Canadian Engineering Qualifications Board

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FINAL DRAFT

CCPE National Guideline on Environment and Sustainability

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CANADIAN COUNCIL OF PROFESSIONAL ENGINEERS

CONSEIL CANADIEN DES INGÉNIEURS

ACKNOWLEDGEMENT

This guideline has been adopted from an APEGGA guideline entitled “Guideline on Environmental Practice”, published in February 2004. APEGGA’s permission to use it as a basis to develop a national version is gratefully acknowledged.

The Association of Professional Engineers and Geoscientists of British Columbia (APEGBC) publication “Guidelines for Sustainability”, published in 1995, provided additional material on the subject that is included in this document. Permission to use this material is gratefully acknowledged.

FOREWORD

National guidelines use the word *should* to indicate that among several possibilities, one is recommended as particularly suitable without necessarily mentioning or excluding others; or that a certain course of action is preferred but not necessarily required; or that (in the negative form) a certain course of action is disapproved of but not prohibited *(should* equals *is recommended that)*. The word *may* is used to indicate a course of action permissible within the limits of the guideline *(may* equals *is permitted)*.

Constituent Members who wish to adopt a version of this guideline in whole or in part are advised to consider substituting the word *shall* for the word *should* to indicate requirements that must be followed (*shall* equals *is required to*) to effectively implement in their jurisdiction.

Constituent Members who wish to reference, instead of adopting a version of this guideline in whole or in part are cautioned that national guidelines are voluntary and not binding on CMs or individual engineers.

GUIDELINE ON ENVIRONMENT AND SUSTAINABILITY

1. PREAMBLE

Provincial and territorial associations/ordre of professional engineers are responsible for regulating the practice of engineering in Canada. Each association/ordre has been established under an Act of its provincial or territorial legislature and serves as the licensing authority for engineers practising within its jurisdiction. The Canadian Council of Professional Engineers (CCPE) is the national federation of these associations. CCPE provides a coordinating function among the provincial and territorial associations/ordre, fostering mutual recognition among them and encouraging the greatest possible commonality of operation.

CCPE issues guidelines on various subjects as a means to achieve co-ordination among its constituent member associations/ordre. Such guidelines are an expression of general principles, which have a broad basis of consensus, while recognizing and supporting the autonomy of each constituent member to administer its engineering act. CCPE guidelines enunciate the principles of an issue, but leave the detailed applications, policies, practices and exceptions to the judgement of the constituent members.

This CCPE guideline has been prepared in accordance with the principles outlined above to assist the constituent associations/ordre to carry out their responsibility to protect the public through programs that encourage and support the continued qualification of professional engineers after initial licensure. This guideline is an adoption of one written by APEGGA, and their willingness to share their document for the purposes of creating a national guideline is gratefully acknowledged.

This guideline has been prepared by the Environment and Sustainability Committee of the Canadian Engineering Qualifications Board (CEQB) in consultation with the constituent Associations/Ordre, and adopted as a national guideline by the Canadian Council of Professional Engineers.

2. OVERVIEW

Professional engineers have a wide diversity of occupations and responsibilities. Many are involved in different types of economic and product development, which should occur in a cost effective and environmentally responsible manner. *Professional engineers* develop new projects and public infrastructure and keep existing facilities operating effectively. They explore resources and design economic and sustainable methods of developing them. Responsible environmental management is an inherent part of performing those duties for all professional engineers, regardless of their discipline.

Professional engineers work as employees, employers, researchers, academics, consultants, and in regulatory and managerial roles. They frequently work as a team where they are involved with other specialists. An individual may or may not have control of, or be solely responsible, for a particular project. To the extent possible, they should understand and manage the environmental aspects of the project.

Professional engineers are expected to exercise *due diligence* in the execution of their work. That expectation includes practicing in accordance with the Code of Ethics of the association/ordre in which they are licensed, provincial and federal law, restricting practice to areas of personal expertise and practicing in accordance with established standards.

Professional engineers may or may not be directly managed by other *professional engineers*. Regardless, *professional engineers* will expect to be supported in environmentally responsible decisions by management and team members, as they too, have a societal responsibility for wise stewardship of the *environment*. The primary duty of *professional engineers* is to hold paramount the protection of public safety and welfare, with due regard for the *environment*.

