEQ).

.2 A roof that doesn't leak over the long-term. (Options: (1) Metal or Concrete tile roof. (2) Flat roof with proper water proofing, using the Protected Roof Membrane System. Concrete pads on filter cloth on rigid insulation, on waterproofing on roof. See Appendix: Recommendations for P-3 Schools on continuous membrane. (3) Sloped roof. Metal sloped roof with non-clogging mesh gutters and well drained.)

.3 Design roof drains to minimize potential for flooding. Have scuppers to take overflow.

.4 Tight wall design. (See Appendix: B. Small, for emission free wall suggestions.)

.5 Design outside walls meticulously to avoid cold spots (condensation issues and comfort issues).

.6 Design building envelope so as to prevent entry of rodents, insects and other pests.

.7 Windows that do not leak over the long-term.

.8 All window frames and sashes must be thermally broken to minimize condensation

.9 In all cases, slope ground away from building for an appropriate distance, and storm drainage to prevent water entry.

.10 Allow adequate storage room for snow pile-up on parking areas, and drainage to accommodate melting snow.

.11 Materials specification is the responsibility of the architectural firm. (Hire professional assistance if necessary. See Source Control information and Appendix.)

.12 Contractors, trades and suppliers will be required to use the materials in the specifications. All substitutions must be approved by the architect and air quality consultant.

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.13 Using Best Practices, specify less toxic/less hazardous products for use during construction, to protect workers, and to protect building users after completion. (Refer to Source Control for Building Construction, and Appendix.)

.14 Include in product evaluation chemical makeup as well as particulate and other potential risks to health. (Some acceptable materials emit higher levels in first several days, but have low emission rates after that.)

.15 Look for materials that are able to retain their least-toxic/least-harmful characteristics through time and use.

.16 Contractors, trades and suppliers must use least-toxic cleaning products on the site.

.17 Contractors, trades and suppliers must not permit tobacco use, alcohol or substance abuse on the site.

.18 Any spills of VOCs and SVOCs (semi-volatile organic compounds), fuels, etc. must be immediately removed from the site with appropriate precautions. Also appropriately collect and remove contaminated cleaning rags and smaller amounts of VOCs/SVOCs.

Specific Conditions:

.19 Unlike most other new buildings, schools must open on time.

- Especially in high school: time lost from studies can cause students complex academic and career losses.
- Opening a school without adequate flush out and HVAC function can add to student and teacher chemical load and cause short term or long term health implications.

.20 TVOC measurements are not proving adequate for determining occupation readiness. Use Controls to ensure good air quality on opening day: (1) Choose low emission/less-toxic building materials. (2) Plan project to allow 6 to 8 weeks of building flush-out prior to occupancy, and after building completion and thorough cleaning. (3) Be sure the HVAC is operating well during those weeks. During building flush-out, with ventilation on high 24 hours a day, have contents in place, all cupboards open, computers on, blinds, fabrics, room dividers, furniture and equipment, etc., exposed to ventilation. (See Appendix.)

.21 Implement a third party commissioning program early in the design phase which will be active through to the final commissioning.

.22 Include Healthy School specialists to help write and pre-approve Requests for Proposals, Tenders and Specifications, and to work with all involved to create and operate a Healthy School.

.23 Consider non-combustion heating systems, or placing furnace/heating equipment in a separate building or joined to, but sealed off from, main building with negative air vestibule.

.24 Avoid systems that may contribute to mold problems, such as heat pump condensation.

.25 Place roof drains on outside of building. Avoid internal routing of drains for ease of maintenance and mold prevention.

.26. Design intakes to avoid water or snow being drawn in (i.e. wetting filters) during storms.

.27 **Design for ease of maintenance.**

.28 Everything easy to clean. (walls, floors, lights, radiators - with access panels. Note: textured walls are hard to keep clean and exposed pipes/conduits etc. need annual cleaning.)

.29 Minimize the use of dust-generating materials.

.30 Avoid dust-catchers throughout the school. (i.e.: ledges, uncovered rafters, rough surfaces, velour stage curtains, etc.)

.31 Use unscented, less-toxic cleaning materials.

.32 Install porous materials after more toxic work is completed and offgassed.

.33 Automatic closures on copy room doors.

.34 Signs on copy room doors, “Keep door closed for ventilation reasons.”

.35 Signs encouraging no vehicle idling in drop off areas for cars, busses and delivery vehicles.

.36 No direct fired oil, propane or natural gas water heaters or equipment in normally occupied areas. (Except chemistry lab burners with local exhaust. Bunsen burner alternative is yet to be found.)

.37 Interior walls of masonry/cement block/durocrete/ceramic preferred over paper-faced gyproc. (Damage/maintenance issues and mold potential.) At a minimum, use wick-resistant wall bases throughout building. (See Appendix.)

.38 Paint options: heavy duty latex, or 100% acrylic with adequate offgassing time/ventilation. Least toxic to do the job. Preferably NO VOC, or less than 250 grams per litre of low toxicity VOC's. Pair with isolation and flush-out. (See Appendix.)

.39 No open flame heaters during construction or at any time. Heat during construction with temporary furnace and appropriate ducting.

.40 Water-borne, low-VOC primers for steel supports are available and require the steel be cleaned first with a water reducible detergent or power water wash.

.41 No tar or asphalt-based products indoors. Minimize their use outdoors.

.42 No K-B board around floor perimeters. (It has been known to rot and create mold problems.)

.43 Avoid use of pressure treated wood (particularly CCA and creosote treated) especially where there may be skin contact. Less toxic treatment alternatives are available, including borate treated materials and naturally rot resistant woods such as larch.

.44 Goal of zero tolerance for formaldehyde - a sensitizer. (See Appendix.)

.45 Use low-emission softwood plywood, not chipboards or particle boards.

.46 Do not use manufactured beams and joists due to high offgassing. (Mmade from particles, chips etc. and glues.)

.47 Minimize use of adhesives. Use alternatives such as hard fasteners where advisable. (Option: 3M Contact Cement where appropriate.)

.48 Consider health impacts from chemicals used in concrete mixes and sealers. (Limit additives to concrete if possible. See Appendix.)

.49 If flyash concrete is to be used, identify source of flyash. To be approved by air quality consultant.

.50 Avoid basements. Consider insulated slab-above-grade to a minimum of 200mm with moisture barrier.

.51 Calculate Dew Point to determine if insulation is needed in slab to prevent floor surface condensation.

.52 Floor temperature between 65 and 84 degrees F. (18 and 29 C.). (Below floor insulation could control for this.)

.53 Install passive sub-floor extraction system as precaution for future need (unexpected radon levels or other in-ground pollution sources). Make it convertible to be an active extraction system if needed.

.54 Double-double hung windows in classrooms.

