Respect Excellence
Integrity Leadership

THE ENVIRONMENTALLY RESPONSIBLE GREEN OFFICE AT A GLANCE

FIRST EDITION

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GREEN OFFICE AT A GLANCE

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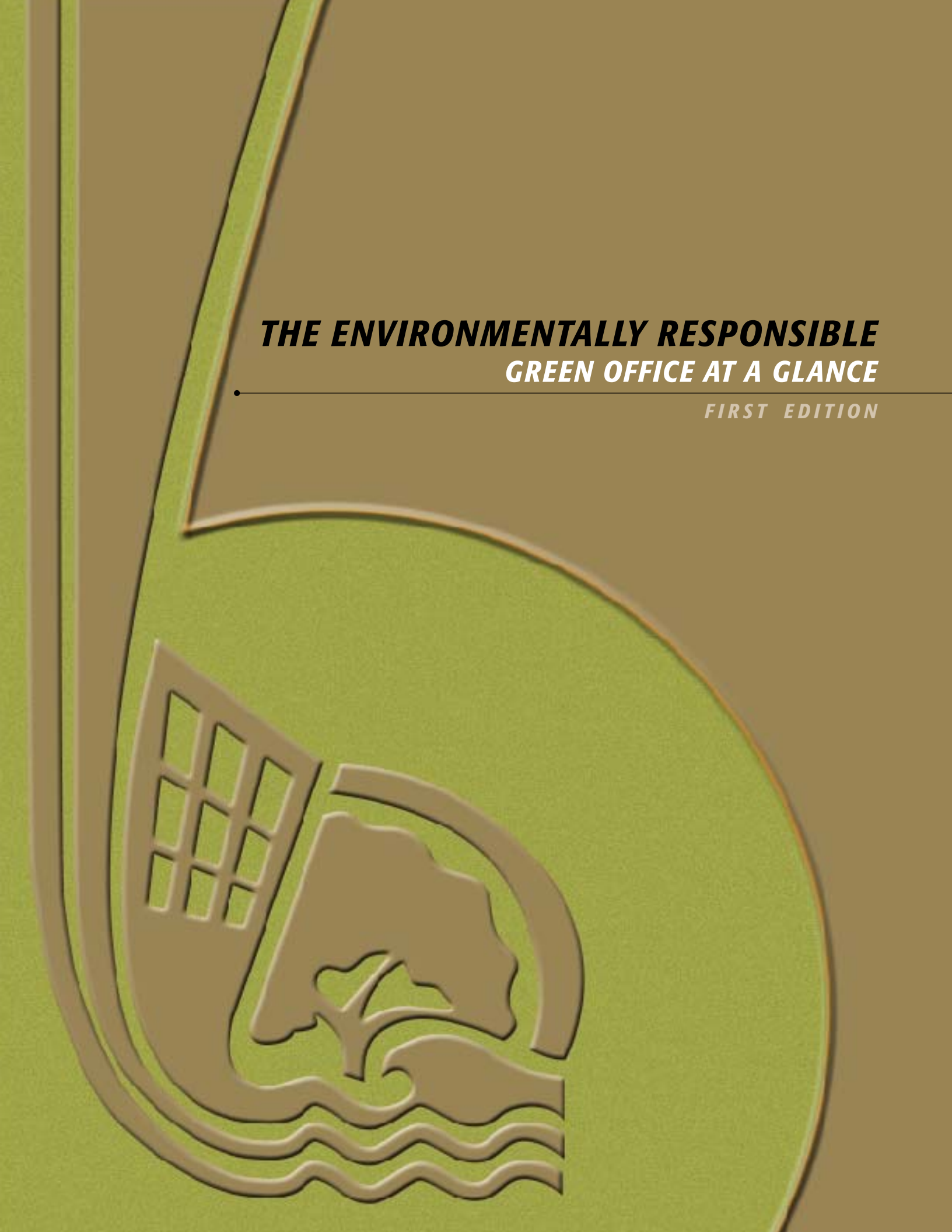

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PLANNING A GREEN OFFICE BUILDING

1.0

PLANNING A GREEN OFFICE BUILDING 1.0

BACKGROUND AND PURPOSE OF THE GREEN OFFICE BUILDING PLAN 1.1

The need for "greening" an office stems from the Treasury Board Federal Real Property Policy, which states that:

- It is the policy of the Government to acquire, manage and retain real property only to support the delivery of government programs and in a manner that is consistent with the principles of sustainable development. Within this context, real property must be managed to:
- the maximum long-term economic advantage of the Government;
- honour environmental objectives;
- provide adequate facilities for the users, and
- respect other relevant government policies.

In March 1997, Public Works and Government Services Canada (PWGSC) signed a Master Occupancy Agreement (MOA) to accept responsibilities for the provision and utilization of office accommodation and to ensure that all aspects of office management and maintenance integrate the principles of sustainable development and environmental stewardship.

The department made a commitment to develop a Green Office Plan (GOP) as part of the MOA. The objective of the GOP is to demonstrate leadership in the greening of office space. One of the goals of the MOA is to achieve accommodation standards that are environmentally sound and to improve the comfort, as well as the well-being of employees while at their place of work. Another goal of the MOA is to raise the awareness of the Government of Canada and its employees to the necessity of embracing the tenets of sound environmental management. These goals must be achieved in a manner that is economically viable without compromising other government or workplace objectives (e.g. heritage conservation, productive work environments, occupational health and safety, etc.).

The Green Office Plan (GOP), committed to in the MOA, is outlined in two parts, which form the Green Office Building Plan (GOBP). The expanded name of the document reflects the fact that the plan focuses on office buildings.

The first part of the GOBP is a working document that includes the key information requirements in checklist form.

The second part of the GOBP is a technical resource document that provides the technical details and examples needed to operationalize the GOBP. It incorporates all of the material contained in The Environmentally Responsible Construction and Renovation Handbook, and includes additional technical detail and case studies that illustrate successful green office projects.

For the purpose of the GOBP, greening of an office building means incorporation of the following features:

- compliance with sustainable development and pollution prevention principles;
- adoption of resource efficient practices to minimize the consumption of energy, water and other resources;
- incorporation of the 4Rs: Reduce, Reuse, Recycle and Renewable, (i.e. building products, systems use and management).

All of these objectives are met while maintaining adequate building performance in the area of spatial, thermal, indoor air quality, acoustic, visual and building integrity and occupant comfort in a sustainable way.

EXISTING BACKGROUND INFORMATION *1.2*

A considerable amount of information on greening products and practices is already available to interested parties through existing PWGSC documents. The detailed information in these documents will not be repeated in the GOBP. Rather, the information will be summarized or referred to, and the reader can access more detail on an as-required basis in the referenced documents. However, this document is intended to be a stand-alone document providing sufficient information on "greening the office".

PWGSC has been making extensive efforts to "green" the various documents that are used for office project planning and execution. These documents are an excellent source of information regarding green office building projects. Green office building project planners may become familiar with these to enhance their knowledge on greening practices. These documents can be obtained from the PWGSC Document Centre and through the departmental intranet. Appendix A presents a summary on the status of these efforts. It also lists documents that can be used as supplementary information along with this GOBP, for planning and implementing green office building projects.

To the extent that the project under consideration may affect heritage and other aspects of the building in question, Treasury Board Real Property should be consulted to ensure that its requirements are also being met.

GOBP STRUCTURE *1.3*

The GOBP guides assist planning and management staff, project managers, project designers and others involved in the project planning and implementation phases of office building projects. It addresses key aspects of office buildings that must be considered when acquiring or disposing, leasing, designing or operating office buildings in a green manner.

The GOBP is intended for the practical use of a number of different stakeholders, including portfolio and asset managers; project managers and building professionals; leasing agents; accommodation users, and property managers. It covers the provision and management of office space under four separate categories, namely:

- renovation, recapitalization and fitup;
- leasing;
- accommodation use, operation and maintenance; and
- acquisition and disposal.

New construction is not specifically addressed in this document as it is significantly more complex and accounts for a minor part of current federal government activities. Nonetheless, many of the greening principles included in this document are also applicable to new construction.

The GOBP provides two checklists which can be used to identify issues for consideration at the concept and design submission, working document submission and contract supervision stages of any office building project. The first checklist, which is presented in Section 2 of this document, is organized by project phase. It addresses general as well as specific considerations. The second check list is presented in Section 3 of this document. It presents green office building considerations by technical area. The following lists these technical areas:

- indoor environmental quality and selection of environmentally sensitive material;
- energy conservation;
- water conservation; and
- solid waste reduction.

The second part of the GOBP provides more detailed technical information on various green office building practices. It incorporates all of the information in the current PWGSC document entitled The Environmentally Responsible Construction and Renovation Handbook and contains a number of new sections that address technical aspects of energy and water conservation, solid waste management and indoor air quality (IAQ).

The main body of the first part of the GOBP addresses greening aspects for office renovation, recapitalization and fitup. Information relevant to other categories is included as Appendices.

Appendices to the GOBP include:
APPENDIX A: Status of Documents to Be Used With GOBP
APPENDIX B: Relevant Sections of Leasing Documents
APPENDIX C: GOBP Considerations for Office Building Operation and Maintenance
APPENDIX D: Environmental Issues and the Sale of Federal Real Property
APPENDIX E: Life-Cycle Cost and Economic Analysis Example.

PLANNING A GREEN OFFICE BUILDING *1.4*

The following sections of the GOBP describe various measures that should be implemented where it is feasible to develop a green office building. The cost and effort involved will vary from building to building, particularly for the range of activities addressed in this document, which focuses on existing rather than new office buildings.

Adhering to the principles of "the earlier the better the feasibility of implementing the green office building measures should be incorporated at the outset of project planning, and be incorporated into the project definition and implementation phases of the office building project. Ongoing best practices for green office building maintenance should also be addressed during the commissioning, operating and evaluation phases.

Four steps should be taken during green office planning, project definition phases, and also during the design element of the implementation phase. The precise timing of the on-site assessment will vary from project to project, depending on the circumstances involved, but should be initiated as soon as practical after the building has been identified, following the options analysis.

This section describes the actions required in general terms, and section 1.5 describes the factors to be considered at various phases of the project delivery system.

The following identifies the four steps to be taken when renovating or refitting a specific office building, parts of a building, or floor of a building.

STEP 1: THE PRELIMINARY ASSESSMENT MEETING

The two checklists presented in Sections 2 and 3 of this document list various measures that should be assessed on a project-by-project basis for different project types. The project leader and project manager should use these lists to identify the actions that should be considered for the green office building project. A meeting should then be arranged with the property manager of the building in question to discuss the feasibility of the various measures and reasons for possible implementation problems in some buildings. A preliminary list of action items or issues requiring followup should be developed at this meeting, and additional staff who will become involved in decisions should be informed of the preliminary assessment meeting and the future outcome.

STEP 2: THE WALK-AROUND ASSESSMENT

The preliminary assessment meeting and discussion should be followed by a walk-around assessment of the office building to look at the feasibility of each GOBP measure identified, and any others that may have been overlooked in the preliminary assessment. This walk-around assessment should be carried out by the project leader and project manager and maintenance supervisor. At the end of this walk-around assessment, the preliminary list will be reviewed, and a new revised list of action items should be developed.

STEP 3: THE SECOND WALK AROUND ASSESSMENT

The project leader and project manager, the person in charge of building maintenance, and other staff who should be involved at this stage of the planning process should carry out a second walk-around assessment. The purpose of this walk around should be to view the existing building infrastructure and assess the complexity of implementing the various potential green office building measures. A list of actions may be developed at that time for further followup. Moreover, during the second walk-around assessment, the team should eliminate measures from further consideration, which are clearly not practical, given the building age, heritage and other considerations. These decisions and the rationale behind them should be documented in the Green Office Building Plan Report discussed later.

STEP 4: ECONOMIC ASSESSMENT

To justify any additional expenditure to create a green office building the costs of the measures, which are considered practically feasible, should be estimated and compared to a base-case scenario. These costs will vary from building to building, and estimation before the Implementation Stage of the Project Delivery System is necessary. A life-cycle cost analysis should be carried out as shown in Appendix E to this document. All the measures presented in the GOBP have generally been proven to be cost effective, particularly when the full building life-cycle is taken into account. If productivity gains from improved IAQ are considered, all IAQ related activities would have an increased positive payback. However, local circumstances vary considerably across Canada and must be taken into account in all cases. In some cases, some of the measures presented in the GOBP will not be economically justifiable because of existing building conditions (HVAC system, etc.), which make green implementation expensive, and thus undesirable.