A substantial body of legislation setting out environmental requirements has existed for some time, and much of this can be found in the *Canadian Environmental Protection Act* [1], the *Canadian Environmental Assessment Act* [2] and various provincial or territorial environmental acts, regulations and standards. Environmental regulations and standards are evolving. In some aspects, legislations and regulations from various jurisdictions overlap in a complex and sometimes contradictory manner. To cope with these complexities, *professional engineers* need to take extra measures to be regularly informed on local, provincial, and national trends in environmental legislations. As well, it will be useful to maintain awareness of emerging international protocols and agreements, even though these may not have legal status in Canada or provincially/territorially.

2.1 Scope

This document, through amplification and commentary of each guideline, summarizes how a *professional engineer* should strive to influence the practice of engineering in an environmentally responsible direction. The application of this guideline will always be a matter of professional judgment. Application of the guideline may require *professional engineers* to balance competing interests. This is an essential element of the practice of engineering.

The guidelines are advisory in nature and are intended to assist *professional engineers*.

2.2 Purpose

The purpose of this document is to inform, provide guidance, and to encourage *professional engineers* and Certificate of Authorization/Permit to Practice holders to be pro-active in the protection and stewardship of the *environment* and to follow principles of sustainability .

2.3 Definitions

For the purposes of this guideline, the following terms and definitions apply.

Act
The applicable *Engineering Act* in the province or territory. Some Acts include geoscientists or geologists and geophysicists.

[1] S.C. 1999, c. 33.
[2] S.C. 1992, c. 37.

Adaptation to Climate Change
An adjustment in natural or human systems in response to actual or expected climatic changes, which moderates harm or exploits beneficial opportunities.

Associations/ordre
The 12 provincial and territorial associations/ordre that regulate the practice of professional engineering (in Quebec, the practice of engineering) in their respective jurisdiction.

Acquiescence
To accept or comply passively, without question or objection.

Adverse Effect
Impairment of, or damage to, the environment, human health or safety or property.

Conservation
The planning, management and implementation of an activity with the objective of protecting the essential physical, chemical and biological characteristics of the environment against degradation.

Cost-Benefit Analysis
An economic analysis method that seeks to express the costs of an activity, in comparison to the benefits, using common units, to aid decision-making. The analysis would normally include capital, operating, maintenance, decommissioning, social and environmental costs.

Cumulative Effects
Individual effects that are incremental, additive and synergistic such that they must be considered collectively and over time, in order for a true measure of the total effect and associated environmental costs of an activity to be assessed.

Due Diligence
The care that a reasonable person exercises under the circumstances to avoid harm to other persons, property and the environment.

Ecosystem
The interactive system involving all of the organisms in a specified area, their interactions with each other, energy and material flows and the components of air, land and water.

Engineering Adaptation
A process of engineering decision-making in response to any kind of vulnerability or socio-political consideration.

Environment
The components of the earth and includes:

i) air, land and water;
ii) all layers of the atmosphere;
iii) all organic and inorganic matter and living organisms; and,
iv) the interacting natural systems that include components referred in subclauses (i), (ii) and (iii) above.

Environmental Assessment
The identification and evaluation of the effects of an undertaking and its alternatives on the environment.

Environmental Audit
A systematic, documented, objective review of the manner in which environmental aspects of a program, project, facility or corporation are being managed.

Environmental Impairment
Damage, harm or loss to the environment.

Environmental Management System (EMS)
A continual cycle of planning, implementing, reviewing and improving the processes and actions that an organization undertakes to meet its business and environmental goals. Most EMS's (i.e. ISO 14001) are built on the "Plan, Do, Check, Act" model. This model leads to continual improvement based upon:

- establishing policy or strategic direction;
- planning, including identifying environmental aspects and establishing goals [plan];
- implementing, including training and operational controls [do];
- checking, including monitoring and corrective action [check]; and
- reviewing, including progress reviews and acting to make needed changes to the EMS

Environmental Protection
Measures and controls to prevent damage and degradation to the environment, including the sustainability of its living resources.

Environmental Specialist
An individual qualified with training, knowledge and experience in a field or discipline of science dealing with the environment.

