Professional Engineers
Ontario

Submission to Part II of the Walkerton Inquiry

The Roles and Responsibilities of Professional Engineers in the Provision of Safe Drinking Water

April 2001

CONTENTS

PRESIDENT'S MESSAGE

Ontario's professional engineers are required, by law, to regard their duty to public welfare as paramount.

Professional Engineers Ontario (PEO) is the organization that licenses professional engineers and regulates the practice of professional engineering in Ontario. PEO regulates engineering under the authority of the *Professional Engineers Act* and its supporting regulations.

PEO, as the regulator of engineering practice in the province, is bound by both statutory obligations and ethical responsibilities to protect the public where the practice of professional engineering is involved. We protect the public by setting standards of technical competence and professional conduct, and by ensuring that all licensed professional engineers meet these standards.

The design of water, and wastewater, infrastructure is recognized as part of the practice of professional engineering, and PEO has regulated this practice in Ontario for nearly 80 years.

We have prepared this report to help the Commission and the public understand the responsibilities of the professional engineer, the role of PEO, and how the practice of professional engineering, as related to the provision of safe drinking water, can be more fully utilized.

The safety and reliability of drinking water has historically been a source of pride to the profession, and the professional engineers of this province are ready to do all that can be done to ensure the long-term safety, efficient use and conservation of this resource.

Peter M. DeVita, P.Eng.
President (2000-2001)

EXECUTIVE SUMMARY

Professional Engineers Ontario recommends that the provincial government use regulations to clearly define the roles and responsibilities for professional engineers in aspects of drinking water supply, including construction, operation and water resource management, to provide a higher level of accountability in the quality of Ontario's drinking water. PEO recommends that such demand-side legislation refine the definition of engineering in relation to safe drinking water and the supervision of water works operations.

Because of the broad definition of the practice of professional engineering in existing legislation, PEO could more effectively regulate the profession if the Professional Engineers Act were supported by demand-side legislation. The regulatory requirement under the Environmental Protection Act that professional engineers be responsible for flow measurement of industrial effluent discharges is an example of the effective use of demand-side legislation related to water quality. This requirement does not currently exist for municipal systems.

The Engineering Profession
In Ontario, the engineering profession is regulated by the Association of Professional Engineers of Ontario. Also known as Professional Engineers Ontario, PEO is responsible for regulating engineering work in the province and for ensuring that licensed professional engineers are responsible for such work, including work related to the provision of drinking water.

Professional engineers are bound by a statutory accountability, which includes a Code of Ethics and requires that they place public welfare above all other interests. Licensed practitioners must complete specific academic and work experience requirements to obtain their licences.

In accordance with the Professional Engineers Act, the current practice of engineering in the provision of drinking water includes, among other responsibilities, design of water treatment plants and distribution systems. In addition, professional engineering is often an important component of construction management, commissioning, and operations and maintenance. Professional engineers participate as regulators (at the provincial and municipal government levels), owners (employed by municipalities overseeing water infrastructure), and in applying new technologies.

Although professional engineers are closely involved in many aspects of the provision of drinking water, laws governing drinking water infrequently reference professional engineers or professional engineering.

Even though requirements that professional engineers be involved in public water systems are not clearly legislated, activities such as design are within the practice of professional engineering as defined under the Professional Engineers Act, which determines the activities for which a professional engineer must be responsible. Because of the licensing system and professional obligations, engineers are ideally suited for assuming increased levels of responsibility and accountability in drinking water and water supply management.

PEO's Commitment to Safe Drinking Water in Ontario
As the organization responsible for licensing professional engineers and regulating engineering practice, PEO administers the Professional Engineers Act and Regulation 941. Licensed professional engineers must have met prescribed academic and experience requirements and need to abide by a Code of Ethics. In respect of ensuring the safety of drinking water, PEO makes the following commitments:

1. Increase Public Health Training
PEO will promote greater emphasis on public health training, through consultation and discussion with individual Ontario universities, the Council of Ontario Deans of Engineering, and the Canadian Engineering Accreditation Board.

2. Raise Awareness of the Role of PEO through Outreach
PEO will consult with stakeholders to:

- Identify and reach consensus on what activities require a professional engineer within both the meaning and spirit of the Professional Engineers Act. This will include developing clear scopes of practice and responsibilities for professional engineers in these areas.

- Identify the needs and expectations of the public that PEO serves, the users of engineering services, the broader regulatory community, and licensed practitioners with respect to what activities related to providing safe drinking water should be regulated.

During the 2001-2002 Council term, PEO will undertake a communications program on the Professional Engineers Act, especially as it pertains to the responsibility of professional engineers to protect life, health, property and the public welfare.