.55 Keyed, operable windows, top and bottom in all rooms, including offices.

.56 No wooden windows as they require maintenance and can become moldy. Aluminum preferred.

.57 No classrooms without windows.

.58 Operable windows in offices and other occupied non-classroom areas.

.59 Provide direct line of sight view glazing equal to or greater than 10% of the floor area, above 2.5 ft. and below 7.5 ft from the floor. (Views, through frequent changes of focal length, contribute to eye health. Views also foster well-being by providing a sense of connectedness with the outdoors.)

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.60 Protect windows to minimize rain penetration.

.61 Interior screens (re: bee sting allergies).

.62 Use clear glazing, with shades if necessary. Avoid low-e, filtered, and tinted windows until research removes health concerns.
Alternatives to minimize heat loss and control classroom overheating and glare:
(1) use good quality sealers
(2) use good quality spacers between panes
(3) use argon another suitable gas between thermo panes
(4) fit the windows well in the openings
(5) conserve heat by closing blinds at night
(6) triple glaze
(7) permanent awnings to help control glare and overheating (See Appendix.)
(8) placement of some windowed walls away from direct sun
- Facing southeast is particularly good for classrooms
- South/southwest/west facing rooms need overhangs to reduce glare and heat (awnings, trees, screens, etc.)
- West facing rooms can be too hot in the afternoons, so gym, library, cafeteria or rooms with few windows may be best facing west

.63 Consider horizontal sun screens/awnings.

.64 Avoid drapery.

.65 Metal blinds (Avoid vinyl blinds. See Appendix.)

.66 Avoid skylights, or ensure they will not leak. (Clear triple glaze, thermally broken skylight frame, mounted on an insulated curb at least 200mm high. Alternatives: south facing clearstory windows, dormer style on roof, light scoops.)

.67 Natural light or a balanced spectrum lighting. Emphasize windows/natural light (Consider T-5 or T-8, 86 CRI).

.68 Maintain 50 footcandles for classrooms. Allow for dirt depreciation, etc. (Minimum of 500 lux. Also maximize daylight in daytime).

.69 Adjustable light levels in various parts of the room, particularly near windows.

.70 Minimize glare.

.71 Wind direction is important re: building placement (avoid stagnant air, pollution "traps").

.72 Rational analysis of building entrances for those arriving by various means.

.73 Parking - buses, staff, student, public parking downwind re: prevailing winds, and away from the building re: air intakes, windows. (Winds do change. School windows are operable. Placing parking lots as far away from building as reasonable, and downwind can help. Traffic/parking areas a minimum of 50 feet away from building to avoid re-entrainment.)

.74 Drop-offs downwind re: prevailing winds.

.75 Driveways - do not circle the school. Place downwind re: prevailing winds.

.76 Delivery doors - location safety re: air intakes and other traffic.

.77 Take precautions to prevent gas/oil fumes from entering the building during tank refilling. For example, place tanks (small or large) away from the building proper and downwind.

.78 Locate dumpsters well away from air intakes.

.79 Prevent some IAQ problems by calculating an assessment of re-ingestion potential of exhausts using the 1989 Fundamentals Manual by D.J. Wilson, US EPA.

.80 Bird-proof architectural design. (No ledges, nooks, etc. that encourage nesting or lighting by birds - especially around air intakes and entryways.)

.81 No air intakes closer than 2 meters to the ground to avoid soil moulds, debris and snow drift issues.

.82 Advantages of outdoor plants: wind breaks and "particle sieve". Disadvantages: moulds and pollen. Caution: plants may grow to block intakes/exhausts later.

.83 The design of the building and the materials and landscaping should reflect and enhance the inherent qualities of the site and the natural environment.

.84 Prevent potential crime through building and landscape design.

.85 Do not use waterless, chemical urinals or toilets until truly non-volatile alternatives are made available. (Chemically sensitive staff and students report health difficulties in the presence of such products.)

.86 Control to prevent water overflows in washrooms from reaching walls, rooms below. Good floor slope to drains. (Discuss options: Water proof membrane under all washroom floors on suspended slabs, complete with floor drains which will also drain the membrane? No electrical rooms etc. below washrooms/kitchens. “Stack” washrooms on top of each other.)

.87 No drywall ceilings in the rooms below washrooms.

.88 Washroom walls should not be gyproced. Preferably a durable, low-maintenance water resistant product. (Concrete blocks or waterproof cement board, glazed or other hard finish: ceramic tile with dark grout.)

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.89 Avoid antimicrobial-treated wallboards and other building materials.

.90 Water-resistant ceiling tiles in locker rooms and shower rooms.

.91 Ceiling heights to allow sufficient space for mechanical equipment. Minimum ceiling height of 9 feet (2.7m) in classrooms with excellent ventilation.

.92 Accessible "runs" for wiring/tech, etc. to minimize the need to open walls or ceilings in future upgrades. (This can be the space above T-bars.) Caution re: offgassing from wires/cables and wire bundles.

.93 Access panels for all key intersections and dampers.

.94 Roomy mechanical/electrical areas (for cleaning and maintenance).
Easy access to mechanical/electrical areas for servicing.

.95 Indoor stairs and vertical door for accessing roof for maintenance. (5 ft. plus from roof edge)

.96 No hatches for accessing roof or storage/maintenance rooms. Full staircases only.

.97 Standard risers/stairs. No ladders or steep stairs.

.98 Use consistent swing direction for doors.

.99 Hallway and stairwell doors connected to fire alarm system (electronic holdback).

.100 Acoustic safety. (See Appendix and Healthy School Handbook p.72 & Rousseau p. 27)
Isolate noises from gym, music, technical rooms, etc. re: sound transition, NS Government mechanical target STC 35 RCN, and STC50 between teaching areas.

.101 Ensure safe acoustic reverberation levels within gym, cafeteria, music, tech rooms, etc. (See Appendix.)

.102 Ambient noise levels should be as low as possible. (Exceed noise criteria.)

.103 Use alternatives to limit use of "fleecy" wall panels for acoustical wall panels (i.e.: alternative panels or "broken" surfaces). Have a materials professional advise on appropriateness of fabric covered fibreglass acoustic panels and their alternatives. Hard fasten panels or take care in choosing low-emission/non-toxic glues.

.104 Good quality fire walls. Use products easy to fix and that do not support mold growth.

.105 No blown-in or spray-applied fire proofing.

.106 No blown-in insulation.

.107 Insulation intended for cooling pipes is not to be used on heated pipes/surfaces.

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.108 Tamper-proof outdoor hose hook ups and electrical outlets for custodial and maintenance worker use.

.109 Adequate storage for custodial supplies and program related supplies.

.110 Janitorial rooms:
- location, sufficient space, negative pressure to rest of school
- sufficient number of custodial closets
- custodial closets with sink, close to entrances
- large sinks

.111 No chemical air fresheners. (See Appendix or Healthy School Handbook, p. 71.)