OPERATION AND MAINTENANCE (O&M)

Ongoing practices to maintain green office building status should be documented in the annual green office O&M plan. To assist with this task, an operation and maintenance checklist is provided in Appendix B of the GOBP.

PLANNING A GREEN OFFICE FOR A RENOVATION, RECAPITALIZATION, AND FIT-UP PROJECT 1.5

This section outlines the environmental considerations to be taken at each of the phases involved in the delivery of projects by Real Property Services.

The section has been written to illustrate integration of green office building consideration in the different phases of the Project Delivery System. It describes the process for renovation, recapitalization and fit-up projects. However, the same principles and approaches can be incorporated into the different phases of other types of projects where a green office is a desired outcome.

PHASE 1: PLANNING

(Needs identification–options analysis)

BY: PWGSC Planners: CASAs and Project Leaders
CONSULT: Client Reps
OUTPUTS: GOP Project Goals/ Objectives and Options Analysis
CEAA screening decision (completed Canadian Environmental Assessment Act Checklist)

The importance of attaining the following goals should be addressed for each individual project. In general, these goals should not vary greatly from one project to another; however, there may be some special circumstances, which may require some adjustment.

ENERGY EFFICIENCY

- To the maximum extent economically feasible, ensure that PWGSC building design applications rely on conservation and renewable energy sources rather than fossil fuel.

SUSTAINABILITY

- To the maximum extent economically feasible, ensure that PWGSC building designs are constructed of non-toxic materials that are manufactured using sustained yield methods and that encourage reuse and recycling.

An integrated approach to design is required to promote green building design practices and meet the objectives. Green office building design approaches should:

- promote resource conservation, including energy efficiency, renewable energy, and water conservation features;
- consider environmental impacts and waste minimization;
- create a healthy and comfortable environment;
- reduce operation and maintenance costs;
- address issues such as historical preservation;
- ensure access to public transportation and other community infrastructure systems; and
- consider the entire life-cycle of the building and its components, as well as the economic and environmental impact and performance.

The various project options should be reviewed with regard to their relative merit and impact on the above objectives. They should be included as part of the decision making process for option selection as part of the Investment Analysis Report (IAR). The project should also be screened for application of the CEAA, and the decision should be reported on the CEAA screening checklist.

PHASE 2: PROJECT DEFINITION

BY: PWGSC Project Manager and Design Team
REVIEW: Environmental Assessment Specialist (if required)
CONSULT: Client Reps
PWGSC Planners: CASAs and Project Leaders
Site Maintenance Staff
OUTPUTS: GOP component of Request for Proposal (RFP)/Project Brief
Environmental Assessment (if required)

The project goals should be reviewed with the maintenance supervisor of the building to discuss the feasibility of various measures and possible implementation implications. If required, an environmental assessment should be conducted to identify regulatory and environmental protection requirements for inclusion in the project definition.

The GOBP component consultant RFP would be developed using the RPS Generic Consultant Selection Documents Request for Proposal (Two-Phase Procedure). It was developed as a standard default document for submitting projects for bid and is presented as an editable document. Project managers are expected to add or subtract sections that are applicable for their projects, taking into account the project goals and specific site considerations.

This generic RFP has been drafted to include environmental aspects ensuring that the department achieves the results in each project that meet the commitments under PWGSC's Sustainable Development Strategies (SDS). These environmental aspects are contained in the Project Brief Section of the RFP and include instruction or discussion on the following topics:

1. basic tenets of PWGSC's SDS and environmental policy;
2. Requirements of CAE;
3. IAQ as it relates to mechanical system design, biological inhibitors, product selection, and commissioning;
4. site and landscape requirements, including building location and orientation, pedestrian and vehicular traffic patterns and surfacing requirements, plant species selection, and water body protection;
5. water efficiency and conservation;
6. energy efficiency and conservation;
7. product selection;
8. hazardous and non-hazardous solid waste management; and
9. life-cycle analysis (LCA) and life cycle costing (LCC).

PHASE 3: IMPLEMENTATION

(Design, working documents, contracting, and construction)

BY: PWGSC / Design Consultant
REVIEW: PWGSC Design Team
(including environmental coordinator)
Design Review Committee
CONSULT: Client Reps
PWGSC PLANNERS: CASAs and Project Leaders
Site Maintenance Staff
OUTPUTS: GOP Design Implementation Reports

PWGSC/Design Consultants should prepare a submission for the environmental component of the conceptual design. This submission would indicate design considerations and evaluations established, including life cycle assessment as documented in Appendix E. It should be updated at each major milestone in the development of the design, working documents, contracting and construction steps.

For projects where significant environmental considerations are present, assign an environmental coordinator to the RPS QA team for project-design review of drawings and specifications.

PHASE 4: COMMISSIONING

Assign or delegate environmental coordinators to project input and to be part of the RPS QA team for project monitoring and project commissioning to assess compliance and adherence to the GOBP.

PHASE 5: OPERATING

This aspect is not covered within the scope of project delivery and should refer to the O&M section. GOBP's ongoing O&M considerations are included in Appendix C of this document.

PHASE 6: EVALUATION

This phase should focus on evaluating the effectiveness of the GOBP application to the project and identify opportunities for improving project-delivery tools such as the project brief and the standard Request for Approval.

LEASING, OPERATION AND MAINTENANCE; ACQUISITION AND DISPOSAL *1.6*

The steps outlined in Section 1.5 are most relevant to renovation, recapitalization and fit-up projects, but elements can be considered for leasing projects.

Green office building considerations can also be incorporated into leasing documents through a requirement where properties are being evaluated for lease, a property with more environmental considerations incorporated into design. Operation will be given preference over other properties, all other things being equal. Sections of current leasing documents relevant to environmental issues and green office building considerations are included in Appendix C of this document.

To keep all green features of the building operating as designed correct operation and maintenance is essential in green office buildings. Appendix B to this document provides various O&M tips for green office buildings.

Green office considerations are not a significant feature of property disposal, although if a building has green features (energy and water efficient, good IAQ) these should be highlighted as an advantage. Environmental considerations in the sale of federal property are presented in Appendix D.

DOCUMENTATION OF THE GREEN OFFICE BUILDING PLAN *1.7*

When a proponent has been through the steps indicated in sections 1.4 and 1.5 and the approach outlined in the following sections, a short document should be prepared outlining the approaches which have been taken and how GOBP requirements have been met. This document simply records the decision-making process that was used to arrive at the final design decisions. It is recommended that consideration be given to incorporating this brief document as an appendix to either the EMS or the Environmental Protection Plan as part of a standard RFP. Inclusion of this document in the RFP will assist in the assessment process of the greening situation or future contracts.

The GOBP Documentation Report format is presented below. Mandatory requirements are requirements that must meet existing codes, standards, regulations, local bylaws, etc.

SECTION 1: BACKGROUND AND DESCRIPTION OF PROJECT
- description of building (location, size, year of construction, any renovations carried out and when);
- which category of activity the building plan falls into (renovation, recapitalization and fit up, leasing or acquisition/disposal); and
- what work was done (whole building or part of the building, etc).

SECTION 2: WATER
- mandatory requirements and how these were met;
- how GOP requirements were met (brief description of various measures put in place to upgrade the building to green status, reduction measures which were not implemented and reasons why);and
- estimated impacts of GOP approach (per capita water use).

SECTION 3: WASTE MANAGEMENT
- mandatory requirements and how these were met;
- how GOP requirements were met (Waste Reduction Action Plan for construction and demolition waste.); and
- diversion and anticipated waste (for office waste) or diversion measured for renovation, recapitalization and fit-up projects.

SECTION 4: ENERGY
- mandatory requirements and how these were met;
- how GOP requirements were met (brief description of various measures put in place to upgrade the building to green status, and measures not implemented with reasons why); and
- energy consumption reduction measured (per capita, per m2).

SECTION 5: IAQ AND ENVIRONMENTALLY SENSITIVE MATERIAL SELECTION
- mandatory requirements and how these were met;
- how GOP requirements were met (brief description of various measures put in place to upgrade the building to green status); and
- differences in any IAQ parameters that were measured before and after the project.

SECTION 6: ONGOING MONITORING AND IMPROVEMENT PLAN
- Present a plan for ongoing monitoring of the various categories addressed, and identify trigger points at which mitigative action will be taken.

The information contained in the GOBP Documentation Report will identify the extent to which greening measures were incorporated into a building. This information may be used to assess the 'green' status of the building, using assessment tools such as BREEAM or Green Leaf. The building maintenance supervisor and others who may be involved in the ongoing green operation of the building (e.g. project managers, leasing agents, etc.), should keep a copy of this report.

GREEN OFFICE BUILDING PLAN CHECKLIST BY PROJECT PHASE

2.0

GREEN OFFICE BUILDING PLAN CHECKLIST BY PROJECT PHASE 2.0

Section 2 of the GOBP provides a checklist of the green office building considerations, which should be incorporated into the Project Delivery System (PDS). The checklist can be used for any office building project, regardless of size and scope, whether the project involves a complete office building or part of an office building. The checklist presented in this section was developed using some of the material from Section AS-7 (Sustainable Development) of the Generic Consultant Selection Documents Request for Proposal (Two-Phase Procedure), which is described in Appendix A. Some of the contents of Section A7 were reorganized by Project phase. They were edited to minimize duplication or repetition and in some cases, where considered appropriate or necessary to add detail and clarification. In the spirit of "the sooner the better" these considerations should be incorporated into the planning and project definition stages of the project, with more detailed scope-out at the Implementation stage of the project.

Most of the green office building considerations will be addressed in the project definition, design, working document, contracting and construction stages of the project. This section provides a checklist to prompt green office considerations at various points along the PDS. They are presented in three broad PDS categories:

- Project Definition and Conceptual Design;
- Working Documents; and
- Contracting and Construction.

Within each of the above broad categories, green office design considerations are presented under the following sub-headings:

- project management;
- construction and renovation waste reduction;
- energy;
- IAQ;
- land use;
- noise;
- office building waste management.
- ozone depletion; and
- water conservation.

Section 3 of this GOBP presents more detailed technical checklists for each of the above mentioned areas.
It is strongly recommended that technical guidance be sought while undertaking the following steps:

PROJECT DEFINITION AND CONCEPTUAL DESIGN 2.1

Green office design should be incorporated as early as possible in the PDS. It is unlikely that green office design will have a significant impact on the very early stages of the PDS, because the planning occurs primarily after the specific building location has been identified. However, some green office building considerations may need to be incorporated at the Options Analysis stage. The early green office design should be incorporated as soon as the building has been identified, i.e. at the project definition stage. This section presents the early, planning level green office design considerations.''

PROJECT DEFINITION AND CONCEPTUAL DESIGN–PROJECT MANAGEMENT

- Consider including an Environmental Coordinator on the Project Team (may be someone already on staff, a specialist, or an outside consultant, depending on scale and complexity of project).
- Consider including documentation of the environmental project coordinator's qualifications.
- Verify the applicability of the Canadian Environmental Assessment Act.
- Identify the potential opportunities (green technologies), implementation strategies practices or procedures, for making cost-effective environmental contributions in the realm of office space provision or its use.
- Determine the cost-effective means of implementing these potential opportunities when evaluating base building, lease fitup, operations or maintenance.
- Consult with the Project Team 's Environmental Coordinator to:
    - ⇨ establish whether or not environmental aspects of the design will be coordinated through an environmental sub-consultant to the consultant;
    - ⇨ review the requirements for the environmental component of the conceptual design; and
    - ⇨ to present the environmental component of the conceptual design for review when completed.
- Note that the Environmental Coordinator may/may not be a building specialist.
- The submission requirement for the environmental component of the conceptual design should include an environmental strategy consisting of:
    - ⇨ an indication of the primary opportunities that the project represents for environmental responsibility;
    - ⇨ an indication of the primary areas where efforts will be expended to achieve environmental goals;
    - ⇨ an indication of the macro decisions which have been made with respect to environmental goals; and
    - ⇨ an indication of the alternatives to those macro decisions that have been considered and rejected, including why they were rejected.

This submission should be presented to the design review committee as part of a total conceptual design submission.

Obtain formal approval for the environmental elements of the environmental strategy related to greening the building, which is contained in the conceptual design submission.