3. Partner with Regulatory and Non-Governmental Organizations
PEO will work with the provincial government and non-governmental organizations to develop and recommend defined scopes of practice and responsibilities for professional engineers involved with the provision of safe drinking water.

4. Promote Continuing Excellence
PEO will incorporate feedback from its outreach activities and membership profiling, the users of engineering services, the broader regulatory community, and licensed practitioners into its Professional Excellence Program (PEP).

5. Provide Guidance and Advice to Practising Engineers
PEO will produce Professional Practice Guidelines relevant to the provision of safe drinking water, such as guidelines on design approaches and quality assurance methods.

PEO's Recommendations to the Walkerton Commission
Safety and protecting public health are critical to the supply of good drinking water. Professional engineers can take a leadership role and provide greater accountability because of their academic qualifications, professional experience, and their individual commitment to the Code of Ethics, which is required for licensing. PEO has identified these recommendations:

1. Refine the Definition of Engineering in Regards to Safe Drinking Water
The provincial government and affected stakeholders should work with PEO to define specific activities and areas of practice that constitute the practice of professional engineering within the meaning and spirit of the Professional Engineers Act. This should include considering whether current activities and regulations are consistent with PEO's statutory mandate, specifically with respect to the evaluation of water supplies and the design of treatment and distribution systems.

The authority and mandate of professional engineers in water resources management and in water supply systems needs to be made clear in provincial legislation so that PEO can more effectively regulate the practice of professional engineering.

2. Increase Professional Engineers' Participation of Waterworks Operations and Management
PEO recommends that participation of professional engineers in the operation and management of water treatment works be defined in demand-side legislation, where appropriate, in order to provide greater accountability based on engineers' duty to the public welfare.

3. Specify Roles of Engineers through Demand-side Legislation
To ensure a higher level of accountability in the quality of Ontario's drinking water, the provincial government should use regulations to clearly define roles and responsibilities for professional engineers in aspects of drinking water supply, including design and construction, operation and water resource management. Such demand-side legislation should reflect the outcome of Recommendations number 1 and 2.

4. Strengthen Provincial Regulation of Water Systems

The Minister of the Environment should use section 5 under the Ontario Water Resources Act (OWRA) to appoint qualified professional engineers as directors for the purposes of issuing director's orders, director's reports, certificates of approval and other instruments prescribed under the OWRA.

Directors should support municipal engineers and/or their engineering consultants that exercise their duty to report risks to public health and safety related to drinking water using section 62 of the OWRA.

5. Clarify and Enhance Duty to Report

The Attorney General should amend The Professional Engineers Act to clarify engineers' obligations to report and provide a measure of protection for those who exercise them.

PEO believes that for this concept to be effective the engineer must be indemnified and protected from reprisal as a result of public notification of such conditions. In this way, the engineer would be provided with protection similar to that clearly defined in the Occupational Health and Safety Act, under which an individual has the right to refuse work without fear of reprisal by the employer.

1. INTRODUCTION

"It is recognised that the continued prosperity and welfare of this Province is closely linked with our great natural resource - water. Water is man's greatest need, and a country thrives and prospers in accordance with the abundance of its water supply. The Government has been concerned about the adequacy of water and sewerage systems for municipal and other uses. Municipalities cannot hope to expand without these basic public services. The rising standard of modern living and comfort sought by all citizens has made it essential that long range planning be undertaken to ensure a plentiful supply of ***good*** *water available to all. This carries with it the control of pollution of these waters. This problem has been accentuated by the tremendous growth in population and industrial expansion in recent years.*

Dr. Albert E. Berry P.Eng., General Manager and Chief Engineer, Ontario Water Resources Commission, 1956 budget report

1.1 The Walkerton Inquiry

The Walkerton Inquiry is an independent commission set up to examine the contamination of the water supply in Walkerton, Ontario, by a particularly virulent strain of *Escherischia coli* (E. coli) bacteria, known as E. coli O157:H7[1], and to look into the future safety of Ontario's water supply.

The Inquiry resulted from an incident that was discovered in May and June of 2000, when approximately 2,300 people in Walkerton became ill and several deaths were directly attributed to the outbreak[2].

The Government of Ontario established the commission on June 12, 2000, under the *Public Inquiries Act*. The commission is mandated to inquire into the cause of the water supply contamination, including the effect, if any, of government policies, procedures, and practices, and to make recommendations to ensure "the safety of the water supply system in Ontario."[3] The Inquiry's findings, conclusions, and recommendations will be delivered to the Attorney General of Ontario and will be made available to the public. Dennis R. O'Connor, a Justice of the Court of Appeal for Ontario, was appointed Commissioner.