.112 Flooring: As with other absorbent materials, avoid carpeting. Options: Terrazzo, ceramic tiles, concrete (architectural grade, stained, sealed) throughout, except hardwood where designated. (See Appendix.) Do not high polish the concrete (slippery). Add texture lines in entryways for extra slip precaution. Quarry tiles or ceramic tile suitable with cement base (No petrochemical based adhesives.) Low emission VCT flooring second choice to terrazzo, concrete or ceramic tile. (Soft vinyl to be definitely avoided. See Appendix.) Alternatives to flooring to be reviewed by air quality consultant.

Hardwood flooring for gymnasium, stage, drama /dance rooms. Otherwise avoid hardwood floors and wood baseboards. (re: baseboards, wood is porous - potential for mold growth. Also periodic refinishing creates dust and fumes and requires extra cleaning of surroundings.)

For wood floor finish: First choice: Water based, 100% polyurethane properly applied (well prepared surface, finish thickness is as important as number of coats, i.e.: 2ml is not enough. See Appendix.) Avoid using solvent-borne finishes. If unavoidable, choose least toxic product, dry between each coat to allow each to offgas, ventilate well, and allow adequate offgassing time (possibly several months) before school opens. Consider prefinished hardwood flooring where possible. (Price, future refinishing issues, and cracks between boards may be prohibitive, but has advantages for new school early occupancy issue.)

.113 Caution: Avoid “rubber” and synthetic flooring. MSDS and tests have claimed emissions way below "allowable" levels, but once installed, the floors may gas off noticeably for years.

.114 Textured, no slip flooring in entrances, cafeterias, stairs, and for monitoring areas for playgrounds/activity areas.

.115 Concrete or hard tile (terrazzo, porcelain) raised continuous baseboards or no baseboards at all (if walls are waterproof). No wood, rubber, PVC etc., baseboards. (Mold tends to grow behind them. Rubber and PVC gas off.)

.116 Gym floors that don't need waxing.

.117 Gym floors of uniform, low contrast wood to prevent visual confusion.

.118 Very large drop mats at all entrances. Mats cleaned over the day, HEPA wetvac. (Alternative:

open grate in a negative pressure vestibule, or mats with sunken area, high absorbant grate, and oversized floor drain, plus three-stage mats - wet/coarse, intermediate and "finish" mats. See Appendix.)

.119 Seal exposed concrete in indoor areas (to avoid emissions such as admixtures, amines, lime).

.120 Raised, cleanable lockers (cleanable all round, including under) with continuous cove base and suspended off the floor. (See Appendix.)

.121 Vented locker areas or vented lockers.

.122 Lockers with slanted tops (unless bulkhead is used for ventilation).

.123 Provide ventilation for halls to prevent stagnant areas, especially if lockers themselves are not mechanically vented.

.124 Enclose areas under stairs to prevent future fire hazard from inappropriate storage use.

.125 Ducted returns, not ceiling plenum returns.

.126 Install a spare filter box in the main system as precaution for future need (i.e. new pollution source such as trucking depot, new industry or farming activity nearby).

.127 Storage rooms exhaust only, negative pressure, and must never be used as an office or classroom without redesign for occupation. (This is a school board issue.)

.128 Use low-particle mineral fibre ceiling tiles sealed on all sides or use metal ceiling tiles. (No vinyl or vinyl-faced or backed; no fibreglass ceiling tiles. See Appendix.) If using pressed particle ceiling tiles, seal all six sides and use hold-down clips to minimize particulate exposure from up-and-down movement of tiles where necessary, or heavy fire-rated tiles. A sniff test of tile samples is important as some have permanent, intolerable smell. Fire-rated, heavy, ceiling tiles may work well.

.129 No vinyl wall coverings. (For mold growth behind and also offgassing.)

.130 Minimize plastics/vinyls throughout building.

.131 Ensure all materials in elevator cabin and shaft are low-emission.

.132 White boards (with non-toxic, no-powder markers) or electronic boards. (Or install special local ventilation and use dustless chalk if necessary.)

.133 Cork bulletin boards mounted on sealed fibreboard. Choose light, not dark cork. Use less toxic glues and hard-mount boards.

.134 Metal, wood or low-emission shelving and furniture.

.135 Classroom shelving options: either half inch gap at top and bottom of doors to allow offgassing while minimizing dust collection, or closed, exhausted, glass front/solid doors, perforated metal shelves to allow for air flow. Filtered intake.

.136 Cabinetry and trims: Use lower-emission softwood plywood, and seal all surfaces using low VOC sealants. Avoid use of particle board or pressed boards (MDF) and plastic for cabinetry and door/window trims. If unavoidable, seal all sides including drill holes with three coats of sealant. Use low-emission woods for trim and cabinetry, except do not use wood for baseboards due to mold concerns. (See Appendix.)

.137 Find alternatives for free standing "vertical panel" room dividers/workstation panels made of particle board, foam, vinyl, various insulation materials, adhesives, etc. (See Appendix and Cutter.)

.138 Avoid materials that have been treated with pesticides, such as some fabrics for curtains.

.139 Avoid chemically-treated fabrics/materials such as water-resistant or dirt-resistant finishes (VOCs).

.140 Use least-toxic flame retardant fabrics.

.141 Wash all fabrics with borax solution before use to help remove chemicals.

.142 Lab tables designed for adequate supervision of all experiments.

.143 Locate display boards in safe locations (for example, not along stair walls).

.144 Supply shelving (storage area) for back packs, etc., in library and specialty classrooms to ensure doorways and walkways are kept clear.

.145 An efficient garbage disposal/storage system. Consider garbage trolleys with three bins for easy separation of recyclables at the source (location in halls/cafeterias) and designed for easy removal to recycle room. Avoid plastic bins.

.146 Recycle room with a sink and door to the outside and close to pick up area. Tight ceiling to floor walls (isolated from rest of building).

.147 Recycling facilities for paper, bottles, plastic. (Reduce fire hazard and pest/microbial hazard of storage on site.) Make sure it is well exhausted.

.148 Cooling room for milk cartons and similar recyclables, with graded floor and floor drain for wash down.

.149 Adequate storage with separate bins, appropriate locations to support garbage separation and recycling.

.150 Plan for some storage rooms to have access to the outdoors for deliveries etc.

.151 External secure shed for outside grounds maintenance equipment.

5.1 Architectural Task List

.152 Cafeteria (no more eating in classrooms).

.153 Lunch room for staff.

.154 Good locking system with independent key (school board-wide).

.155 Drinking fountains - deep basin, mechanically cooled.

.156 Drinking fountains must meet current Canadian standards for drinking water equipment, but also lead free and free of plastic parts with plasticizers.