PROJECT DEFINITION AND CONCEPTUAL DESIGN–CONSTRUCTION AND RENOVATION (CRD) WASTE REDUCTION

- Review the scope of the work with respect to asbestos removal. Examine the alternatives with respect to asbestos, which is currently encapsulated in the exterior walls. Recommend a plan for asbestos removal.
- Ensure that an environmental asbestos specialist supervises the asbestos removal aspect of the project.
- Review the condition and potential for exposure to lead-base paint, which currently exists within the building. Prepare recommendations.
- Carry out a waste audit and identify the materials and equipment within the building which will be dismantled and determine which materials can be reused in the renovation, and which materials can be recycled.
- Propose a means of reducing construction waste destined for landfill. List construction debris materials that are to be source separated at the construction site for reuse/recycling.
- Submit a plan for dismantling of building materials, including source separation. Specify dismantling, rather than demolition processes.
- Propose contractual means of ensuring that all recyclable materials and equipment are diverted from landfill.
- Ensure that architectural materials such as: ferrous metals, non-ferrous metals, doors, demountable partitions, cabinets, interior trim, tracks and blinds, carpet, windows, limestone, brick, and speed tile (crushed or filled), and mechanical items such as equipment, wiring, receptacles, switches, power poles, conduit and fixtures are reused where feasible and recycled where they can not be reused.

PROJECT DEFINITION AND CONCEPTUAL DESIGN–ENERGY

- Establish goals for the overall energy consumption of the building or renovated area. These goals should be broken down by category of energy use (e.g. heating, cooling, pumps and fans, lighting, receptacle loads, etc.).
- Consider meeting or exceeding C-2000, Commercial Buildings Incentive Program or other established energy efficiency guideline requirements. Investigate previous work done through the Federal Buildings Initiative to identify any information relevant to the current project. The Office of Energy Efficiency at Natural Resources Canada has information on all of these programs. To ensure compliance carry out energy analysis during design and after occupancy.
- Investigate means of reducing energy consumption in the design of the renovation that are most appropriate to the goals established. After more conventional approaches have been established, investigate measures that are considered innovative or above the standard of considerations normally undertaken.
- Utilize energy efficient motors where possible.
- Design conventional heating equipment for the maximum energy efficiency that life-cycle costing analysis will support.
- Consider alternative heating sources such as ground-source heat pumps, geothermal heat pumps, solar or other renewable energy sources.
- Investigate instances where it could be considered cost-effective and desirable to exceed existing energy standards in system design.
- Organize electrical services to permit sub-metering of energy use by category: cooling, pumping, fans and heating, plug loads etc. or tenant.
- Collect and analyse sub-metered energy data on a regular basis (e.g., semi-annual).
- Consider the use of a direct digital control system for central and zone systems control.
- Energy metering should be trend logged by DDC System where possible.
- Consider ventilation heat recovery.
- Provide occupants with information on how they use energy and what they can do to reduce energy use.
- Design conventional cooling equipment for the maximum energy efficiency that life-cycle costing analysis will support.
- In dry climates, consider alternative cooling technologies, including: direct evaporative cooling (water sprays into incoming ventilation air).
- In humid climates, consider indirect evaporative cooling (spray cooling of exhaust air upstream of an energy recovery ventilator, roof ponds, water economizers, etc).
- Review stack emissions records if existing heating sources are considered for reuse in the renovation.
- Consider district-heating connections when selecting coils and terminal equipment.
- Design for shaded areas adjacent to the building to reduce solar radiation striking the building in the summer and allow solar penetration in the winter.
- When appropriate, provide sheltered areas for Public Transit, to minimize inconvenience and encourage staff to use public transit, thus reducing greenhouse gas emissions.
- Design glazing in particular, and all other elements of the building's envelope to minimize the energy consumption requirements of the building.
- Investigate specifying high reflective ceiling systems to allow for installation of lower illumination levels of lighting.
- Design lighting to minimize energy requirements. Consider design alternatives that maximize the penetration of daylight into the building interior. Maximize day lighting by design of partition layout. Consider interior/exterior light shelves to increase daylight penetration.
- Provide lighting with optimum colour rendering index.
- Consider electronic ballasts, high efficacy lamps and reflectors in fixtures.
- Use task lighting where possible to facilitate occupant control of amount and direction of light at each workstation.
- Switch lighting controls automatically according to occupancy and day lighting availability.
- Install an intelligent building lighting control system where possible.
- Consider setting up an energy monitoring and improvement team that would monitor and analyze energy use data and patterns, keeping up to date with current information on energy efficiency issues and recommend improvement for continuous reductions in energy use.
- Establish procedures for continuous monitoring, inspecting, maintaining and operating all equipment that can affect energy consumption.
- Provide bicycle racks to encourage staff to bicycle rather than drive to work.

PROJECT DEFINITION AND CONCEPTUAL DESIGN–IAQ

- Start ventilation systems one to two hours before the office opens to provide morning flushing.
- Review existing documentation regarding stack emissions levels or measure existing stack emissions.
- Consider designing or renovating to minimize stack emissions.
- Design to minimize the potential for growth of bacteria and fungi in ventilation systems; design to MD 15000 and ASHRAE 62 recommendations for prevention of standing water.
- Minimize duct linings; eliminate loose mineral fibres within the air system.
- Design humidification and condensate systems to minimize moisture in ducts and contamination of duct liners.
- Establish design criteria for ensuring carbon dioxide levels in the office area do not exceed maximum allowable levels.
- Design for high levels of air filtration performance.
- Locate machines using toners and copy fluids in a dedicated area, and install exhaust-only ventilation for areas to remove vapours and gases from the building.
- Identify materials with off-gassing volatile organic compounds (VOC) emission rates of any consequence which will be utilized in the office. Determine how each material will be addressed with respect to reducing its off-gassing potential within the building. Consider substituting with non-VOC emitting materials where practical.
- Consider heating and cooling distribution systems, (e.g. hydronic systems) that minimize the potential for the distribution of dust and contaminants throughout the building.
- Locate and design cooling towers to prevent drift loss from entering the building or from entering exterior public areas.
- Ensure all populated areas of the building have effective ventilation air supply. Design to supply ventilation air as close as possible to each workstation, and the possible use of occupant controlled ventilation systems. Ensure exhaust draws contaminated air away from workstations.
- Review available data, and establish the types and levels of pollution that are likely to be encountered in the outdoor air, and consider this data when designing air intake systems.
- Provide air locks and pressurization to reduce entry of contamination from outside sources.
- Design to optimize air circulation thus improving IAQ. Consider exceeding code requirements by using technologies such as heat recovery ventilation and free cooling.
- Consider designing to provide "Free Cooling" using 100 percent outside air when appropriate.
- Gain familiarity with the current state of the art in IAQ considerations and reflect these in the building design.
- Consider using plants (interior and exterior) that absorb toxic substances from the air.
- Incorporate sustainable concepts into landscape plans and consider how the interior and exterior landscaping contributes to improving the indoor environmental quality. Other options to consider include:
    - ⇨ trees for summer shading, winter light access;
    - ⇨ run-off water retention; and
    - ⇨ xeriscaping
- Consider setting up an IAQ monitoring and improvement team to investigate IAQ complaints, keep up to date with current information on IAQ issues and recommend improvements for maintaining high standards of IAQ.
- Establish procedures for continuous monitoring, inspecting, maintaining and operating all equipment that can affect IAQ.

PROJECT DEFINITION AND CONCEPTUAL DESIGN–LAND USE

- Verify whether or not the site currently has, or previously contained any fuel storage tanks. If so, determine whether or not there is a potential for petroleum contaminants to exist on site. Reports are available from PWGSC.
- Review the site history to determine the potential for hazardous materials to exist on site. Reports are available from PWGSC.
- Develop a landscape plan that minimizes erosion.
- Consider the potential for working around existing trees and other vegetation when undertaking construction activities.

PROJECT DEFINITION AND CONCEPTUAL DESIGN–NOISE

- Design to minimize the effect of noise.

PROJECT DEFINITION AND CONCEPTUAL DESIGN–OZONE DEPLETION

- List materials and equipment containing CFC's and HCFC's that will be removed during the renovations.
- Wherever possible, specify foam and plastic products such as insulation and furniture stuffing blown with steam rather than CFC's, HCFC's or other ozone depleting substances.
- Investigate the potential for replacing equipment (such as refrigeration and chilling equipment) with systems that use refrigerants that do not use ozone-depleting substances.
- Design replacement equipment containing refrigeration gases to ensure zero leakage of gas to the atmosphere, as required by the Federal Halocarbon Regulations.

PROJECT DEFINITION AND CONCEPTUAL DESIGN–OFFICE WASTE REDUCTION

- Plan interior layouts to accommodate recycling of waste paper–the primary waste material to be generated through the operation of the building.
- Plan interior layout to accommodate a Multi-Material Recycling Program.
- Consider waste chutes to facilitate recyclables collections in a central area.
- If the building will accommodate a cafeteria, plan to accommodate the composting of organic waste.

PROJECT DEFINITION AND CONCEPTUAL DESIGN–WATER CONSERVATION

- Establish baseline water use data through a water audit. Document current water uses at the facility (including equipment, landscaping activities, etc.) and volumes for each. Obtain water audit details and submit to project authority.
- Produce a list of potential undertakings to reduce water consumption, the estimated reduction for each and the cost of each.
- Consider the potential for future requirements to separate grey water from sanitary sewage.
- Consider the potential for storing rainwater to irrigate landscaping or for use in equipment such as cooling towers.
- Ensure parking lot runoff is not directed to storm water management ponds that will be used for irrigation or in equipment.
- Consider the benefits from using sand rather than salt for the parking areas.
- Ensure all plumbing fixtures specified are low water consumption types. The National Master Specification requires that these be specified automatically for federal facilities. This is also a requirement of the Ontario Building Code and other provinces are following suit.
- Consider recording water consumption for analysis either manually or by building automation systems.
- Design landscaping to minimize the need for water.
- Do water quality tests under standing water conditions. Undertake any necessary action that may be required if lead or any other contaminant in the standing water is found to exceed Canadian Drinking Water Guidelines.
- Consider setting up a water monitoring and improvement team to investigate and recommend improvements for the reduction of water use in the building.
- Establish procedures for continuous monitoring, inspecting, maintaining and operating all equipment that consumes water.
- Specify water efficient practices and processes, e.g. closed loop instead of once-through systems.

DESIGN AND WORKING DOCUMENTS *2.2*

Carry out more specific green office building measures at the detailed design of the project and incorporate them into design drawings and contract specifications. The considerations at this more detailed stage are listed in this section.

DESIGN AND WORKING DOCUMENTS–PROJECT MANAGEMENT

- The consultant should meet with the environmental coordinator of project team (or equivalent) to present, for review and approval, the environment component of the working documents at the various stages established by the project authority.
- Incorporate green aspects of NMS sections with most recent environmental updates.
- The contractor is to provide the project authority with an Environmental Protection Plan.

DESIGN AND WORKING DOCUMENTS–ENERGY

- Confirm that the design is projected to meet or exceed the established energy consumption level.
- Consider specifying high efficiency motors on all major equipment.
- Design documentation for all energy consuming building systems will include a statement of the design intent and operational recommendations. Such information should include:
  - ⇨ descriptive information about each system detailing its function, design capability, performance characteristic and distribution arrangement;
  - ⇨ schematic diagrams, control diagrams, and sequence of operation;
  - ⇨ information required includes stop/start and adjustment procedures, changeover, start-up and shutdown sequences; and
  - ⇨ commissioning requirements and procedures.
- Specify (when viable choices exist) materials with low embodied energy, and propose initiatives to incorporate low embodied energy materials as substitutes for material that would normally be specified.