Hazardous Substance
A substance or mixture of substances, other than a pesticide, that exhibits characteristics of flammability, corrosivity, reactivity or toxicity, including, without limitation, any substance that is designated as a Hazardous Substance within the meaning of the regulations.

Hazardous Waste
A category of waste requiring special handling, treatment or disposal as specified in currently applicable regulations.

Liability
Legal responsibility to another or to society, which is enforceable by civil remedy or criminal penalty.

Life-Cycle Assessment
Assessing the environmental effects of a chemical, product, development or activity from its inception, implementation and operation through to termination or decommissioning.

Mitigation
In respect of a project, the elimination, reduction or control of the adverse environmental effects of the project, and includes restitution for any damage to the environment caused by such effects through replacement, restoration, compensation or any other means.

Persistent Effect
A compound or substance that is resistant to degradation processes, and has the potential to accumulate in the environment and exert long-term environmental effects.

Professional Engineer
The protected title given to a person licensed to engage in the practice of professional engineering under the applicable Engineering Act. In Quebec, the title of such a person is “engineer” or ”ingénieur”.

Quality of Life
The factors related to the state of health and well being of an individual or a community.

Reclamation
The removal of equipment or buildings or other structures or appurtenances; and the stabilization, contouring, maintenance, conditioning or reconstruction of the surface of land resulting in a biologically productive landscape equivalent to pre-disturbed state.

Recycle
To do anything that results in providing a use for a thing that otherwise would be disposed of or dealt with as waste, including collecting, transporting, handling, storing, sorting, separating and processing the thing, but does not include the application of waste to land or the use of a thermal destruction process.

Remediation
The process of correcting or counteracting the contamination of buildings or other structures or other appurtenances, or land or water to meet or exceed regulatory requirements.

Societal Values
The attitudes, beliefs, perceptions and expectations generally held in common in a society at a particular time.

Socio-economic Effects
The effects of a development, product or activity, on the economy and social structure of affected communities. Socio-economic effects may include issues such as: employment, housing and social needs, medical services, recreational facilities, transportation and municipal infrastructure and financial benefits to local residents and businesses.

Stakeholder
A person or organization who is directly involved with, or affected by, a development, product, or activity and therefore has an interest in it.

Sustainability
Ability to meet the needs of the present without compromising the ability of future generations to meet their own needs, through the balanced application of integrated planning and the combination of environmental, social, and economic decision-making processes.

Visual Effects
Additions to or alterations of the existing landscape and horizons that are visible to, and create reaction, among the public.

Vulnerability
The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate, including climate variability and extremes or any other natural events or man-made activity.

Waste
A material or substance that is unwanted by its generator.

3. ENVIRONMENTAL PRACTICE AND PROFESSIONAL ENGINEERS

This National *Guideline for Environmental Practice* has been prepared to complement the existing Codes of Ethics of the provincial and territorial associations/ordre. It supplements environmental and sustainability guidelines and codes of practice that have been developed for local use by some of the individual associations/ordre. It serves as a national benchmark that has been mutually agreed. The formulation of this guideline recognizes the prominent role of the associations/ordre, whose licensed engineers are not only concerned with development projects and their maintenance, but also with a wide variety of environmental management responsibilities.

Environmental impairment is recognized as a risk to public welfare, and in response members of society are being urged to protect, preserve and enhance the quality of the *environment*. The long-term objectives are to sustain the viability of our *ecosystems*, and to ensure that the well being of future generations is not compromised by our activities today.

Professional engineers recognize that stewardship of the environment is a responsibility of all citizens, and the public expects and has a rightful role in setting goals for environmental management, even though public expectations are evolving and vary widely.

The associations/ordre recognize the need for continuing development for the benefit of society. A balanced approach will most likely create development that will meet the needs of society. Integrating fundamental environmental sustainability with social and economic considerations will require professional engineers to be innovative and creative in their planning and design. In its broader context, this will require that *professional engineers* take a more holistic view of their role in shaping the future, by not only being innovative, but by showing to others how these innovations advance the interests of:

- public safety, health and welfare;
- the environment;
- sustainability;
- risk minimization and management; and,
- social and cultural values.