.157 Measure and control for Electromagnetic Fields (EMF's) and radio waves.

.158 Place computers and other equipment to avoid EMF's. (See Appendix.) Flat screens may have lower emissions and also use less energy. Keep power bar and plug in transformers as far away from operators as possible.

.159 Consider ergonomics (i.e.: adjustable height seating for computer labs and art tables, and adjustable, large enough, work surface areas).

.160 Avoid indoor plants except for specified program areas. (Use with care: place gravel, charcoal or marbles on top of soil, well ventilated area.) Alternative: washable silk plants.

.161 No indoor landscaping with soil.

.162 No indoor decorative water fountains.

.163 Avoid bringing mold contaminated books and materials into new school from old school (See Appendix).

.164 Building completely handicapped accessible re: Code plus Universal Design Principles.

.165 Zone to isolate public areas.

.166 Separate entrance and separate security system for public functions (gyms, cafetoriums and A.V. theatres, etc.).

.167 Plan for possible future expansion (i.e.: allow for increasing building size vertically and horizontally if appropriate).

.168 Build an Eco-classroom if the intention is not to provide air throughout the school of the same high quality as is at Halifax West High School. However, all children and staff benefit from high quality air.

.169 Compile maintenance and operations manuals with details on maintaining all equipment and for operating building systems.

.170 Provide equipment and product supplier contact information.

.171 Provide thorough training of maintenance staff. Video this training for use for future staff turnover.

.172 Create a user's guide for staff and administration on how to operate the lighting, heat communications etc. systems in their areas.

5.2 Contract Task List

This is a "living document". Items are actions considered advisable for producing a healthier school. Some items indicate an issue still needing a solution. The Healthy Schools Construction Committee's Procedures for input into the Design and Building Process, as approved by the Department of Education, and Procedures for input into the Construction Process provide for HSCC participation in discussions and final decisions on items.

.1 Full time, highly qualified construction inspector(s) on site throughout process to represent client and to oversee activities and products with potential impacts on present and future Healthy School issues including indoor environment quality (IEQ).

.2 Prime contractor designate individual responsible for environmental health and safety during construction. If designate is off-site, identify backup individual in writing.

.3 Hire a consultant specializing in healthy school design and construction to assist in all stages.

.4 Calls for consultant services tender should clearly require that only companies providing Environmentally Healthy Building Design and Construction need apply.

.5 Unlike most other new buildings, schools must open on time.

- Especially in high school, time lost from studies can cause students complex academic and career losses.
- Opening a school without adequate flush out and HVAC function can add to student and teacher chemical load and cause short term or long term health implications.

.6 TVOC measurements are not proving adequate for determining occupation readiness. Use Controls to ensure good air quality on opening day: (1) Choose low emission/less-toxic building materials. (2) Plan project to allow 6 to 8 weeks of building flush-out prior to occupancy, and after building completion and thorough cleaning. (3) Be sure the HVAC is operating well during those weeks. During building flush-out, with ventilation on high 24 hours a day, have contents in place, all cupboards open, computers on, blinds, fabrics, room dividers, furniture and equipment, etc., exposed to ventilation. (See Appendix.)

.7 All contracts should specify detailed safe-building requirements, and liability for non-compliance. (Start with OH&S standards and whenever possible, exceed all safety standards, controls and Best Practice because we are dealing with children.)

.8 Implement a third party commissioning program early in the design phase which will be active through to the final commissioning.

.9 Allow time and money to correct deficiencies.

.10 See Appendix for suggested building readiness guidelines from Healthy School perspective.

.11 Finish gymnasium first and do not use gym for storage area.

.12 Finish classrooms last, but allow for enough flush-out time.

5.2 Contract Task List

.13 HVAC final commissioning during winter (also a primary conditioning if school opens in Spring or Fall).

.14 Air conditioning final commissioning in summer.

.15 Using Best Practices, specify less toxic/less hazardous products for use during construction, to protect workers, and to protect building users after completion. (Refer to Source Control for Building Construction and Appendix.)

.16 Materials specification is the responsibility of the architectural firm. (Hire additional professional assistance if necessary. See Source Control information and Appendix.)

.17 Include in evaluation chemical makeup as well as particulate and other potential risks to health. (Some acceptable materials emit higher levels in first several days, but have low emission rates after that.)

.18 Also look for materials that are able to retain their less toxic/less harmful/low particulate characteristics through time and use.

.19 Contractors, trades and suppliers will be required to use the materials in the specifications. Any substitutions must be approved by the architect and air quality consultant.

.20 Cleaning and maintenance protocol must be in place during construction and on completion - very important. Hire school board custodian to assist with final weeks of clean-up. (Contractors tend to have a more lenient view of what is an adequate final clean-up of building and grounds for student use.)

.21 Contractors, trades and suppliers must use least-toxic cleaning products on the site.

.22 Use school board cleaning materials for final clean-up.

.23 Replace all filters prior to occupancy and after system testing and building flush-out.

.24 Contractors, trades and suppliers must not permit tobacco use, alcohol or substance abuse on the site.

.25 Any spills of VOCs such as gasoline, oil, etc. must be immediately removed from the site.

.26 Insulation intended for cooling pipes is not to be used on heated pipes/surfaces.

.27 No open flame heaters at any time. Heat during construction with temporary furnace and appropriate ducting.

.28 Use source control for low-VOC materials choices and construction activities (timing, isolation, offgassing). Specifics are provided in this document and the Appendix.

.29 Construction should be completed in a planned order to avoid contamination of materials, furnishings etc.

5.2 Contract Task List

.30 Keep materials dry & clean before installation (i.e.: don't leave plywood destined for walls out in the rain).

.31 Ensure all filters are stored dry and away from mold or chemical contamination.

.32 Require in contracts that contractors remove and replace any wetted/damaged materials, such as damaged moisture-wicked drywall, at the contractor's expense.

.33 Require all building cavities (walls, under cabinetry, ducts, etc.) to be free of refuse.

.34 Training of builders and subcontractors in Healthy School goals and construction practices.

.35 Contract for additional staff/operations training and manual development.

.36 Create a user’s guide for staff and administration on how to operate the lighting, heat communications etc. systems in their areas.

.37 Operations and Users Manual for the new building, including a "log book" system for recording maintenance and repairs, supplier information, operation and maintenance instructions, including preventive maintenance, for all systems and equipment, and engineering details of the heating, ventilation and air-conditioning systems.

.38 Include user videos. Make a video of the training session(s) when the building is turned over to the users.

.39 Preventative maintenance – School Board responsibility. Establish maintenance log in Operational Manual.

.40 Archive in three or four locations complete copies of architectural drawings, materials/systems/equipment information, and other important documents. (Copies with the Department, school board, architectural firm and the school itself.)