DESIGN AND WORKING DOCUMENTS–IAQ

- Fitup and furnishing are to incorporate products with low VOC emissions. In choosing material, ensure that they are off-gassed. Furthermore, to facilitate future recycling, choose either all synthetic or all natural, but not mixed.
- Consider limiting the amount of specified carpet floor (less than half, if practical). The remainder should be linoleum, ceramic tiles or other materials that do not off-gas.
- Specify interior partitions with non-absorbent finishes. Reducing the amount of surface area thereby reduces the potential for materials to act as a sink for negative air quality emissions within the building. Interior partitions comprise the single largest area within the building that has the capacity to entrap emissions.
- Minimize bacteria and mould growth within the building by:
  - ⇨ minimizing the use of fibrous liners inside HVAC ducts;
  - ⇨ avoiding the use of suspended ceilings as return air plenums and duct returns to the extent practical, particularly given limitations within existing buildings; and
  - ⇨ avoiding the use of uncontained mineral fibre materials.
- Optimize ventilation effectiveness by eliminating short-circuiting and dead-air zones.
- Optimize air-intake locations: isolate intakes from sources of hazardous air contaminants and nuisance air contaminants. Locate intakes to avoid "re-entrainment" of exhaust air.
- Specify and indicate that materials considered for the renovation have been reviewed with respect to their potential sources of emissions contributing to IAQ problems. Likewise, ensure that these materials have been excluded or limited in scope of use in the working documents. Select building materials with positive IAQ ratings.
- Review the potential for stack emissions, sulphur dioxide and salt air to be encountered by building materials utilized on the exterior of the building.
- Review contemplated construction sequences to ensure that the occurrences of major events causing dust within the building during construction are minimized.
- Paints merit special consideration, as they can be a significant contributor to internal VOC emissions. Specify environmentally responsible products such as paints, which do not contain mercury, lead, hexavelant chromium or cadmium compounds. Specify water based paints with reduced volatile, preservative and solvent content and reduced VOC emissions.
- Consider carpets that do not have latex backing. Woven carpets made of natural materials off-gas the least. Carpet installed by tackless or skrim installation methods off-gas less than double glue-down installations.
- Carpet undercushions can also contribute to poor IAQ. Products manufactured from natural materials tend to off-gas the least. Other products such as some brands of carpet undercushion manufactured from recycled tires have been specifically treated to reduce negative impacts on IAQ.
- Specify the use of latex adhesives and glues that have lower emissions during curing.
- Some carpet tile can produce high VOC emissions from the backing materials. If these types of products are to be specified manufactures should be asked to submitted copies of off-gassing testing to ensure that the materials will not negatively impact on the IAQ of the building.
- Consider caulking materials, adhesives, finishes, retardants, sealers and waxes with low VOC emissions. Acrylic and latex caulking are preferred for indoor use. Many of the product categories are included in environmental labelling programs or directories that provide advice on appropriate choices.

- Specify materials with reduced formaldehyde content or contain phenolformaldehyde, which has a more stable chemical composition.
- Specify materials with anti-microbial treatment only for areas where such materials may be in contact with elevated moisture levels.
- Avoid the use of varnish, furniture polish, oil finish and liquid floor wax (poor IAQ characteristics). Water-based products should be selected whenever possible, as they usually have reduced VOC emissions. Selected natural waxes are preferred above oil finishes.
- Material Safety Data Sheets (MDS Sheets) can be utilized to monitor the chemical composition of materials that are being considered in the design concept. Monitoring the chemical composition of materials can reduce the VOC load within a building.

DESIGN AND WORKING DOCUMENTS–LAND USE
- Consider plants that minimize requirement for pesticides.
- The use of plantings will minimize the potential for erosion. However, certain plants may be more effective in specific applications. For example, the planting of willow species on the banks of watercourses will provide increased erosion protection due to their expansive root systems. Care should be taken to ensure that plantings are selected to provide maximum erosion protection.
- Consider plants that minimize the need for irrigation.
- Consider native plants with low/no watering requirements.

DESIGN AND WORKING DOCUMENTS–NOISE
- The following measures should be considered where viable to reduce noise within the building by:
  - ⇨ utilizing low noise generating equipment;
  - ⇨ lowering equipment room noise;
  - ⇨ blocking flanking sound paths and isolating plumbing noise;
  - ⇨ designing HVAC systems and equipment for low NC rating;
  - ⇨ designing telephone systems to minimize noise; and
  - ⇨ provide acoustic partitions and appropriate acoustic treatment at ceilings, doors and sidelights.

DESIGN AND WORKING DOCUMENTS–WASTE REDUCTION
- Specify materials with recycled content but do not specify recycled materials where data indicates that recycled content or recycled product has potential to compromise IAQ performance characteristics.
- Specify durable materials with low maintenance finishes.
- Standard sizes of construction materials should be considered during the design process. The adaptation of the design to accommodate standard material sizes will minimize waste generation by reducing the quantity of cut-off materials.
- Minimize specification of finite and non-renewable resources where practical.
- Provide in writing the rationale for use of all materials, based on recycled content, embodied energy, durability, etc.
- Specify dismantling with reuse and recycling rather than demolition.
- Include required spaces for material storage to facilitate recycling.
- Include spaces for on-site composting where appropriate and feasible.
- Refer to NMS section 01355, Waste Management and Disposal.
- Consider carpets with recycled content in fibres and backing and carpets that can be recycled.

DESIGN AND WORKING DOCUMENTS–WATER CONSERVATION
- As part of the Water Efficiency Action Plan, install meters, or other equipment or monitoring system that will track water usage.
- Design documentation for all water consuming equipment, and systems should include a statement of the design intent and operational recommendations. Such information would include:
  - ⇨ descriptive information about each system detailing its function, design capability, performance characteristic and distribution arrangement;
  - ⇨ schematic diagrams, control diagrams, and sequence of operation as needed; and
  - ⇨ information required includes stop/start and adjustment procedures, changeover, start-up and shutdown sequences for water economizers, cooling tower operation irrigation systems, etc.

CONTRACTING AND CONSTRUCTION *2.3*

Consideration for specific green office design practices should be considered as soon as the project is awarded to a specific contractor and construction proceeds. These considerations are listed in this section.

CONTRACTING AND CONSTRUCTION–PROJECT MANAGEMENT
- The environmental coordinator should table progress of the Environmental Strategy as a separate agenda item during project meetings.
- The contractor should provide the project authority with an Environmental Protection Plan for the construction process.
- The project authority and contractor should ensure that all sub-contractors are advised of the environmental objectives of the project.

CONTRACTING AND CONSTRUCTION–IAQ
- The project authority should approve the building flush-out or bake-off strategy before occupancy.
- Review construction practices to ensure that workers are protected from dust.
- Review construction practices to ensure that workers' exposure to fumes, which may contribute to environmental sensitivities, are minimized. Ensure that workers wear appropriate face masks or respirators when applying paints and other materials where there is a risk of impacts due to exposure. Provide temporary ventilation as required for products utilized.
- Review construction practices to minimize the impacts of construction dust on adjacent properties. Surrounding sites could be adversely impacted by blowing dusts from exposed soil, dust escaping from sandblasting activities and overspray from sealants and paints, which may be used on the outside of the building.
- Shop drawing review includes, when appropriate, test results from ASTM D51116, Guide for Small Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials Products and Material Safety Data Sheets.

CONTRACTING AND CONSTRUCTION–LAND USE
- Review practices to ensure erosion is minimized or eliminated during construction.

CONTRACTING AND CONSTRUCTION–WASTE REDUCTION
- Set up a meeting with contractor, sub-contractor and installers to ensure that all material installation meets with environmental objectives.
- Inspect and report on contractor's disposal practices for paints, solvents and pressure-treated wood scraps.
- Sort construction waste on-site by types, based on the potential for reuse/recycling.
- The working documents ensure that all personnel on-site are aware of the expectations regarding waste recycling. The working documents are to ensure that labelled waste bins for recycling of waste materials produced by all sub-contractors are provided on-site.
- Project documentation should assert the degree of waste diversion that is desired on the project site.
- Transportation waybills and bills of lading should be compiled along with reuse/recycling receipts and landfill tipping-fee receipts, and summarized in a Waste Management Report.

CONTRACTING AND CONSTRUCTION–WATER CONSERVATION
- Review practices to minimize the impacts of construction on adjacent water bodies, water supplies and wastewater systems.
- Ensure no polluting substances are released into any water bodies.

CHECKLIST OF GREEN OFFICE BUILDING ACTIVITIES BY TECHNICAL AREA

3.0

CHECKLIST OF GREEN OFFICE BUILDING ACTIVITIES BY TECHNICAL AREA 3.0

This section presents more detailed green office building information and practices by technical area, in checklist format. The detailed information from which this list was compiled is contained in Sections 3, 5, 7 and 9 of the second edition of The Environmentally Responsible Construction and Renovation Handbook (March 2000). This more detailed source material should be referred to if additional information is required.

WATER CONSERVATION 3.1

WATER CONSERVATION–DOMESTIC WATER SUPPLY

BASIC MEASURES

- Water closets (maximum water consumption 6.0 L/flush).
- Urinals (maximum water consumption 3.8 L/flush).
- Faucet aerators (maximum flow rate 4 L/m @ 413 kPa).
- Shower heads (maximum flow rate 7.6 L/m@ 550 kPa).
- Automatic shut-off (manual or electronic) for all faucets and showers.
- Notices posted beside the showerheads explaining use of water conserving features.
- Residential dishwashers–maximum water consumption 24 L/cycle.
- Single load commercial dishwashers–maximum water consumption 5.3 L/rack.
- Conveyor Type Commercial Dishwashers–maximum water consumption 21 L/meter of conveyor width/minute of operation at highest speed.
- Water softeners–demand initiated back flushing with counterflow operation.

ADDITIONAL MEASURES

- Locate water heaters centrally to minimize piping runs.
- Install pedal switch on kitchen sinks.
- Consider installing waterless urinals.

WATER CONSERVATION–HEATING VENTILATION AND AIR CONDITIONING (HVAC) SYSTEMS

BASIC MEASURES

- Do not specify open-loop equipment.
- Schedule regular water quality testing for cooling tower sump water.
- Perform cooling tower blow down procedures only when indicated by water quality test results.
- Specify counter flow evaporative cooling towers with a maximum drift loss 0.002 percent of total water flow.

ADDITIONAL MEASURES

- Check and calibrate humidifier controls annually.
- Consider chemical treatments that suspend minerals and minimize the need for tower blow down.
- Consider using rainwater for cooling tower water makeup.

WATER CONSERVATION–LANDSCAPING

BASIC MEASURES

- Avoid using Kentucky Bluegrass turf (very water intensive).
- If automatic irrigation systems are to be specified the systems should be equipped with both timers and electronic moisture sensors to ensure that the system engages only when the moisture levels in the ground are below acceptable levels.
- Do not conduct irrigation procedures during the day when evaporation rates are highest.
- Set automatic irrigation systems for 15mm/week watering or less, as consistent with the species planted.
- Adjust sprinklers to avoid overspray into parking lots and other non-landscaped areas.
- Use drought-resistant native plants to cover a minimum 70 percent of landscaped areas.
- Use trees and shrubs to provide shade and wind protection.

ADDITIONAL MEASURES

- Collect rainwater (i.e. rain barrel, cistern, retention pond) for use in irrigation procedures.
- Ensure chemistry of selected soils and mulches meets the needs of the plantings to minimize irrigation requirements.
- Consider installing porous paving surfaces and grass paving surfaces to maximize rainwater retention and minimize run off.

SOLID, NON-HAZARDOUS WASTE MANAGEMENT *3.2*

This section deals with issues related to solid non-hazardous waste only. Hazardous wastes should be handled in accordance with applicable provincial regulations.

SOLID NON-HAZARDOUS WASTE MANAGEMENT–CONSTRUCTION, RENOVATION AND DEMOLITION (CRD) WASTE

CRD GENERAL ACTIVITIES

- Conduct a waste audit prior to commencing activities to determine which materials can be diverted from landfill.
- Prepare a waste diversion work plan.
- Use the National Master Specification (NMS) to write CRD specifications.

CRD WASTE REDUCTION AND REUSE ACTIVITIES

- Separate building materials and equipment for:
  - ⇨ donation or sale to other facilities (i.e. used building materials centre, demolition contractors);
  - ⇨ reuse on-site; and
  - ⇨ other off-site projects.
- Ensure that Crown Assets remove all equipment and materials identified in its report.

CRD WASTE RECYCLING ACTIVITIES

- Identify local recycling markets for CRD materials.
- Contact local recycling companies for information on recycling services.
- Decide whether CRD recyclables are to be diverted into single material type outlets (accept source separated recyclable materials) or full-service type recycling outlets (accept mixed shipments of recyclable materials which are separated off-site).
- Ensure contract with recycler specifies materials to be recycled, price schedule, pick-up requirements and proper documentation.

CRD WASTE MONITORING AND REPORTING

- Summarize weight and volume of CRD materials that will be generated throughout the project.
- Summarize weight and volume of CRD materials reused or recycled throughout the project.
- Summarize the cost and savings (i.e. labour costs, shipping and disposal costs and savings).
- Develop projected waste-diversion percentages (using waste audit baseline measurements).
- Identify the condition of the reusable materials.
- Summarize problems that were encountered and document solutions.
- Develop list of recommendations for future projects.