Environmental work is often best accomplished by a multi-disciplinary team. *Due diligence* requires that all reasonable steps are taken to ensure that the team comprises the necessary expertise and that this expertise is appropriately applied. The *professional engineer* shall only apply his or her stamp to professional documents he or she has prepared or to professional documents that were prepared under his or her supervision and control. In the case of professional documents prepared by someone else, a professional engineer should only apply his or her engineering stamp, or engineering seal to the documents after thoroughly reviewing the documents and accepting professional responsibility for them. The *professional engineer* must be aware that he or she is liable for all work that is conducted under his or her authority – *liability* cannot be avoided simply by not stamping/sealing the document.

The philosophy of this guideline is to encourage sustainable environmental plans that are anticipatory and preventative, rather than reactive. It would be prudent for professional engineers to strive to inform, advise, and counsel the employer, client or owner as to the implications of possible changes in standards and expectations.

The provincial and federal governments have overlapping jurisdiction as it relates to the *environment*. Consequently, it is possible that municipal, provincial and federal laws may regulate the *environment* concurrently.

Some examples of municipal, provincial and federal environmental laws that may apply to an activity undertaken by the *professional engineer* include*:*

1. Municipal - *waste* by-laws;
2. Provincial *environmental protection* Acts – e.g. the Alberta *Environmental Protection and Enhancement Act,* the Alberta *Water Act*, and associated regulations; and,
3. Federal - the *Canadian Environmental Protection Act 1999*, the *Canadian Environmental Assessment Act,* and associated regulations.

This is not an exhaustive list. To ensure compliance with any applicable municipal, provincial and/or federal environmental laws, *professional engineers* should determine what environmental laws, if any, apply to the activity they are undertaking as early in an activity's timeline as possible. To aid in this, *professional engineers* should consider consulting with municipal, provincial and federal authorities at the project scoping and planning stage of an activity. It is the *professional engineer's* responsibility to ensure compliance with all applicable environmental laws when undertaking any activity.

It is intended that this guideline will be universally applied, regardless of the scale of the undertaking. Certain projects will require a full environmental impact assessment; other projects will simply require thought and planning to minimize environmental disruption, even if that disruption appears to be very minor. *Professional engineers* should always practice *due diligence* and the application of reasonable care.

3.1 Guideline Summary

Professional engineers are committed to environmental protection and safeguarding the well being of the public.

Professional engineers:

1. Should develop and maintain a reasonable level of understanding, awareness, and a system of monitoring environmental and *sustainability* issues related to their field of expertise;

2. Should use appropriate expertise of specialists in areas where the engineer's knowledge alone is not adequate to address environmental and *sustainability* issues;

3. Should apply professional and responsible judgment in their environmental and *sustainability* considerations;

4. Should ensure that environmental planning and management is integrated into all their activities which are likely to have any *adverse effects*;

5. Should include the costs of *environmental protection* among the essential factors used for evaluating the economic viability of projects for which they are responsible;

6. Should recognize the value of environmental efficiency and *sustainability*, consider full *life-cycle assessment* to determine the benefits and costs of additional environmental stewardship, and endeavor to implement efficient, sustainable solutions;

7. Should engage and solicit input from *stakeholders* in an open manner, and strive to respond to environmental concerns in a timely fashion;

8. Should comply with regulatory requirements and endeavor to exceed or better them by striving toward the application of best available, cost-effective technologies and procedures;

9. Should disclose information necessary to protect public safety to appropriate authorities; and,

10. Should actively work with others to improve environmental understanding and *sustainability* practices.

4. GUIDELINES AND COMMENTARY

4.1 Guideline #1

***Professional engineers* should develop and maintain a reasonable level of understanding, awareness, and a system of monitoring environmental and *sustainability* issues related to their field of expertise.**

AMPLIFICATION

- They should recognize the general extent to which their professional activities can affect the *environment* and *sustainability*. They should recognize the importance of *Environmental Management Systems* (EMS) to identify, control, and reduce these effects.
- They should stay informed of the major environmental issues facing society so that they may broadly judge the potential interaction of their professional activities with those issues.
- They should always practice *due diligence* and the application of reasonable care.