.41 Provide signage designating this as a scent free, smoke free Healthy School, “Keep Copy Room Door Closed”, and “No Vehicle-Idling”.

.42 Exceed LEED, C-2000 and its companion GB-Tool 2000 altered or meshed to fit Healthy School recommendations and priorities.

.43 Meet or exceed N.S.'s Greenhouse Gas commitment (by 2020 achieve 26% below 1990 levels).

.44 Exceed National Energy Code by 45 %.

.45 The following are IEQ categories in C-2000 that should be addressed:

M1 Construction Process Planning - follow explicit and demanding directives regarding construction quality control practices as specified in construction documents, and additional site supervision to ensure compliance is planned.

M2 Performance Tuning

5.2 Contract Task List

M2.1 Appointment of commissioning agent and development of commissioning protocols.
- Appoint prior to the preparation of contract documentation for the building and develop a comprehensive commissioning protocol to include the inspection and performance verification of all major mechanical and electrical systems and the building envelope.

Exceed M2.2 Building Flush-out minimum.

M2.3 - Mechanical burn-out. Degrease and burn off any furnaces, heat exchangers, ranges, etc. in another location before installation in school.
Also specify type of insulation, gaskets, etc., when possible.

M3 Building Operational Planning
M3.1 Provision of As-Built drawings and documentation on building systems
- prepare a full set of operations and maintenance documentation, including a full set of systems manuals, complete as-built drawings and an operations and maintenance guide. Ensure the reporting and documentation protocol for the operation of the building is fully consistent with size and complexity of the building.

M3.2 Training of operating and maintenance staff
- Have all building operators complete a comprehensive training course in efficient building operations and maintenance as part of an established management program.

.46 Exceed Green Building Challenge 98 and LEED for Schools.

.47 Specify environmentally sensitive construction procedures.

.48 Plan for occupant environmental awareness program. (This is a school board issue.)

.49 Plan for staff and student environmental health awareness program. (This is a school board issue.)

.50 Plan for First Aid Kit disbursement with appropriate signage, and implement a kit maintenance protocol. (This is a school board issue.)

5.3 Electrical Task List

This is a "living document". Items are actions considered advisable for producing a healthier school. Some items indicate an issue still needing a solution. The Healthy Schools Construction Committee's Procedures for input Into the Design and Building Process, as approved by the Department of Education, provides for HSCC participation in discussions and final decisions on items.

.1 Everything easy to clean (including lights).

.2 Key operated light switches in washrooms.

.3 Tamper proof switches and controls.

.4 Key operated lights in stairways and other public areas. Or control in administration office.

.5 Natural light or a balanced spectrum lighting. Emphasize windows/natural light.

.6 Maintain 50 footcandles for classrooms. Allow for dirt depreciation, etc. (Minimum of 500 lux. Also maximize daylight in daytime.)

.7 Adjustable light levels in various parts of the room, particularly near windows. Switch or photo-electric controls.

.8 Electronic ballast lights (see Healthy School Handbook chapter 10 and Rousseau and Rapp)

.9 Minimum colour rendering index (CRI) of 85 (80% of daylight).

.10 Measure on site and shield as necessary radio frequencies (RFs) (see Appendix) from:
- radio tower emissions (Check for radio frequencies, FM & HDTV [high definition])
- cellular phone towers
- microwave repeater stations

.11 Wire building to avoid electromagnetic fields (EMF's) (see Appendix).

.12 Feed power grid underground with attention to configuration (See Rapp).

.13 Place computers and other equipment to avoid EMF's. (See Appendix.) Flat screens may have lower emissions and also use less energy. Keep power bar and plug in transformers as far away from operators as possible.

.14 Hallway and stairwell doors connected to fire alarm system (electronic holdback).

.15 Security cameras entries/exits etc.

.16 Zoning of security system for public functions (gyms, cafetoriums and A.V. theatres, etc.).

.17 Internal communication system in place for those working alone in the building.

5.3 Electrical Task List

.18 Standby generator for electrical backup (isolated from occupied spaces).

.19 Frequent electrical outlets for custodial & maintenance worker use throughout.

.20 Consider motion sensors for less frequently used rooms, for light turn on/off for safety and energy conservation.

.21 Accessible "runs" for wiring/tech, etc. to minimize the need to open walls or ceilings in future upgrades. (This can be above T-bars.) There is concern re: offgassing of wire bundles.

5.4 Mechanical Task List

This is a "living document". Items are actions considered advisable for producing a healthier school. Some items indicate an issue still needing a solution. The Healthy Schools Construction Committee's Procedures for Input into the Design and Building Process, as approved by the Department of Education, provides for HSCC participation in discussions and final decisions on items.

.1 The goal is to make indoor air quality better than outdoor air quality.

.2 HVAC system off until after cleanup to avoid contamination. (Or fresh air delivery on only when nearing completion to assist with offgassing. Keep exhaust portion well sealed until after final cleaning and open windows/doors to allow air to exhaust.)

.3 Replace all filters prior to occupancy and after system testing and building flush-out.

.4 Ensure all filters are stored dry and away from chemical contamination.

.5 HVAC final commissioning during winter. (Also a primary conditioning if school opens in Spring or Fall.)

.6 Look for alternative to heat wheels.

.7 No sectional boilers. (Our experience has been that they tend to leak fumes even when new.)

.8 Furnace/heating equipment in separate building (power plant) or joined to, but sealed off from, main building with negative air vestibule.

.9 No direct fired oil, propane or natural gas water heaters or equipment in normally occupied areas. (Except chemistry lab burners with local exhaust. An alternative to bunsen burners has yet to be found.)

.10 All fuel storage above ground and away from building.

.11 Consider non-combustion heating systems.

.12 Avoid systems that may contribute to mold problems, such as from condensation on heat pumps.

.13. Design intakes to avoid water or snow being drawn in (i.e. wetting filters) during storms.

.14 Caution: When using cisterns for heat pump system, caution re: positioning it or sealing it well from the school to prevent moisture/mold problems now or in the future. Also well insulated against condensation, and alarm system for leaks.

.15 Properly installed drain pans. (Including a positive slope and oversized drainage system.)

.16 Properly installed primed traps when system is connected to sewer system.

.17 Refrigerator condensation lines drained directly into plumbing.

5.4 Mechanical Task List

.18 Well sealed plumbing vents and waste lines.

.19 Air grilles and radiators that are easy to clean.

.20 Everything easy to clean and accessible.

.21 Sprayed on insulation intended for cooling pipes is not to be used on heated pipes/surfaces.

.22 Avoid ozonators and ionizers for air freshening.

.23 Exceed ASHRAE /Model National Energy Code guidelines for ventilation. (20cfm for CO2 control and higher rates if there are pollutant sources such as offgassing materials or particulate sources.)