OFFICE WASTE RECYCLING *3.3*

OFFICE WASTE RECYCLING–MULTI-MATERIALS RECYCLING

- To meet separation requirements of the recycling program, central recycling bins should have the appropriate number of compartments.
- Central recycling bins for glass, metal, plastics and polystyrene should be conveniently placed on each floor and properly identified.
- Sufficient and properly signed bins should be placed in areas throughout the building where recyclable materials are generated such as lunchrooms, cafeterias, catering areas and outdoor lunch areas.
- Bins should be checked frequently by cleaning staff to ensure they do not overflow.
- Bins should be wiped down periodically.
- Employees should be instructed to remove excess food and liquids from packaging before placement in recycling bins.

OFFICE WASTE RECYCLING–OFFICE WASTE REDUCTION PLANNING

- Allocate convenient locations for recycling centres or receptacles.
- Allocate sufficient storage area for recyclables.
- Design recycling centres that complement office decor.
- Incorporate receptacles for recycling materials into lunchroom, coffee station and other heavy traffic areas.
- Ensure recycling stations do not block hallways.
- Place recycling stations within required distance of smoke detectors and fire sprinklers.

OFFICE WASTE RECYCLING–ORGANIC WASTE COLLECTION

- Signage should clearly indicate what materials are acceptable to the composting program.
- Ensure that there is support from the property management and staff to ensure handling of the organic waste (especially on floors).
- Educate employees on the importance of eliminating contamination.
- Organic waste requires removal from floor bins and cafeterias daily to reduce odours and pests (flies).
- Organic materials should be collected at least every second or third day, unless there is cold storage in the building.

OFFICE WASTE RECYCLING–PAPER RECYCLING

- Provide a PaperSave bin near each desk where paper-recycling programs are in place.
- Locate PaperSave bins close to central photocopiers, printers and mail centres.
- Provide sufficient and appropriate signage to explain the program to employees.
- New employees should receive explanations of site recycling programs.

OFFICE WASTE RECYCLING–WASTE AND RECYCLING COLLECTION SERVICES

- There should be enough waste collection bins throughout the building to meet the needs of the occupants.
- Waste should be compacted where possible.
- Ensure that the collection schedule meets the requirements of the building.
- Review waste collection storage and collection frequencies quarterly.
- Ensure that the waste hauler can provide the name, phone number and tipping rate structure for disposal facilities used. If possible, the disposal facility should be within the local area and must be a licensed operation.
- The haulage contract should allow flexibility in frequency of service.
- Waste and recycling contracts should have collected weights included on invoices or by separate monthly reporting mechanism to allow for auditing purposes.
- Provide feedback to employees about their waste diversion performance.

IAQ AND MATERIAL SELECTION *3.4*

IAQ AND MATERIAL SELECTION–CONSTRUCTION PRACTICES

- Ensure construction materials are protected from rain and other moisture sources.
- Control fibre and particulate release during installation procedures.
- Verify that all materials arriving on-site meet environmental specifications.
- Commission heating, ventilation and air-conditioning systems to ensure they meet design specifications.

IAQ AND MATERIAL SELECTION–SOURCE CONTROL

BASIC MEASURES

- Ensure basement moisture control prevents soil gases and moisture from entering the building.
- Reduce off-gassing from finishes by selecting water-based (latex or acrylic) paints, caulkings and adhesives. Use third-party certifications, where available, to identify low emissions products.
- Specify only materials with no or low VOCs for interior surfaces in the building (i.e. ceiling coatings, wall coverings and panelling, floor coverings, office partitions, etc.).
- Limit the levels of formaldehyde emissions by eliminating the specification of materials that have been manufactured with urea-formaldehyde. Specifications can be amended to call for products that have been manufactured with phenolformaldeyde, which will not adversely impact on IAQ. If substitutions are unavailable, designs should be modified to ensure that all surfaces with the potential to emit formaldehyde have been effectively sealed with low VOC sealants.
- Limit amount of carpeting in the interior of the building.
- When specifying carpeting, the Carpet and Rug Institute (CRI) can provide test data on VOC emission rates for many carpets. These test results can be used for disclosure or comparative purposes. However, care should be taken when using industry-driven programs, as the standards for certification may not meet criteria that have been established by third party or non-industry driven certification programs. This information should be used for evaluation purposes only.
- Use “low-emission” or water-based adhesives for affixing carpets.
- Prevent condensation on interior surfaces (such as window frames) by designing all components for a minimum indoor surface temperature of 10oC (50oF).
- Ensure that fresh ventilation air is drawn from clean outdoor locations.
- Do not use ozone generating devices claiming to be air purification devices.

ADDITIONAL MEASURES

- Eliminate trim made from manufactured wood containing formaldehyde and trim from species that emit high levels of VOCs.
- Select furniture and furnishings (e.g. cabinets, desks, tables, chairs and bookshelves) manufactured from materials known not to contain urea-formaldehyde and other VOCs.

IAQ AND MATERIAL SELECTION –VENTILATION SYSTEM DESIGN

BASIC MEASURES

- Ensure that the ventilation air system is designed to meet the requirements of ASHRAE 62.
- Ensure ventilation supply and exhaust grilles are located to avoid short-circuiting of supply air directly into the return grille.
- Design outside air louvers and ducts (including economizers) to limit intake air velocities to exclude rainwater entry (maximum face velocity 2.54 m/s).
- Specify air velocities through cooling coils and humidifiers to prevent wetting of downstream surfaces (maximum face velocity 2.54 m/s).
- Eliminate use of fibrous duct-liner or glass fibre ducting.
- Isolate potential pollution sources and vent to the outdoors with separate ventilation systems. Vents should exhaust directly to the outdoors with no recirculation of exhaust air from kitchens, washrooms, smoking lounges, custodial closets, cleaning chemical storage areas and dedicated printing/copying areas. Adding these locations to existing washroom exhaust may be one way of retrofitting dedicated ventilation.

ADDITIONAL MEASURES

- If possible design air-based systems for a minimum total air movement of 5.1 litres/second/m2.
- Investigate potential for installation of displacement ventilation.
- Investigate potential to use high-efficiency filters (minimum 60 percent dust-spot efficiency) in all makeup and return-air ducting.
- If possible, design air handler and control sequence to provide modulation up to 100 percent of air-handler capacity in outdoor air as outdoor conditions warrant.
- Specify a night purge cycle during air-conditioning season to flush building with night air, thereby removing pollutants that have built up in the interior space. Night flushing avoids the need to condition the air during flushing.
- Evaluate the incorporation of natural ventilation through the use of operable windows.

ENERGY EFFICIENCY *3.5*

ENERGY EFFICIENCY–AIR DISTRIBUTION

- The zones within a given airflow area should be on the same occupancy schedule and have off-hours setback or on/off controls.
- Divide air distribution system into airflow control areas of not more than 2500 m2 (or one storey), if serving multiple temperature control zones and having a combined conditioned floor area of more than 2500 m2.
- Variable-air-volume (VAV) system fan power requirements must not exceed 2.65 W per L/s of design supply airflow to the conditioned space (calculated according to MNECB Sentence 5.3.1.2[2]).
- Constant volume systems must not exceed 1.6 W per L/s of design airflow (calculated according to MNECB Sentence 5.3.1.2[2] and excluding fans with performance requirements cited in MNECB Subsection 5.2.13).
- All fans in a VAV system (including central fans in distributed systems served by VAV boxes) must have a power reduction of 45 percent or more for an airflow reduction of 50 percent.
- Design all duct systems with provisions for balancing.
- Seal all HVAC ducts and plenums to the SMACNA HVAC Duct Construction Standard and MNECB Table 4.2.2.3.

ADDITIONAL CONSIDERATIONS

- Consider converting CV systems with dual ducts or terminal reheat that use backward-inclined or airfoil fans to VAV operation.
- Consider converting existing VAV systems with inlet vane airflow controls or outlet dampers to variable frequency drives (VFDs).
- If building heating or cooling loads have been reduced lower fan speed on VAV systems. Reduce the fan RPM if vanes or dampers are closed more than 20 percent on a peak cooling day. Lower the fan speed by changing pulley sizes.
- Evaluate changing fan belts to timing belt type drives. "Cogged" drive belts experience less energy loss than ordinary V-belts, are much more durable, and require less maintenance.
- Replace existing motors with properly sized energy-efficient motors when: the motor is due for rewinding or replacement; the motor runs a significant number of hours per year; and/or the motor is significantly below current efficiency standards.
- High efficiency motors run at a higher speed than standard efficiency motors. The drives must be adjusted to account for this difference.

VENTILATION AND HEAT RECOVERY

- Consider installing heat recovery ventilation if additional ventilation air is required during the retrofit of an existing building.
- Heat recovery can be applied between the building general exhaust (typically washroom exhaust), reducing the ventilation energy load by about 60 percent.
- Heat recovery can reduce the required capacity and cost of heating and cooling equipment by a corresponding amount.
- Heat recovery can also make it feasible to deliver ventilation at greater than minimum rates required by Code.
- Energy recovery techniques include plate heat exchangers, rotary wheel heat exchangers (with or without desiccant coating for moisture and latent energy transfer), heat pipes, or run-around coils.

ENERGY EFFICIENCY–BUILDING ENVELOPE INSULATION

- Thermal transmittance (U-value) of walls, roof and floors-on-ground must not exceed the values of the Model National Energy Code for Buildings (MNECB).
- An assembly's U-value must account for thermal bridging due to framing members.
- The edge of a concrete floor or roof, where it intersects an exterior wall, would be insulated so that its U-value is not more than twice that of the associated wall.
- Wall areas containing recessed heaters, pipes and ducts that partly penetrate the building envelope should have a U-value not exceeding the overall U-value of the remainder of the wall.
- Floors on grade, exterior walls or exterior ceilings containing embedded radiant heating sources should be insulated to 20 percent better than the U-value allowed by the MNECB.
- Attic insulation must be continuous over the top plate of the wall bearing the roof and have a U-value not more than that of the associated wall.
- At discontinuities where the plane of the insulation is offset and cannot physically be joined, each layer should be continuous and overlap for a length of at least four times the distance separating the two layers of insulation.
- Where a concrete or masonry interior wall penetrates an exterior roof or wall, it should be insulated on both sides to a distance of at least four times the thickness of that interior wall to the same U-value as the exterior wall.
- Insulate all required below grade walls over their full height to the U-value specified in the MNECB.
- Airbarrier/vapour retarder systems should be designed and installed in accordance with Part 5 of the National Building Code of Canada (NBC) to provide the required envelope airtightness and resistance to vapour diffusion.

ENERGY EFFICIENCY–DOCUMENTATION

- Design documentation for all energy consuming building systems should include a statement of the design intent and operational recommendations. The following details the required information:
- descriptive information about each system, detailing its function, design capability, performance characteristic and distribution arrangement; and
- schematic diagrams, control diagrams and sequence of operation

Required information includes stop/start and adjustment procedures, changeover, and start-up/shutdown sequences.

ENERGY EFFICIENCY–ECONOMIZER SYSTEMS

- Use outdoor air economizer systems to provide cool outdoor air to the extent available and in the volumes required to displace as much mechanical cooling as possible.
- Install air economizer systems if system is greater than 1500 L/s supply air or 20 kW cooling capacity.
- Use water economizer systems as an alternative to outdoor air economizer systems if designed to operate efficiently.

ENERGY EFFICIENCY–ELECTRIC POWER

- Plan energy monitoring for systems with capacity greater than 250 kVA.
- Control exterior power receptacles by a switch or timer (may need to be accessible to tenants).
- Transformers and their power-loss characteristics should comply with the MNECB 7.2.3.1.
- Three-phase motors and their efficiency must comply with MNECB 7.2.4.
- Evaluate and correct voltage imbalances, voltage deviations, poor connections, undersized conductors, poor power factors, insulation leakage and harmonics.
- Document the design and the maintenance requirements of the electrical power system.

ENERGY EFFICIENCY–FENESTRATION AND DOORS

- U-value of windows and skylights should not exceed the values specified in MNECB. Airtightness ratings should be A2 or better.
- Overall U-value of swinging doors should not exceed values in MNECB. (Airtightness should comply with MNECB article 3.2.4.3).
- Install all doors and windows with insulation and air barrier/vapour retarder continuous to and securely attached to the frame.
- Vestibules are required at all entry doors that separate the conditioned space from the outdoors (except where exempted in MNECB article 3.2.2.3).