COMMENTARY

Sustaining the viability of our *environment* is a broad responsibility of all citizens. Likewise, our society must seek to reconcile these environmental needs with our need for responsible development. *Professional engineers* should take a pro-active and cooperative role to assist society to meet these challenges. This could apply even though the individual professional activities of some members may primarily involve expertise that is apparently unrelated to environmental matters. *Professional engineers* are responsible for maintaining their knowledge in areas that have a bearing on the quality and effect of their work. As society has developed an increased awareness of the degree to which development activities can affect the *environment*, so the *professional engineers* involved in designing and implementing developments must maintain a reasonable level of understanding of those environmental concerns, and the possible significant effects of their professional activities on the *environment*.

The foregoing responsibility does not imply that every individual *professional engineer* can or should be an *environmental specialist*. As with any other specialization, there will be degrees of environmental expertise that will be appropriate for specific circumstances. The general obligation is to possess sufficient knowledge of relevant environmental issues to be able to competently judge the degree of need for specialist assistance. Given the normal technical responsibilities of *professional engineers*, society may expect them to anticipate and understand environmental problems.

Environmental legislation can place responsibility for *environmental impairment* on any individual. In such cases, a defense for the individual may have to rely upon demonstrating *due diligence*; the premise that the individual took all reasonable measures to prevent the offence. The basis for judging these measures for a *professional engineer* should be determined by comparison with good current practice among peers and by compliance with the requirements of any legislation, approval or order relating to the project in which the *professional engineer* is involved.

If the accused individual was in a position where he or she should have been aware of environmental problems, or of the process and protocols by which environmental problems were to be detected, being unaware or taking no steps to ensure that the process and protocols were effective would not assist a *due diligence* defense. The individual can ensure a high level of *due diligence* by ensuring that activities take place within an adequate *EMS*, which is either consistent with or formally certified to a recognized standard.

The steps or precautions that are likely to be judged reasonable care will vary from circumstance to circumstance. But, generally, the greater the likelihood and/or consequences of a negative occurrence, the greater the care that is expected. An important element of *due diligence* is being able to document that reasonable care has been exercised. Reasonable care may be assessed by comparing what was done to what could have been done, and determining if there were any practical alternatives that could have been used to avoid or to minimize problems. Furthermore, in recent Canadian environmental legislation, an individual can be deemed to be a party to an offence if the individual acquiesced in the commission of the offence.

4.2 Guideline #2

***Professional engineers* should use appropriate expertise of specialists in areas where the engineer's knowledge alone is inadequate to address environmental issues.**

AMPLIFICATION

- They should recognize that environmental issues are interdisciplinary in nature, requiring the expertise of a range of disciplines.
- They should undertake only that aspect of environmental work that they are competent to perform by virtue of training and experience.
- They should seek out and use appropriate *environmental specialists* to provide expert advice on environmental issues.

COMMENTARY

As the practice of environmental science requires the integration of diverse disciplines and philosophies, many projects will require a team of appropriate specialists to address complex environmental issues. As all association/ordre Codes of Ethics state, *professional engineers* should undertake only that work that they are competent to perform by virtue of training and experience. Integrated decision-making by knowledgeable specialists is often required in environmental issues.

4.3 Guideline #3

***Professional engineers* should apply professional and responsible judgment in their environmental considerations.**

AMPLIFICATION

- They should begin the environmental assessment process at the earliest planning stages of an initiative to provide the basis for project life-cycle environmental management.

- They should develop a structured set of criteria, which reflect standards relating to *sustainability* or carrying capacity and in accordance with scientific research and experience, with respect to projects, or initiatives, which they are planning or designing.
- They should recognize the value of multi-disciplinary involvement in the decision making process for projects having environmental effects.
- They should identify and promote cost-efficient solutions and approaches in integrating environmental, social, and economic considerations, which reflect the concepts of *sustainability*.

COMMENTARY

Professional engineers should bring the same structured problem solving approach to the environmental review process as they do in engineering design, where known criteria, standards and procedures are applied in the planning, design development and *life-cycle assessment* process.

The recognition of specialist responsibility in this area is paramount. The *professional engineer* must be vigilant in selecting a process or assembling a team to apply sufficient and appropriate knowledge to the proposed development.

Of similar concern is the need for *professional engineers* to recognize *societal values* applicable to the social and economic effects of developments. Local and neighbourhood concerns, *quality of life*, specific effect concerns (e.g. *visual*, sound, odour), along with traditional and cultural values, have all gained acceptance as pertinent and definable criteria that many jurisdictions are now interpreting and applying.