.24 Rate of delivery – Exceed ASHRAE 62.1 (1999).

.25 100 % fresh air. (For gym, cafeteria, auditorium, etc. design fresh air supply for maximum occupancy. Match unit output to occupancy load based on CO2 sensors.)

.26 Proper distribution for sufficient fresh air in all occupied areas.

.27 Air diffusers to manage air flow volumes and distribution patterns for occupant comfort.

.28 Multiple diffusers to serve all areas of classrooms (i.e.: four delivery & whatever is needed for exhaust. Place exhausts near or around chalkboard, whiteboard and/or other pollution sources.)

.29 Fully hard-ducted supply/return. No unducted ceiling plenum use.

.30 Air filtering appropriate for site conditions, but to a minimum of 95% ASHRAE efficiency.
MERV (Minimum Efficiency Reporting Value) rating 12 or above. (See Appendix.)
Prefilter 15-20% efficiency
Medium filters 60-80% efficiency
High efficiency filters (95%)
HEPA filters if necessary for removing small particulate (HEPA is 99.97% efficient down to .3 micron particle size.)
Activated carbon pre-filters (i.e.: coconut) and media filters as necessary and as appropriate for the contaminant being filtered. Important for providing uncontaminated air especially in areas of higher outdoor pollution such as agricultural areas and industrial areas. (Assess outdoor pollution. Measure at different times of the year.) These types of filters have a limited service life and therefore need frequent replacement.

.31 Install a spare filter box in the main system as precaution for future need (i.e. new pollution source such as trucking depot, new industry or farming activity nearby).

.32 Install passive sub-floor extraction system as precaution for future need (unexpected radon levels or other in-ground pollution sources). Make it adaptable to be an active extraction system if needed.

5.4 Mechanical Task List

.33 Protect intakes, exhausts and unintentional intakes such as elevator shaft intakes from possible reverse drafts during roof construction.

.34 Clean inside surfaces of ductwork during/prior to installation to remove oil, debris and dust. Use least toxic cleaner. (i.e.: TSP) or require delivery of oil-free ducting from supplier and test ducts for dust during commissioning. (See Appendix.)

.35 During construction, seal open ends of ducting after each day/work period to prevent dust entry.

.36 During construction store all chemicals (oils, cleaning materials, lubricants, etc.) in an exhausted separate room.

.37 Require all building cavities (walls, under cabinetry, ducts, etc.) are free of refuse.

.38 When designing new schools it is very valuable to prevent problems by calculating an assessment of re-ingestion potential of exhausts using the 1989 Fundamentals Manual by D.J. Wilson, US EPA.

.39 Air intake and exhaust should be placed to avoid re-entrainment (i.e.: as far apart as possible. Ten metres minimum.)

.40 Air intakes away from pollution sources (i.e.: traffic/parking areas a minimum of 50 feet away from building to avoid re-entrainment).

.41 Filters located/adjusted re: intake to prevent wetting by ingress of rain or snow.

.42 Caution: outdoor plants may grow to block intakes/exhausts later.

.43 No air intakes closer than 2 metres to the ground to avoid soil moulds, debris and snow drift issues.

.44 Separate combustion/heating system from ventilation equipment to prevent cross contamination and backdrafting.

.45 Scrub or filter exhaust from science lab hoods or other potential pollution areas, to prevent contributing to outdoor pollution.

.46 Provide ventilation to hallways to prevent stagnant air.

.47 Custodial closets exhaust only, negative pressure.

.48 Storage rooms exhaust only, negative pressure, and must never be used as an office or classroom without redesign for occupation. (This is a school board issue.)

.49 Ventilate gym storage rooms/equipment rooms.

.50 Fume hoods vented to exterior in accordance with code.

5.4 Mechanical Task List

.51 Fume hoods for visual arts.

.52 Fume hoods for theatre craft areas.

.53 Fume hoods for stoves in family studies room and staff room stoves.

.54 A few gas bunsen burners in appropriate labs, with movable or fixed exhaust hood(s)over the areas, or balanced, two-stage fan exhaust for entire room, teacher operated and timed off-switch.

.55 Mechanically ventilate cabinets under sinks and dishwashers or leave open.

.56 Classroom shelving options: half inch gap at top and bottom of doors to allow offgassing while minimizing dust collection or closed, exhausted, glass front or solid doors, perforated metal shelves to allow for air flow. Filtered intake.

.57 Exhaust all chemical storage rooms at all times.

.58 Mechanically vent lockers or locker areas. (Second choice, mechanically ventilated halls, grilles in lockers. In locker rooms, metal mesh lockers.)

.59 Local exhaust to remove point sources of contaminants before they can be dispersed into the indoor air.

.60 Ventilate and provide negative pressure for:
restrooms
a storage rooms
custodial closets
labs
kilns
shower rooms
computer rooms
recycle storage room
entrance vestibules
coat closets

.61 Isolate and ventilate pollution generating areas such as labs, locker rooms, gym, cafetorium, etc.

.62 No recirculation of used air in woodworking dust collectors or other equipment.

.63 Copy rooms and laminators located in a separate room with exhaust, negative air pressure. (At least four air changes per hour, 0.5 cubic feet per minute, per square foot, assuming an 8 foot ceiling. ½ an air change per hour when equipment is not operating. Use motion sensors to increase exhaust rate.)

.64 Control for computer room hazards such as ozone and toner dust. (i.e.: source control such as filtered laser jet printers and/or increased ventilation options or locate printers in separate, ventilated room.)

5.4 Mechanical Task List

.65 Air condition computer classrooms to control heat build-up.

.66 In cold seasons consider programming heat/ventilation system to minimize condensation by running heat and air at normal levels after occupants have left until humidity has dropped.

.67 Important: CO2 sensors for demand controlled ventilation.

.68 Drinking fountains, deep basin, mechanically cooled.

.69 Drinking fountains must meet current Canadian standards for drinking water equipment, but also lead free and free of plastic parts with plasticizers.

.70 No indoor decorative water fountains.

.71 Quiet HVAC systems.

.72 Ducts easily cleanable inside (access ports for cleaning), not easily damaged, smooth joints and surfaces to discourage dirt buildup and microbial growth, and do not emit materials or gasses that can harm occupants.

.73 Do not use anti microbial treatments/sprays in ducts or in any part of the HVAC system.

.74 Do not use fibreglass or other fleecy lining inside ducts.

.75 Galvanized ducts. Not plastic or wood.

.76 Avoid neoprene and EPDM gaskets in HVAC due to VOCs. Silicone gaskets preferred.

.77 Use inert flexible anti-vibration caulking materials so that vibrating components do not come in contact with building components.

.78 Consistent heat/humidity/comfort.