ENERGY EFFICIENCY–HVAC SYSTEMS

- Size HVAC equipment to meet load conditions as required by ASHRAE 90.1.
- Packaged and field assembled HVAC equipment should comply with efficiency requirement in MNECB 5.2.13.
- Service water equipment used for space heating should comply with efficiency requirements of MNECB 6.2.2.1.
- Use HVAC equipment must be used only under conditions allowed by manufacturer.
- Snow and ice melting equipment for sidewalks and driveways should not be installed unless manual clearing is not possible. If equipment is installed, controls should be automatic or easily accessible manual, with clear signage and trouble lights.
- The supply air handler should achieve the supply air set-point temperature without heating previously cooled air, cooling previously heated air, or heating outdoor air, which is in excess of the minimum required for ventilation.

ADDITIONAL MEASURES FOR HYDRONIC SYSTEMS

- Add radiator controls to each radiator or group, to eliminate radiators that operate "wild" at full output and require opening windows to maintain comfort conditions in winter.
- Replace old, inefficient boilers.
- Decentralize systems. Several smaller units strategically located around a large facility reduce distribution losses and offer flexibility in meeting the demands of differing schedules and loads.
- Multiple small boilers may be staged to meet loads using less energy than a single large central plant.
- Modernize boiler controls with DDC controls, which allow logic-intense functions such as optimizing fuel/air mixture based on continuous flue gas sampling, managing combustion, controlling feed drum levels and controlling steam header pressure.
- Install an economizer in the flue to preheat boiler feedwater. Efficiency increases about 1 percent for every 5.5 C° increase in feedwater temperature. Ensure that stack temperature remains above the acid dew point and that excess stack temperature is not due to a maintenance problem such as scaling.
- Install an oxygen trim system to optimize fuel/air ratio.
- Install automatic flue dampers to reduce heat loss through the flue during the boiler off cycle.
- Retrofit standing gas pilots with electronic ignition.
- Add automatic, demand operated blow down controls to reduce waste from uncontrolled continuous blow down.
- Add waste heat recovery to blow downs. Use recovery tanks and heat exchangers to preheat feedwater.
- Consider retrofitting boiler fire tubes with turbulators when re-tubing.
- Ensure boiler casing and boiler piping are insulated with at least 25mm insulation.

ENERGY EFFICIENCY–LIGHTING

- All exterior lights must provide at least 60 lm/W.
- Use schedule controllers and/or photocells to control exterior lighting.
- Facade lighting must be less than 1.2 W/m2 of face.
- Overall building lighting power density shall not exceed 11.5 W/m2.
- There must be one control per circuit–next to an entrance, visible and readily accessible.
- Occupancy sensors should be used in spaces not continuously occupied (e.g. washrooms, utility rooms, etc.).
- Use photoelectric on/off or dimming controls to provide daylighting in common areas greater than 40m2 and within 6m of appropriate windows in the building perimeter.
- Where workstations have been equipped with task lighting, switches should be installed in close proximity.
- Exit signs should be rated less than 12W each or be self-luminating.
- Fluorescent lamp ballasts should comply with MNECB 4.2.5.
- Document design intent and operational recommendations for lighting systems.

ENERGY EFFICIENCY–OTHER COMPONENTS

- Every duct or opening discharging air from a conditioned space to the outdoors or to an unconditioned space must have a motorized damper (some exceptions apply, see MNECB 5.2.3.1 [2] to [4]).
- Outdoor air intake ducts or openings must have a motorized damper (some exceptions apply, see MNECB 5.2.3.1 [2] to [4]).
- Locate dampers as closely as possible to the plane of the building envelope.
- Design dampers to close automatically when system is not in operation.
- Use only low-leakage dampers.
- Dampers can be located inside outdoor heating and cooling equipment.
- Automatic controls should turn off ventilation equipment during unoccupied periods.
- Automatic controls should set back heating temperature or set up cooling temperature set points during unoccupied periods.
- Controls should be interlocked to ensure prevention of simultaneous heating and cooling of space.
- All zones should have their own heating and cooling thermostatic controls. For perimeter radiation, all orientations should have their own controls.
- Seasonal hydronic pumping systems should be automatic or readily accessible and have clearly labelled controls to shut down the pumps when they are not in use.
- In comfort conditioning applications, automatic controls should limit humidifier operation to times when space RH is below 30 percent. Dehumidifier operation should be limited to times when the space RH is above 60 percent.

ENERGY EFFICIENCY–PIPING FOR HEATING AND COOLING SYSTEMS

- Design hydronic systems with incorporated balancing devices.
- Insulate pipes containing fluid with design-operating temperatures outside a range of 13oC to 40oC to MNECB Table 5.2.4.3 (unless exempted to MNECB Sentences 5.2.4.3 [2-6]).
- Hydronic heating and cooling systems with pumping power of 7.5 kW or more should have variable flow capability able to reduce system flow to 50 percent of full design flow or less.
- Insulate HVAC piping outside the building envelope to MNECB Table 5.2.4.3.

ENERGY EFFICIENCY–SERVICE WATER HEATING

- Hydronic heating and cooling systems with pumping power of 7.5 kW or more should have a variable flow capability able to reduce system flow to 50 percent of full design flow or less.
- Service water heaters, storage tank boilers and pool heaters should comply with MNECB Table 6.2.2.1.
- Insulate storage tanks not located in conditioned spaces with a maximum U-value of 0.55 W/m2/oC. Those located within conditioned space should have insulation with a maximum U-value of 0.8 W/m2/oC.
- Protect all insulation materials from physical damage.
- Locate all heating equipment (excluding storage tanks) in a temperature-conditioned space.
- Insulate all service hot water piping in accordance with MNECB Table 6.2.3.1 and sentences 6.2.3.1(2) to (4).
- Separate remote heaters are required to meet any hot water demand exceeding 55°C. (In buildings where hot water usage is mainly in washrooms, service hot water heating should not exceed 50°C.)
- Set automatic, adjustable controls to maintain the water temperatures at the minimum allowable requirement.
- Insulate all hot water pipes.

STATUS OF DOCUMENTS TO BE USED WITH GOBP

appendix A

Appendix A

Status of Documents To Be Used with GOBP

Environmental Services, Buildings, Technology and Project Management Directorates along with colleagues in other Federal Departments, other levels of government, and the private sector have been working to reduce environmental impacts of renovations and refits. In this area, the following resources will be helpful to others:

1. THE WATER EFFICIENCY EXPERIENCE DATABASE (WED). This Internet based tool is designed to encourage the exchange of information on both the successes and the difficulties encountered in the rapidly growing field of water use efficiency. Currently there are over 130 experiences described on the site, from all levels of government, educational institutions and the private sector. Each case study provides a brief description of the water efficiency project, a contact person for more information, and, where available, details on costs and savings. People can make use of and contribute to the database regardless of the sector they represent. The site can be reached at http://www.cwwa.ca/wed.htm. Facility managers could search the site to see if anyone has done a project similar to what they are planning and then contact the source directly for advice.

2. GENERIC CONSULTANT SELECTION DOCUMENTS REQUEST FOR PROPOSAL (TWO PHASE PROCEDURE) The Buildings Directorate, A&ES, has developed a Generic Consultant Selection Documents Request for Proposal (Two Phase Procedure) that is intended to be the standard "default" document for submitting projects for bid. It is presented as an editable document, to which Project Managers are expected to add to, or subtract from, sections that are applicable, or not applicable, as they judge for their projects.

This generic RFP has been drafted to include environmental aspects to ensure that in each project, the department achieves the results that meet the commitments under PWGSC's and RPSB's Sustainable Development Strategies. These environmental aspects are contained in the Project Brief Section of the RFP and include instruction or discussion on the following topics:

1. Basic tenants of PWGSC's and RPSB's SDSs and environmental policy;
2. Requirements of CEAA;
3. Indoor Air Quality (IAQ) as it relates to mechanical system design, biological inhibitors, product selection, and commissioning;
4. Site and landscape requirements including building location and orientation, pedestrian and vehicular traffic patterns and surfacing requirements, plant species selection, and water body protection;
5. Water conservation;
6. Energy efficiency and conservation;
7. Product selection;
8. Ozone Depleting Substances management;
9. Hazardous and non-hazardous solid waste management;
10. Contaminated sites management;
11. Land and marine / fresh water activities management; and
12. Life Cycle Analysis (LCA) and Life Cycle Costing (LCC).

A very useful aspect of the Project Brief portion to the RFP is a point form checklist of environmental issues categorized under headings similar to above as well as issues related to the RPS Project Delivery System. This checklist provides the design team clear guidance on many specific issues and ensures that they are considered in the design process. Undoubtedly it can and will be improved with time and experience, but it is an excellent beginning.

3. RPSB CONSTRUCTION, RENOVATION AND DEMOLITION NON-HAZARDOUS SOLID WASTE MANAGEMENT STRATEGY AND PROTOCOL: This strategy and protocol lay out the Branches strategy and methodology for meeting its Sustainable Development Strategy commitments to reduce the amount of waste directed to landfills. Demonstration projects that have used this approach have achieved impressive results whereby almost all material removed from a facility during a renovation has been recovered in some form. One project in Winnipeg realized 94% diversion while another in Ottawa reached 89%. In both cases, costs were comparable to the usual costs of waste disposal.

4. WEB SITE ON CRD WASTE: The department shares sponsorship with other public and private sector organizations of a Internet Web site on CRD Waste at http://www.cdwaste.com. This site list end markets for recovered construction materials; contractors experienced in CRD waste management and presents examples of successful waste management initiatives.

5. AN ARCHITECT'S GUIDE TO SUSTAINABLE BUILDING DESIGN OF OFFICE BUILDINGS: This publication is intended to give architects and overview of environmental concerns, presents the issues involved in designing for sustainability and how these issues relate to the design of office space and the commitments the Branch has made towards sustainable development.

6. GREENING OF THE NATIONAL MASTER SPECIFICATIONS (NMS): A multi-year project, the Greening of the NMS is a process of review and revision of the 650 sections of the full document to incorporate environmental issues where appropriate. The process has already addressed the most environmentally significant sections and is proceeding to examine the remainder on a priority basis. To date between 150 and 200 sections have been reviewed and modified. When the initial process of the full review is complete, environmental concerns will form part of the normal continuing review process that the entire NMS undergoes on a 2 to 3 year basis.

7. GREENING OF THE PROJECT DELIVERY SYSTEM (PDS): In order to incorporate environmental concerns throughout the RPSB approach to delivering projects, the PDS is being examined for revision. The first phase of this review is to identify and establish the scope of the environmental issues that are affected by the PDS and conversely, the parts of the PDS, which are affected by environmental issues. This phase is under way and due to be completed by the end of Fiscal 1999/2000. When the parts of the process that need to be addressed have been identified and the scope of the revisions defined, the greening process will commence to revise those parts to incorporate environmental concerns.

8. GENERIC REQUEST FOR PROPOSAL (RFP) AND SUSTAINABLE DEVELOPMENT: This project is a redraft of the RFP to consulting companies for projects and includes a redesigned project bid submission and contract award procedure. The Project Brief is an integral part of the RFP and this has also been revised to include environmental issues under the Departmental Sustainable Development Strategy. It includes comments to guide the RFP writer and check lists to highlight the environmental issues pertaining to most design requirements.

9. THE GREEN BUILDING MATERIALS SAMPLE ROOM: The Green building Materials Sample Room is a virtual display of building materials that have been recognized by an independent third party as having an environmentally sound aspect. These third parties are generally a formal certifying agency, such as the Environmental Choice Program (EcoLogo), or a published or Internet listing service. The information is also available in the internet at http://www.designingreen.com

10. PROPERTY TRANSFER ASSESSMENT (PTA): Property Transfer Assessments are phased assessments of real property to determine if there are any environmental contaminants existing on site. These contaminants can range from soil contaminated with hazardous or toxic materials to the presence of asbestos or lead paint in buildings. The intent of the PTA is to identify these contaminates and the associated environmental risk or remediation requirements. The environmental liability or absence of such can then be accurately reflected in the price of the asset as well as the responsibility for dealing with it. While a PTA is mandatory for acquiring or disposing real property in the federal government, it is also being used for leases that run for long periods of time (i.e., greater than 5 years.)

11. GREEN BUILDING CHALLENGE 2000: Green Building Challenge 2000 (GBC2000) is an international program to identify aspects of building design that constitute environmental design based on an international accepted standard that incorporates enough flexibility to accommodate local climatic, economic and social conditions.

12. C2000: This is a support program developed by NRCan available to incorporate environmental design elements into new design programs. NRCan is interested in adapting the program to renovation projects and is working with RPSB to identify and demonstrate this possibility. The C2000 program is similar to the R2000 program for residential buildings but intended for the commercial sector. It has a strong focus on energy issues but is broader in its application and includes all aspects of environmental design.