Finally, there is a need to take initiative in the application of *cost-benefit* and other analysis tools, and the evaluation of alternative designs for integrating the viability of projects with the concepts of sustainable development. *Professional engineers* are encouraged to bring expertise and a comprehensive approach to problem solving, in terms of optimizing the returns to society at large.

4.4 Guideline #4

***Professional engineers* should consider environmental planning, *sustainability* concepts and management into all their activities that relate to the *environment*, and which are likely to have any *adverse effects*.**

AMPLIFICATION

- They should recognize that projects undertaken by members are likely to have some effect on the *environment*. Effects to be investigated should include noise, visual pollution, electromagnetic pollution and other environmental factors that may impact on human beings as well as the natural *environment*.
- They should identify the possible environmental effects and *sustainability* of all substantial aspects of a project (e.g. design, construction, operation and decommissioning), using the *life-cycle assessment* approach.

- Prevention of *adverse effect* is the preferred option, followed by *mitigation.*
- They are encouraged, in assessing project alternatives, to seek opportunities not only to protect, but also to enhance the *environment* and its *sustainability.*
- They should, where possible, work within an *EMS* that requires the identification and prioritization of environmental aspects and the organization of cost-effective programs to control and reduce the related effects for the ongoing operation.

COMMENTARY

Professional engineers must recognize that societal expectations and demands for environmental protection are such that if environmental effect prevention and *mitigation* is not inherent in the initial project development, it will likely be required subsequently, probably at much higher cost and after public debate.

Almost every aspect of a project can have either direct or indirect environmental effects, both positive and negative. Project siting, design, construction, operations, maintenance, decommissioning and *reclamation* all have environmental consequences, which must be considered early in project evaluation. To effectively address such environmental issues requires a systematic evaluation procedure. Developing effective prevention or *mitigation* strategies requires integrated project planning. *Professional engineers* are encouraged to ensure that such evaluation procedures are in place and are followed so that effective environmental protection strategies are an integral part of their activities. The *professional engineer*, as well as the project proponent, has a responsibility to consider environmental effect prevention and *mitigation* as a part of doing business.

Many projects also present an opportunity to consider planning and design alternatives that may actually enhance the environment by having a positive effect. An example of such an opportunity would be during the planning of a bridge near a fish stream, where the natural stream could be improved for fish habitat by using selected excavated material such as large boulders to enhance hydraulic conditions, rather than simply discarding *waste* materials at landfills or quarries.

Consideration of the full scope of environmental costs at the earliest possible stage of project development will often provide considerable cost savings, as compared with retrofitting or remedial actions. Consequently, the interests of the project proponent, as well as those of society, can best be served by recognition of the environmental effects of a project during the planning stages. Likewise, the risks posed by hazardous circumstances associated with a project may often be most cost-effectively remedied by early recognition of such circumstances, through the use of formalized hazard identification protocols. These measures can be efficiently organized within an *EMS* that is formally implemented at the beginning of a project.

4.5 Guideline #5

***Professional engineers* should include the costs of environmental protection and *sustainability* among the essential factors used for evaluating the economic viability of projects for which they are responsible.**

AMPLIFICATION

- They should acknowledge the role of various decision-makers in determining technical feasibility for evaluating the economic viability and *sustainability* of projects.
- They should acknowledge the importance of all relevant technical, economic, environmental, and social information to the ultimate decision-makers.
- They should recognize that environmental protection is an integral part of project development.
- They should include environmental protection and *sustainability* in *life cycle assessment* for comprehensive project costing.

COMMENTARY

Professional engineers usually must provide the technical detail that will form the basis for costing developments, even if the overall decisions about proceeding with a development are the responsibility of others. Project costing must now routinely consider the full, life-cycle costs, from project conception to final decommissioning. If the technical detail for the project life-cycle fails to consider the full scope of environmental costs, then project decision makers may reach an invalid decision about the true economic viability of a project. These environmental costs may include: prevention, *mitigation* or compensation for *adverse effects*, operational and long term monitoring, inspection and maintenance and decommissioning and *reclamation* costs. Although it was once common to externalize some or most of these costs, current awareness and resulting legislation are requiring that environmental costs be assigned to project proponents. Consequently, *professional engineers* need to advise the responsible parties of these obligations.