.79 Humidity - ideal range is the lowest healthy humidity to discourage mold growth and minimize infections. (CMHC recommends 30 to 50 RH. See Appendix.)

.80 Thermal Comfort - ASHRAE (68 degrees to 75 degrees F, 20-24 C, in winter, and 73-79 degrees F, 23-26 C, in summer.)

.81 Separate heat controls for each classroom, library, labs, gymnasiums, etc.

.82 Consider passive or geothermal heating and cooling systems (heat pumps and earth tubes, etc.).

.83 Consider in-floor heating. (Reduces dust, spills dry out faster, etc.)

.84 Floor temperature between 65 and 84 degrees F (18-29 C.). (Insulation under the floor slab could help.)

5.4 Mechanical Task List

.85 Accessible "runs" for wiring/tech, etc. to minimize the need to open walls or ceilings in future upgrades. (This can be above T-bars.)

.86 In case of unexpected emergencies provide the school office with an HVAC shut off switch.

.87 Positive building pressure (minimum of 5 Pascals to prevent ingress of outdoor contaminants).

.88 Either no VAV setting where air is totally off, or timed on-switches for areas such as gym, library, cafeteria, offices, classrooms for use after hours and on weekends.

.89 Central Vacuum system.

.90 Incorporate solar energy (REDI program), wind power, or other alternate power sources.

.91 Exceed LEED or C-2000 and its companion GB-Tool 2000, altered or meshed to fit healthy school priorities.

.92 Consider meeting or exceeding Nova Scotia's Greenhouse Gas commitment (by 2020 achieve 26% below 1990 levels.)

.93 Exceed National Energy Code by 45%.

.94 Compile maintenance and operations manuals with details on maintaining all equipment and for operating building systems.

.95 Provide equipment and product supplier contact information.

.96 Provide thorough operations training of maintenance staff. Video this training for use for future staff turnover.

.97 Create a user’s guide for staff and administration on how to operate the lighting, heat communications etc. systems in their areas.

.98 Archive as-built charts in at least three places: in the school, school board maintenance department, and Department of Education offices.

5.5 Programs Task List

This list includes Operations, Technical and FF&E (furniture, fixtures, equipment and technology)

This is a "living document". Items are actions considered advisable for producing a healthier school. Some items indicate an issue still needing a solution. The Healthy Schools Construction Committee's Procedures for input into the Design and Building Process, as approved by the Department of Education, and the Procedures for input into the FF&E Process provide for HSCC participation in discussions and final decisions on items.

.1 No direct fired oil, propane or natural gas water heaters or equipment in normally occupied areas (except chem lab burners with local exhaust).

.2 Electric burners to replace some, not all, bunsen burners.

.3 Bunsen burners in appropriate labs and with enhanced exhaust ventilation. (Option: burners in one location and/or with fixed or movable exhaust hood(s), or timed balanced two-stage whole room exhaust operable by teacher.)

.4 Self-cleaning ovens to avoid strong chemical cleaners.

.5 Wood and metal/baked-on enamel furniture preferred.

.6 Minimize use of PVC/plastics. If plastic items must be used for some reason, purchase early and offgas.

.7 Upholstered items: Minimize use of upholstery and foam stuffing to only what is needed for comfort. Buy early and offgas in a dry and chemical-free location. Alternatives to foam such as cotton stuffed futon sofas and chairs, with wood or metal frames, are available. Additional professional help may be needed to choose chemical-reduced fabrics.

.8 Avoid chemically-treated fabrics and materials such as water-resistant or dirt-resistant finishes.

.9 Avoid materials that have been treated with pesticides, such as fabrics for curtains/furniture and anti-microbial cutting boards in kitchens. (Hardwood cleans well with soap and hot water.)

.10 Fabric covers removable, washable if possible.

.11 Wash all fabrics with borax solution before use to help remove chemicals. (Do not inhale borax powder. It is caustic.)

.12 Choose furnishings that aren't absorbers or emitters.

.13 Porous materials should be installed after more toxic work is completed and offgassed.

5.5 Programs Task List

.14 Use low-emission woods for trim and cabinetry (except do not use wood for baseboards due to mold concerns). Use lower-emission softwood plywood, composites, and seal all surfaces using low VOC sealants. Avoid use of particle board or pressed boards (MDF) unless using no/low-emission kinds. If MDF is used, follow the specs provided by professional including sealing on all sides with approved laminate or sealant. (See Appendix.)

.15 Goal of zero tolerance for formaldehyde - a sensitizer.

.16 Find alternatives for free standing "vertical panel" room dividers/workstation panels made of particle board, foam, vinyl, various insulation materials, adhesives, etc. (Materials made from plastics or vinyl contain a wide range of VOCs. See Appendix and Cutter.)

.17 Some furnishings may require their own flush-out, preferably ahead of time. Remove plastic wrapping from furniture and equipment beforehand. (Consider using completely offgassed gymnasium or designate a smaller room as a centre for materials, furniture and gym equipment offgassing, with ventilation on high six to eight weeks.)

.18 Offgas new textbooks or bake at 100 F (38 C) for at least 5 hours and air out.

.19 Offgas new computers and plastic/PVC encased equipment. (Turn on and heat up, for several weeks.)

.20 Offgas leather equipment (such as the apron for technology).

.21 Seek less toxic alternative to vinyl gym floor protective sheet. (One school's solution is to rent a used, offgassed, sheet for special occasions.)

.22 Avoid drapery and other absorbent materials.

.23 No vinyl wall coverings.

.24 Cork bulletin boards mounted on sealed fibreboard. Choose light, not dark cork. Choose high quality, low-emission display boards.

.25 Locate display boards in safe locations (e.g. not along stairs).

.26 Metal/wood shelving.

.27 Use alternatives to limit use of "fleecy" acoustical wall panels (i.e.: alternative panels or "broken" surfaces). Have materials professional advise on appropriateness of fabric-covered fibreglass acoustic panels and their alternatives.

.28 Very large drop mats at all entrances (to be cleaned over the day, HEPA wetvac.
Alternative: mats with sunken area, high absorbant grate, and floor drain, or open grate entry floor with negative pressure vestibule. See Appendix.)

.29 No chemical air fresheners (See Appendix and Healthy School Handbook p. 71.)

5.5 Programs Task List

.30 Do not use ozone generating air purifiers. (See Appendix.)

.31 Everything easy to clean and maintain.

.32 Minimize the use of dust-generating materials.

.33 Avoid dust-catchers throughout the school. (i.e.: ledges, uncovered rafters, rough surfaces, velour stage curtains...)

.34 No recirculation of used air in woodworking dust collectors or other equipment.

.35 Use less toxic, fragrance free cleaning products.

.36 HEPA shop vacs if portable vacuums are to be used.

.37 Equipment handicapped accessible. Use Universal Design to accommodate all occupants.