13. GREENLEAFTM PROGRAM: A pilot project has been undertaken to demonstrate the possibilities of evaluating leased properties on the basis of the GreenLeafTM Assessment Method. This assessment method is based on the Building Research Establishment Environmental Assessment Methodology (BREEAM) as it has been adapted for Canada and published as an information document by CSA. The pilot project assessed three typical leased office buildings in the NCA for fabric and management issues, all with positive results and recommendations for improvement. The approached is being examined for extending it to a wide segment of RPSB leased space.

14. KYOTO COMMITMENTS: Several initiatives on energy reductions and management are being examined in order to make RPSB's contribution to the Federal Government's commitment to reduce Greenhouse Gas (GHG) emissions by 6% relative to 1990 levels. These vary from Green Energy purchases, to energy reductions under programs like the FBI, to employee awareness programs.

RELEVANT SECTIONS OF LEASING DOCUMENTS

appendix B

Appendix B

Relevant Sections of Leasing Documents

The following is a comprehensive review of the PWGSC approved clauses, which encourage and promote cost effective and environmentally responsible practices by building owners, and are included in the standard leasing document.

Other options are being investigated to further enhance the environmental considerations, and hence updates to this section will be prepared, as approvals are completed. Further enhancements must always be made while assessing the liability issue even more so where the liability in question is one which rests with the building owner in law (Environmental Protection Act) and would not normally be attributable to the Crown as tenant.

EXTRACTS FROM PWGSC GENERIC LEASE DOCUMENTATION PACKAGE–APRIL 1999 VERSION

EXTRACT FROM OFFER TO LEASE:

We reserve the right to re-use existing improvements in space offered (3 R's)

4. SPACE

(e) *.... the Offeror hereby agrees to transfer to the Lessee free and clear of all encumbrance, and at no cost, those existing improvements or fit-ups which the Lessee has elected, at its sole discretion, to use. The Offeror shall remove, at its sole expense, any remaining improvements or fit-ups which are not acceptable to the Lessee.*

The following clause informs the bidder that we reserve the right to do an Environmental Assessment (EA) to establish if the modifications/fit-up to be carried out in the building offered creates a "project" under CEAA. Most of our leases are for office space in office buildings, therefore, rarely fall within the definition of a "project" under CEAA.

10. CANADIAN ENVIRONMENT ASSESSMENT ACT

The Offeror acknowledges that:

(a) *The activity to be carried out in and on the Leased Premises may fall within the definition of a "project" as referred to in the Canadian Environment Assessment Act (CEAA);*

(b) *The Lessee cannot proceed with a project before an Environmental Assessment (EA), if required, is carried out and any necessary mitigation plan is implemented;*

(c) *The Offer will not be accepted until an EA has been completed and the findings or results thereof satisfactory to the Lessee;*

(d) *There may arise from the EA a need for a mitigation plan which may require incorporation of such plan into the Lease, and which may require an agreement between the Offeror and the Lessee as to responsibility for costs of such plan, prior to any acceptance of the Offer by the Lessee.*

EXTRACTS FROM OUR SPECIMEN LEASE:

The paper recycling program applies where recycling facilities exist in the vicinity (some smaller communities do not have recycling facilities). We are evaluating the feasibility and impact of expanding this requirement to include a multi-material recycling program where economically viable.

11. SERVICES AND EQUIPMENT

(1) The Lessor shall, at all times during the Term, at the Lessor's own expense and to the satisfaction of the Lessee provide ..... :

(u) all labour for collection, storage and disposal of paper and cardboard in connection with the Lessee's paper recycling program in the manner and not less often than as specified in the Schedule entitled "Cleaning Specifications".

The Lessor is requested to ensure all products used in the workplace for cleaning operations are classified, labeled and are environmental friendly. We are exploring the feasibility of requiring that all cleaning products meet the Environmental Choice guidelines for cleaning products.

4. MATERIALS & EQUIPMENT (EXTRACT FROM GENERIC CLEANING SPECIFICATIONS)

.1 The Lessor shall ensure that all products used in the work place are classified and labeled according to the Workplace Hazardous Materials Information Systems (WHMIS) legislation which requires the employer to provide detailed worker education on potential health effects of hazardous materials in their work environment and how they can be handled and disposed of safely.

.2 A copy of the Material Safety Data Sheets (M.S.D.S.) for all products and materials used in buildings will be given to the Lessee's Representative at time of entry to the building. A binder with the copies of the M.S.D.S. shall be maintained by Lessor in the building and updated when new products are purchased. This binder shall be made available for the Lessee's Representative upon request.

.3 The Lessor shall use only products that are Environmental friendly.

Our CPI adjustment clause (shown hereunder), which includes energy expenditures, has been recognized as an effective energy savings inducement and an innovative initiative that differs from standard business practices. The CPI clause permits landlords to benefit from energy efficiency savings; we also benefit from reduced administrative costs of processing escalation claims.

12. OPERATING COSTS ADJUSTMENT

(1) In this Part,

(a) "Subsequent year" means any period of twelve (12) consecutive months, commencing on an anniversary of the date of commencement of the Lease;

(b) the "Basic Unit Operating Rate" is xxxx xxx Dollars ($ xx.xx) per rentable square metre of office space;

(c) "Operating costs" with respect to the basic unit operating rate means the amounts estimated by the Lessor only, by reason of, and in respect to, the provision of the services listed hereunder:

(i) sewer services and water (other than for installation thereof);

(ii) fuel for heating and hot water;

(iii) electricity;

(iv) cleaning of the interior of the Building and windows as such may be described in the Schedule entitled "Cleaning Specifications" appended hereto (including related wages, cleaning supplies and cleaning contracts); and

(v) maintenance of the grounds forming part of the Lands as such may be described in the Schedule entitled "Cleaning Specifications" appended hereto (including related labour and payments to contractors); such services and the costs thereof being reasonable and equitably attributable to the Office Space forming part of the Leased Premises and which are not otherwise recoverable from the Lessee, other lessees or occupants of the Building;

(d) The "Total Operating Costs" means that portion of the annual rent hereby reserved arrived at by multiplying the Basic Unit Operating Rate with the total rentable square metres of Office Space;

(e) the "Basic Annual Rent" means the total of all amounts payable hereunder less the Total Operating Costs;

(f) the "Basic Index" means the All Item Consumer Price Index for Canada published by Statistics Canada (No. 62-001) for the month of xxxxxxx 199? (insert the third month prior to the Lease Commencement Date);

(g) the "New Index" means the index for the same month of any Subsequent year from the publication described in the preceding subclause (f) hereof;

(h) the "Factor" means the result obtained by dividing any New Index by the Basic Index and rounding off such result to 5 decimal points.

(2) For each Subsequent year during the Term, the total annual rent payable hereunder shall be adjusted by applying the Factor to the Total Operating Costs by using the established formula:
Basic Annual Rent + (Total Operating Costs x Factor)
and the monthly installments of rent hereinbefore provided to be paid shall be adjusted accordingly.

The Lessor must comply with all regulations, etc.

17. LAWS

The Lessor shall, at its cost, fully comply with and fulfill the provisions and requirements of all applicable Statutes, Regulations, By-laws, Rules, Orders and Instructions relating to the Lands, the Building and the Leased Premises.

This clause pertains to the Owner's obligations under the Act (includes the land)

23. ENVIRONMENTAL REPRESENTATIONS AND WARRANTIES

The Lessor represents and warrants to the Lessee as follows:

(a) The Building, the Leased Premises and the Lands on which the Leased Premises is located and their existing and prior uses comply and have at all times complied with, and the Lessor is not in violation of and has not violated, in relation to this ownership, use, maintenance or operation and uses related thereto, any applicable federal, provincial, municipal or local laws, regulations, orders or approvals of all governmental authorities relating to environmental matters.

(b) There are no orders or directions relating to environmental matters related to the Building, the Leased Premises and the Lands on which the Leased Premises is located.

(c) To the knowledge of the Lessor, no hazardous or toxic materials, substances, pollutants, contaminants or wastes have been discharged into the environment, or deposited, discharged, placed or disposed of at, on or near the Building, the Leased Premises and the Lands on which the Leased Premises is located.

(d) The Lessor shall indemnify and save harmless the Lessee, the Lessee's employees, servants, agents and contractors, and all those for whom the Lessee may in law be responsible, from and against all claims, demands, losses, costs, damages, actions, suits or proceedings by whosoever made, brought or prosecuted in any manner based upon, arising out of, related to, occasioned by or attributable to the breach of any representation and warranty contained herein.

Obligation to comply with Standards for Leased Accommodation

18. STANDARDS OF REPAIR

(2) The Lessor covenants that all provisions set forth in the Standards for Leased Accommodation, hereto attached, have been fully complied with and shall continue to be fully complied with throughout the Term.

EXTRACTS FROM STANDARDS FOR LEASED ACCOMMODATION:

PART 1: GENERAL STANDARDS

The Lessor must comply with all codes, including the Canadian Environmental Protection Act.

1. CODES

(1) The Building must comply with all applicable laws, acts, regulations, and codes of all governments and levels of administration including the federal and provincial governments, and territorial, regional and municipal administrations. This includes but is not limited to, the National Building Code of Canada, the Canada Labour Code, the National Fire Code of Canada (1995), the Canadian Electrical Code and the Canadian Environmental Protection Act.

Premises must be free of hazardous materials

15. HAZARDOUS SUBSTANCES

(1) The Building must be free and kept free of hazardous friable asbestos material.

(2) When polychlorinated biphenals (PCB's) exist in the building, an inventory of PCB's shall be kept by the Lessor. Removal, storage and disposal/destruction of PCB's shall comply with Federal and Provincial Regulations.

(3) The building shall be free of formaldehyde levels greater than the ceiling threshold limit value of 0.1 parts per million (ppm) or 100 parts per billion (ppb).

(4) All chemicals used within the Building for cleaning, maintenance, and operations shall comply with Workplace Hazardous Material Information System (WHMIS) regulations.

PART 3: MECHANICAL STANDARDS

Contains provisions to maximize energy savings :

1. GENERAL

(3) [The] comfort standards shall be maintained during the occupancy period of the Lessee, which for the purpose of these **comfort standards shall be between the hours of 06:30 and 18:00.**

2. THERMAL COMFORT REQUIREMENTS

(2) During the unoccupied periods in the heating season, the temperature may be reduced for energy conservation purposes to 18°C (note however, the requirements of Clause 4.1(c).

4. SYSTEMS

(1) (a) Building heating system shall be capable of maintaining 21°C at the 2.5% winter design conditions as specified by the National Building Code, while providing the ventilation rate defined above.

(b) Building cooling system shall be capable of maintaining 24°C at the summer design conditions as specified by the National Building Code, while providing the ventilation rate defined above.

(c) Operation of the HVAC systems shall be extended beyond the normal working hours by a lead time sufficient to meet the defined ventilation and thermal comfort standards by the start of the occupancy period of the Lessee's "occupant" during every normal working day, refer to Clause 1 (3).

(3) Building heating, ventilation and air conditioning systems shall:

(c) be conducive to, and be operated in such a way as to maximize energy savings;

GOBP CONSIDERATIONS OF OFFICE BUILDING OPERATION & MAINTENANCE

appendix C

Appendix C

GOBP Considerations for Office Building Operation and Maintenance

INTRODUCTION *C.1*

Carefully considered operations and maintenance (O&M) procedures are absolutely essential and integral parts of any green building. O & M considerations are relevant to Phases 5 and 6 of the PDS (operating Phase and Evaluation Phase). Green buildings are designed for significant reductions in energy use, water use and waste disposal as well as improvements in indoor air quality. The best efforts of designers and builders will be defeated unless those who operate and maintain the buildings and facilities adequately perform their roles. Planned procedures are needed to guide staff thereby ensuring the design intent for these qualities are sustained. Improvements in the environmentally responsible features and designs in the building can be achieved by involving teams in continuous improvement programs.

Operation and maintenance encompasses all tasks required to maintain the building systems and environment on a day-to-day basis and over the long term. Sufficient knowledge about the green features and how they function is required by the O&M staff to allow them to make intelligent decisions about carrying out and improving those procedures.

The information in this appendix should be factored into the routine operational procedures of facility managers and can contribute greatly to lowered energy and water and waste management costs, higher employee productivity, and a generally improved work environment.