4.6 Guideline #6

***Professional engineers* should recognize the value of environmental efficiency and *sustainability*, consider full *Life-Cycle Assessment* to determine the benefits and costs of additional environmental stewardship, and endeavor to implement efficient, sustainable solutions.**

AMPLIFICATION

- They should consider the true cost of the use of a raw product including manufacturing, by-products and disposal.
- They should identify the sources, types and quantities of resources required to complete a project and undertake to find innovative ways to minimize the need for the resources, especially resources with scarcity issues.
- They should make reasonable investigations as to the individual and *cumulative effects* on other micro *ecosystems* in the vicinity of the work being completed as well as the social and economic implications.
- They should take into account the short and long-term as well as direct and indirect consequences.
- They should assess reasonable alternative concepts, designs and/or methodologies.
- They should, wherever applicable, monitor the effect of changing climate on standard design practices and adapt their daily decisions and project designs to accommodate these changes as they evolve.

- They should comply with all relevant legislation, approvals and orders relating to the sustainable treatment of resources and disposal of same resources and by-products. In addition, even where not required by legislation, approvals or orders, they should arrange to increase the lifecycle of a resource as a means to increase *sustainability*.

COMMENTARY

Sound engineering, the application of modern technology and innovative design approaches are important aspects in achieving *sustainability*. All aspects of a project must be fully investigated and mitigated. Therefore, the *professional engineer* should endeavor to resolve all issues surrounding a project or product before proceeding.

For product development, the appropriate choice of materials, packaging requirements and planned obsolescence are key factors.

Sustainability has, in the past, often focused on the development and use of natural resources. A change in this focus is required. *Professional engineers* must understand the effect of all projects on resources, both natural and man-made. Although *waste* minimization is a key part of *sustainability* so is the effect of a project on its surroundings. For example a new sky-rise building may effect nesting habits of falcons, and energy and water consumption; therefore energy efficient equipment and a roof top garden may be necessary to offset some of the effects of the new building. Similarly, automotive design incorporating alternative fuels should evaluate the *cumulative effects* of production, emissions and other by-products to understand the full effect to *sustainability*.

Climate change is a recognized phenomenon. Whether the observed changes in climate are caused by humankind or are due to natural causes these changes can have significant effects on engineered structures. Statistics governing the return frequencies of extreme weather events such as ice storms and floods may no longer be accurate or relevant. Structures designed based on historical information may not be robust enough to withstand weather events that are now much more common. In the best case this could result in higher repair costs. In the worst case, the inadequate design could present a significant risk to the safety of the public who depends on these structures and systems. The *professional engineer* should stay apprised of climate change developments and apply reasonable improvements to the systems and structures that they design in order to accommodate these changes.

4.7 Guideline #7

***Professional engineers* should engage and solicit input from *stakeholders* in an open manner, and shall respond to environmental concerns in a timely fashion.**

AMPLIFICATION

- *Professional engineers* are encouraged to involve *stakeholders* during the design of a project that may have an *environmental* effect. This would allow for *stakeholder* concerns to be addressed up front.
- They should recognize the importance of social and economic values in the environmental assessment process and the potential need for local, neighbourhood, traditional and cultural

criteria through *stakeholder* involvement.
- They should immediately advise their employer and/or client of any concern they may have about potentially *adverse effects* discovered in the course of any assignments in which they are involved.

COMMENTARY

When *professional engineers* become aware of public concerns relative to an assignment they may be involved in, the nature of the concern should be investigated in a timely manner. Once they have determined the validity of the concern they should promptly communicate the information through the normal lines of responsibility. *Professional engineers* are encouraged to seek a second professional or specialist opinion as to the technical validity of their conclusions whenever possible, especially when there appears to be a difference of opinion with the other responsible parties regarding environmental effects.

In disclosing information about environmental effects, *professional engineers* should communicate the information through normal channels and lines of responsibility. Where, in the opinion of the professional, the withholding of confidential information poses a potential threat to the *environment*, he or she should make reasonable effort to contact responsible parties before disclosure of the information to the proper regulatory authority. However, *professional engineers* must recognize their individual responsibilities for reporting releases and for *environmental protection* in accordance with legislated reporting requirements and the Code of Ethics.