.38 Electromagnetic Fields - measure/control for EMF's. (i.e.: Place computers and other equipment to avoid EMF's. See Appendix.)

.39 Labs - separate CSA or ULC approved cabinets for strong acids, alkalines, flammable materials (vented to outdoors).

.40 Custodial storage with CSA approved cabinets for flammable materials, paints and solvents.

.41 Consider ergonomics for equipment & furniture. (i.e.: adjustable height seating for computer labs and adjustable, large enough, chairs and desks for art department.)

.42 Avoid indoor plants except for specified program areas. Use with care: place charcoal, gravel or marbles on top of soil - area well ventilated.

.43 No indoor landscaping with soil.

.44 No indoor decorative water fountains.

.45 Whiteboards (with non-toxic markers) or electronic boards. (If chalkboards are used, install special local ventilation and use dustless chalk.)

.46 Choose metal over "rubber"/plastic waste cans (and other objects) wherever possible.

.47 Avoid Teflon-like finishes on cookware.

.48 Limit plastics in kitchens/cafeteria.

.49 Find alternative to vinyl gym/room dividers.

.50 Consider flat screen TV and computer screens to avoid EMFs and save energy.

5.5 Programs Task List

.51 Purchase cold laminators rather than those using heat process.

.52 Plan for possible future overcrowding situations.

.53 Avoid use of pressure treated wood (particularly CCA and creosote treated) especially where there may be skin contact. Alternatives are available: Borate treated materials and naturally rot resistant woods such as larch.

.54 Use the Task Lists' Source Control information and Appendix as a guide.

.55 Security will be an issue during offgassing.

.56 Build and furnish an Eco classroom if the intention is not to provide indoor air throughout the school comparable to Halifax West High School. However, all children and staff benefit from high quality air.

5.6 Site Task List

This is a "living document". Items are actions considered advisable for producing a healthier school. Some items indicate an issue still needing a solution. The Healthy Schools Construction Committee's Procedures for input into the Design and Building Process, as approved by the Department of Education, and Procedures for input into the Construction Process provide for HSCC participation in discussions and final decisions on items.

(See CMHC and the attached "Site Evaluation" sheet)

.1 Site selection can involve seasonal factors.

.2 Wind direction is important re: building placement (avoid stagnant air, pollution "traps").

.3 Parking: buses, staff, student, public parking downwind re: prevailing winds, and away from the building (re air intakes, windows). Winds do change. School windows are openable. Placing parking lots as far away from building as reasonable, and downwind can help. i.e.: traffic/parking areas a minimum of 50 feet away from building to avoid re-entrainment.

.4 Drop-offs downwind re: prevailing winds.

.5 Driveways - do not circle the school. Place downwind re: prevailing winds.

.6 Delivery doors - location safety re: traffic & air intakes.

.7 Separate pedestrian, bus and public vehicular traffic.

.8 Rational analysis of building entrances for those arriving by various means.

.9 Do not build on marshy, wet land, or where the water table may rise occasionally.

.10 In all cases, slope ground away from building for an appropriate distance, and consider storm drainage to prevent water entry.

.11 Textured, no slip surfaces, stairs, and for monitoring areas for playgrounds/activity areas.

.12 Avoid use of pressure treated wood (particularly CCA and creosote treated) especially where there may be skin contact. Alternative products are available, including Borate treated materials and naturally rot resistant woods such as larch.

.13 External secure shed for outside grounds maintenance equipment.

.14 Radon - Upgrade polyethylene vapour barrier over sub grade, seal control joints, utility penetrations, etc. if applicable. Install passive sub-floor extraction system as a precaution. Make it easily convertible to a mechanical system if necessary.

.15 Measure on site and shield as necessary radio frequencies (RF), for

.16 radio tower emissions (Check for radio frequencies, FM & HDTV [high definitionTV]), for

.17 cellular phone towers, and for

.18 microwave repeater stations.

.19 Although not a guarantee, evaluate any existing plans for future adjacent properties. In some cases a limit on the type of development may be necessary to protect schools.

.20 Consider distance of at least 1000 feet from multi-lane roadways as a rule of thumb. (Closer to roadways has higher carbon monoxide, ground level ozone, etc. Research shows ten times the pollutants at 300 feet as compared to 1000 feet. Option: better air filtration system.)

.21 The design of the building and the materials and landscaping should reflect and enhance the inherent qualities of the site and the natural environment.

.22 Paths to and from the school and on school property should be efficient, of sufficient width, and also reflect the natural qualities of the site. These paths must be designed for safe and secure passage (light, drainage, etc.).

.23 Prevent potential crime through building and landscape design.

* * *

Site Evaluation/Selection

The following are proposed items for school site evaluation, keeping in mind that the primary users of the school will be children whose bodies continue to grow and develop until adulthood. What they do, breathe, and ingest can impact on their current and future well-being.

1. Site history research - including aerial photographs, ownership records, environmental assessment reports, geological reports, environmental permits or charges information on hazardous materials storage or contamination of adjacent sites.

2. Site visit - Look For:
    - hazardous waste storage
    - climate factors such as prevailing winds
    - elevations, swamp, marsh
    - EMF sources, radio frequency sources (towers, power lines)
    - drainage survey
    - testing of surface soils (geotechnical for foundations and for hazardous materials if warranted)
    - consider drinking water (test if warranted)

5.6 Site Task List

- unusual odors
- adequate space for playgrounds, sport areas, parking, sidewalks, bus and vehicle delivery.
- adjacent sites that could negatively impact the site
- take photographs

3. Interviews with selected individuals (site history...For example, was it a landfill?)

4. Written Report - should include all documents, photos, maps, figures, site description, interviews, references and supporting documentation, contracts, assessments including property value, written evaluation of findings and conclusions.

5. Consider minimum distance from major highway, 1000ft.

6. Site Assessment for Reusable Energy - above and below ground

Among potential hazards needing Risk/Hazard Analysis and mitigation recommendations from a qualified engineer:

propane storage facilities
railroads
airport approach or departure paths
munitions storage facilities
nuclear waste storage facilities
natural gas lines larger than ten inches and with a pressure of 200 psi or more.
oil or petroleum product storage facilities or transmission lines
high radon levels
EMF sources (electrical transmission lines of 115KV or higher, also cellular, microwave, RF...)
high traffic areas
dust generators such as sawmills, cement plants, fertilizer plants
soil/groundwater/air contamination from:
hazardous waste sites
industrial waste disposal sites
dry cleaning outlets, chemical plants,
pesticide users/producers
chemical spill sites
mines
scrap yards
refineries
pulp & paper plants
garbage dumps - solvents, paints, heavy metals
oil/fuel leaks/spills

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The Appendix is under revision, however the current edition (2003) contains important information for your review.