An operation and maintenance plan should contain the following:
- brief description of each system (e.g. HVAC and lighting);
- troubleshooting guide for operators;
- description of operation during occupied and unoccupied hours;
- required cleaning and maintenance schedules;
- guidelines for energy consumption and appliance operations;
- details on waste and recyclables service such as contact names, collection arrangements, costs, list of equipment provided by contractor and notes of service issues such as problems and special collections
- cleaning and maintenance schedules for waste handling equipment (e.g. compactors, balers etc.)

Each of the technical areas addressed in the GOBP (energy conservation, water conservation, indoor air quality and waste reduction) should have a facility wide "Green Team". The team requires representatives of all stakeholders to design and activate "Greening Plans" for operation, maintenance, and on-going improvements facility wide. They need to be:

- directed to provide on-going water, energy, IAQ and waste monitoring and auditing;
- empowered to recommend and implement improvements that will reduce energy consumption, reduce water consumption, improve indoor air quality and reduce waste production, and
- encourage staff to upgrade skills and knowledge through reading appropriate publications and attending training courses, seminars, and conferences.

It is important to perform quarterly reviews of all utility bills to track the performance of improvements and other changes made.

ENERGY SYSTEMS AND ENERGY EFFICIENCY *C.2*

Space and water heating are responsible for nearly 35% of energy use in office buildings. Often there are simple ways to reduce energy consumption in these categories, but they are often overlooked because they may result in occupant inconvenience. Energy systems and efficiency can be broken up into four categories: HVAC systems; lighting; water heating; and office appliances. Operation and maintenance considerations for each of these areas are discussed separately below.

HEATING VENTILATION AND AIR CONDITIONING (HVAC) OPERATION CONSIDERATIONS:

- Develop operating manuals for all equipment including design intent, set points, setback and setup schedules, on/off time schedules, special features and requirements, etc.
- As office schedules change, ensure time schedules for ventilation fans, purge cycles, heating and cooling are changed to match building occupancy schedules. Documentation needs to be revised when these changes occur.
- Maintain building temperature no higher than 16ºC when unoccupied and 22ºC when occupied during the heating season.
- Maintain building temperature no lower than 30ºC when unoccupied and 24ºC when occupied during the cooling season.
- Ensure heating and cooling are on different schedules and that it is not possible to have the two operating coincidentally.
- Use up to 100% outdoor air for cooling/heating as temperatures allow, without energy penalties during a mild weather.
- Any over-ride that allows systems to be turned on manually when additional hours are required should automatically be returned to the original schedule once the over-ride period has expired or the next normally scheduled period begins.

HVAC MAINTENANCE

- Provide preventative maintenance checks annually to ensure all HVAC systems are operating properly; make any necessary repairs.
- Ensure automatic shutdown features of ventilation systems are installed and operating properly.
- Develop maintenance manuals for all HVAC equipment with schedules and frequency of service required.
- Ensure service technicians provide detailed listings of all service performed and findings made.
- Seal all unused openings in the building shell to ensure a continuous air barrier and vapour barrier as per the original construction details.
- Seal any joints or cracks in the building construction to ensure an effective rain screen is maintained on the exterior.
- Check for, and repair air leakage in supply and return ducts.
- Ensure all changes to equipment are documented and all parties effected are informed.
- When demand controlled ventilation (DCV) systems are used carbon dioxide sensors must be calibrated annually to ensure proper operating function.
- Carry out an annual calibration and functionality check of all building automation systems to verify operation and performance.

LIGHTING:

- Rely on daylighting as much as possible and turn off or dim interior lights to take advantage of daylighting.
- Turn lights off when not needed and ensure occupancy sensors have not been overridden.
- Keep light fixtures clean, as dust greatly decreases the amount of light delivered.
- Use light sensors to control lighting levels with manual on/off and auto on/off–adjust levels to time of day and effective outdoor levels.
- Use most energy efficient lamps and ballasts available for replacements.
- Specify single bulb fixtures and florescent fixtures to replace incandescent ones at the end of their useful life.
- When replacing bulbs, use a group relamping method- replace bulbs in groups or by area. This will provide brighter and more uniform lighting.
- Specify mercury-free fluorescent lamps for replacements.
- Have the cleaning and maintenance schedule overlap regular hours to minimize energy use. After hours work should be done by area, using only necessary lights.

WATER HEATING:

- Insulate pipes and the storage tank to minimize heat loss.
- Set water temperature to between 50ºC and 60ºC.
- Shut down domestic hot water circulating pumps during unoccupied hours.
- Flush sediment from the tank at least once a year more often in hard water areas.
- Have heat exchanger cleaned and burner adjusted annually on boilers to maintain maximum energy efficiency.

OFFICE EQUIPMENT:

- Enable energy saving options on computers, monitors, printers, photocopiers, etc.
- When not in use (both day and night), turn equipment off, this will increase the equipment lifetime.
- Share printers, faxes and other tools.
- Use the double sided copying capability of printers, faxes, copiers.
- Reuse paper as much as possible.
- Keep soft copies rather than printing everything.
- Batch copy jobs rather than doing single copies.

WASTE MANAGEMENT *C.3*

OPERATION

- Develop monthly monitoring program for waste and all recyclable materials collected. Monitoring program should calculated overall waste diversion and per employee waste generation and diversion rates.
- Ensure each desk has a PaperSave bin, collection bins are located close to central photocopiers, printers and mail centres and sufficient and appropriate signage is in place.
- Ensure central recycling bins from multi-materials (e.g. metal cans, glass, plastics) have the appropriate number of compartments to meet separation requirements of recycling company and are conveniently placed on each floor and properly signed.
- Sufficient and properly signed bins are placed in areas throughout the building where recyclable containers are generated such as lunchrooms, cafeterias, catering areas and outdoor lunch areas.
- Bins are checked frequently by cleaning staff to ensure they do not overflow.
- If organic waste is being collected, organics need to be removed from floor bins and cafeterias daily to reduce odours and pests (insects) and contracted collection should be at least every second or third day, unless there is cold storage in the building.
- Insure that waste hauler can provide you with name, phone number and tipping rate structure for disposal facilities used. Disposal facility should be within the region and needs to be a licensed operation.
- Waste and recycling contracts should have weight collected included on invoices or by separate monthly reporting.
- If space is available, consider establishing a reusable building materials area. Reusable building products could be stored for possible reuse applications in the future. The types of building products that could be reused include doors, door handles and frames, acoustical ceiling tiles, power bars, demountable partitions, plumbing and electrical fixtures.

MAINTENANCE

- Provide preventive maintenance checks annually to ensure waste handling and storage equipment (e.g. carts, balers, compactors) are operating properly; make any necessary repairs.
- Ensure compactors are working at their optimum performance.

WATER AND WASTEWATER *C.4*

The following O&M activities will ensure that the measures described elsewhere in the GOP will continue to operate as designed:

- Regularly check that all valves are operating properly.
- Inspect for and repair leaks on a monthly basis.
- Ensure sensors and automatic shut-off devices are not overridden. Do not run water longer than necessary.
- Annually check that lawn-watering schedule is properly set and does not over-water.
- Refrain from using chemical pesticides/ herbicides; opt for natural fertilizers instead.

INDOOR AIR QUALITY (IAQ) *C.5*

The following O&M practices will ensure that the measures described elsewhere will operate as designed:

- Develop specification and verification criteria for environmentally acceptable cleaning and other supplies used in the office. The Material Safety Data Sheet (MSDS) and the product label should be reviewed to identify potentially harmful constituents of cleaners etc. Products that are labeled with warnings such as "USE ONLY IN WELL VENTILATED AREAS, OPEN DOORS AND WINDOWS TO CREATE CROSS VENTILATION" "KEEP AWAY FROM SMOKE AND FIRE" are clues that the materials contain substances that could be harmful to health and possibly should not be used.
- Establish criteria for maximum levels of chemical compounds allowable in cleaning products, floor finishes, and other materials brought into the office for operating and maintaining the facility.
- Clean and/or change all air filters on a regular schedule.
- Be aware that synthetic materials will bond to oil based staining agents and toxic cleaners may be necessary to break those bonds.
- Monitor temperature/ humidity to ensure they are maintained at comfortable and healthy levels (under 65% RH summer, lower in winter);
- Avoid occupant exposure to airborne pollutants by performing unusual cleaning and pest control activities when the building is unoccupied.

LIFECYCLE COST AND ECONOMIC ANALYSIS EXAMPLE

appendix D

Appendix D

Lifecycle Cost and Economic Analysis Example

A simple economic analysis model is used for life cycle cost analysis for the various technologies and approaches discussed in the GOP. This analysis was developed by the federal government to justify measures required and recommended in the 1995 National Energy Code for Buildings, and is considered suitable and appropriate for decision making in the GOP. The National Energy Code required that a minimum total life cycle cost be used to economically justify measures. The same procedure will be used in the GOP.

Table E.1 presents the economic factors to be used for each activity category addressed in the GOP (water, solid waste, energy, IAQ and material selection). Application of the table will be discussed with reference to water, but the same principles apply to each of the other activities to be addressed. The following explanatory notes refer to Table E.1:

- An economic life of 30 years is chosen as a reasonable lifetime for a building before major refitting is done. In cases were a particular technology is not expected to have a 30 year life, the expected useful life can be used.
- Water cost and escalation rates are still under review.
- The provinces have provided factors such as general inflation rate, discount rate and environmental multiplier.

The environmental multiplier is the premium that provinces were willing to pay for environmentally preferable products. It is interesting to note that most provinces were not willing to pay any premium and the largest premium reported was 10% (i.e. environmental multiplier of 1.1)

TABLE D.1.
BASIC ECONOMIC INFORMATION FOR LIFE CYCLE ANALYSIS OF GOP OPTIONS

PROVINCE /TERRITORY	GENERAL INFLATION RATE	DISCOUNT RATE (EXCLUDING INFLATION)	ECONOMIC LIFE (YEARS)	ENVIRONMENTAL MULTIPLIER	WATER COST ($/1,000 M3)	ESCALATION RATE (EXCLUDING INFLATION)
Cdn Avg	3.0 %	6.0 %	30[1]	1.0	$1,031	5.15 %

[1]The shorter of the expected economic building life (i.e., 30 years) or the expected useful life of the product was used.

Using the factors above and the formulas given below, the total life cycle costs (TLCC) for both the standard technology and contemplated Green Office technology or approach can be evaluated. The technology or approach with the lower TLCC can then be identified. A final decision on whether to use the Green Office technology will be made on the basis of economic and also other factors.

Total Life Cycle Cost (TLCC) = CCI + PCF*(OCI+MCI)

Where TLCC = Total Life Cycle Cost
CCI = Capital Cost Increment
PCF = Present Cost Factor
OCI = Operating Cost Increment
MCI = Maintenance Cost Increment

Energy and water conservation measures in the GOP have been subjected to the above analysis to ensure they have a favourable TLCC compared to conventional measures. The cost of installing and operating each of these measures has been shown to be less than the base case over its useful life. In the case of solid waste management, indoor air quality and material selection, a slightly modified approach to the economic and life cycle assessment is presented in the relevant sections of this document.

To evaluate any measure independently or for any specific project based on the costs involved in that project, the analysis technique is given in Table A.2, with an example for water conservation. The top two rows of the table show the calculation of the present cost factor (PCF). The bottom three rows show the calculation of the base case and an alternative. The base case costs $10 more per year to operate, and maintenance is the same. The alternative has an initial capital cost which is $100 higher than the base case. Based on this analysis the alternative is the preferable option because it has the lower total life cycle cost.

TABLE D.2
EXAMPLE TOTAL LIFE CYCLE COST PARAMETER ANALYSIS

(I) GENERAL INFLATION RATE	(D) DISCOUNT RATE	(E) WATER COST ESCALATION RATE	(A) EFFECTIVE INTEREST RATE	(N) PROJECT LIFE	(PCF) PRESENT COST FACTOR
3%	6%	5.15%	0.93% (1)	30	26.09 (2)

[1] ((d+i)-(e+i)) / (1-(e+i)

[2] (1-(1+a)-n) / a

TABLE D.3
EXAMPLE TOTAL LIFE CYCLE COST EVALUATION

BASE CASE CAPITAL COST	ALTERNATIVE CASE CAPITAL COST	(CCI) CAPITAL COST INCREMENT	(OCI) OPERATING COST INCREMENT	(MCI) MAINTENANCE COST INCREMENT	(TLCC) TOTAL LIFE CYCLE COST OVER N YEARS
300	300	0	10	0	$261 (3)
300	400	100	0	0	$100 (4)

[3] TLCC1 = CCI + PCF(OCI+MCI) = 0 + 26.09*(10 + 0)*

[4] TLCC2 = 100 + 26.09(0+0)*