4.8 Guideline #8

***Professional engineers* should comply with regulatory requirements and should, where possible, endeavor to exceed or better them by striving toward the application of best available, cost-effective technologies and procedures. They should disclose information necessary to protect public safety to the appropriate authorities.**

AMPLIFICATION

- They should develop and maintain current knowledge and understanding of legislation, regulations, approvals, codes and guidelines; their purposes and limitations, and should ensure that these requirements are applied both on a procedural and substantive basis.
- They should ensure that proper documentation of adherence to environmental procedures, protocols and regulations is maintained and that relevant information be provided to regulatory agencies in a timely fashion.
- They should have regard for both the reality and the trend of environmental legislation to assign personal responsibility for both action and omission. They should reflect this reality in their professional duties accordingly as it relates to themselves, their employer, colleagues and clients.
- They should endeavor to go above and beyond standards and regulatory requirements to protect the health and well being of the public. They are encouraged to take into account evidence of *cumulative*, synergistic and *persistent effects*, where these may not be fully considered in standards or regulations.
- They should make public regulatory authorities aware of all environmental effects of any assignment they are involved in, through the normal regulatory review and approval process.

- They should maintain client and/or employer confidentiality unless otherwise required by relevant legislation, approvals or orders. Where any confidential information is disclosed to public authorities, the *professional engineer* should ensure that their employers and clients are advised of such disclosure as soon as possible.
- They should ensure that appropriate action or notification of proper authorities occurs in any instance where they believe that public safety or the *environment* is endangered, or where required by relevant legislation, approvals or orders.

COMMENTARY

Professional engineers are responsible for knowledge and awareness of environmental laws and regulations, either directly or through the retention of appropriate expertise. *Due diligence* is required in the conduct of professional duties to ensure that everything reasonable is done to comply with environmental requirements. This implies an understanding of environmental policy and appropriate behaviour, including the obligation to establish and maintain clear lines of management responsibility, and the maintenance of technical excellence. *Environmental audits* and the implementation of an *EMS* are effective means for accomplishing these objectives.

Professional engineers should know their obligations with respect to the role of the regulatory authorities relative to protection of the *environment*. In dealing with employers, clients and public regulatory authorities, *professional engineers* shall not intentionally withhold information concerning environmental effects of any assignment they may be working on. Current legislation may hold them personally responsible or liable for any offenses, omissions, or acquiescence. *Due diligence* is a moving standard which will be more clearly defined by the Courts with the passage of time. In this regard, *professional engineers* have an obligation to their colleagues, employers, client and regulatory authorities, for a well-documented and comprehensive approach to problem solving where environmental concerns are involved.

Professional engineers must conduct their work in a manner such that the confidentiality can be maintained to the maximum degree possible. In doing so, however, it must be recognized that in some instances there may be regulatory requirements to release or report information relating to environmental effects.

4.9 Guideline #9

***Professional engineers* should actively work with others to improve environmental and *sustainability* understanding and practices.**

AMPLIFICATION

- They should recognize the potential of their activities and membership to influence society.
- They should recognize the value of early involvement and action versus reaction.
- They are encouraged to share their expertise and educate other members, governments and the public on environmental issues.
- They are encouraged to interact with other disciplines to bring theoretical and technological research into applied practice.

COMMENTARY

The practice of engineering continuously improves due to technological advances, innovation and design changes. Parallel to this, environmental consequences need to be addressed. This is central to the concept of *sustainability*. Thus, continuous attention also needs to be given to environmental understanding and practices.

Professional engineers are encouraged to be actively involved with environmental issues. They should go beyond merely facilitating improvements. By being pro-actively involved, they may anticipate and prevent, rather than react.

Professional engineers are uniquely poised between the two extremes of absolute preservation and unfettered development. Education is crucial: firstly, for engineers so that they will say "no" when "no" needs to be said; secondly, to be participants of bodies constituted to formulate environmental laws and their enforcement; and thirdly, for the public so that they see professional engineers as true stewards who have viable, knowledge-based solutions.

Professional engineers deal with environmental issues. Research is one means to improve designs, procedures and technologies. The solution to complex long-term problems requires the participation of industry, governments and academia. *Professional engineers* are encouraged to interact with others to translate from theoretical research into applied practice.