The Inquiry is proceeding in two parts. Part I relied on formal evidentiary hearings into the circumstances of the incident. Part II focuses on policy issues related to ensuring the safety of Ontario's drinking water. The Inquiry is reviewing a range of factors that impact on the safety of drinking water, including public health, technological and management factors associated with the production, treatment, and distribution of drinking water as well as the contamination of source waters, focusing on microbial contaminants capable of causing acute threats to public health. The commission intends to gather the best technical, professional, and otherwise informed advice, which will be debated and revised through public processes, and which will ultimately form the basis for the Commissioner's report.

On August 24, 2000, Professional Engineers Ontario (PEO) requested official standing for Part II of the Walkerton Inquiry via a letter to Justice O'Connor. In response to this request, PEO was invited to make an oral submission to the commission on September 7, 2000, in support of its application. On September 12, 2000, PEO was granted standing. Standing before the commission entitles PEO to make written submissions to the Inquiry and to directly participate in public meetings. PEO determined that it would be appropriate to prepare a written submission and PEO President Peter DeVita, P.Eng., charged the PEO Environment Committee with responsibility for coordinating PEO's submission to the Walkerton Inquiry. The results of PEO's efforts are summarized in this report.

1.2 Professional Engineering and Drinking Water Safety

The *Professional Engineers Act* places responsibility on each licensed professional engineer to ensure that life, health, property, and the public welfare are protected, and places the onus on Professional Engineers Ontario to ensure that any individual engaged in activities defined as professional engineering under the Act is licensed.

1 Bruce-Grey-Owen Sound Health Unit (2000).
2 Toronto Star (2001).
3 Canada News Wire (2001).

PEO's mandate is contained in provincial legislation, namely: *Professional Engineers Act* R.S.0. 1990, Chapter P.28, and, R.R.0. 1990 Regulation 941, amended to Ontario Regulation 286/99.

The practice of professional engineering is defined under Section 1 of the *Professional Engineers Act* as comprising three tests:

- (1) any act of designing, composing, evaluating, advising, reporting, directing or supervising;
- (2) wherein the safeguarding of life, health, property or the public welfare is concerned; and
- (3) that requires the application of engineering principles, but does not include practising as a natural scientist.

The Act, in effect, authorizes PEO to determine what constitutes the practice of professional engineering. It is also important that PEO recognizes that this authority is to be exercised in the broader public interest. This often proves challenging in practice. This makes it important that the public, users of engineering services, the regulatory community, and licensed engineers work together to build a framework for the provision for safe drinking water that integrates the skills and advice of all three groups.

Not only do professional engineers have the technical expertise and accountability to ensure that drinking water is safe, but they are also bound by a Code of Ethics that requires them to put the public welfare (including public health, safety, and the environment) above all other interests. They also have a duty to report situations that are found to be unsafe or that may endanger public welfare.

Design of water treatment plants and distribution systems, construction management, commissioning, and operations and maintenance, are just a few of the responsibilities involving professional engineers in the provision of drinking water. Professional engineers also participate as regulators at the provincial and municipal levels of government, as owners (when employed by municipalities to oversee water infrastructure) and in applying new technologies. But, beyond these responsibilities, Ontario professional engineers have been leaders in innovative methods of ensuring safe drinking water.

For example, one of the founders of PEO, Dr. Albert Berry P.Eng., in his role as Provincial Sanitary Engineer, actively promoted chlorination as a water treatment process in order to halt the spread of typhoid. Also, as General Manager and Chief Engineer of the Ontario Water Resources Commission (OWRC) from 1956 to 1963, he not only positively impacted the introduction of water chlorination and milk postulation, but he also instituted a uniform standard of operator training, a key component of the OWRC mandate. He established the Mandatory Order to ensure water and wastewater treatment plants and systems would be built as and where they were determined to be necessary through engineering analysis. He was both a highly honoured environmental engineer and a public health authority with multiple national and international distinctions and awards. [4]

1.3 About this Report

This report provides the Walkerton Inquiry with details about the practice of professional engineering, how professional engineers are involved in the provision of drinking water, and what more the profession can do to ensure the safety of Ontario's drinking water.

Chapter 1 provides an introduction, including an overview of the Walkerton Inquiry and the involvement of PEO in the Inquiry process.

Chapter 2 contains an overview of the rules, including legislation, regulations, and codes of conduct, governing professional engineers in Ontario; a brief history of the development of the *Professional Engineers Act*; and a description of the current Act. The guiding principles for professional conduct of Ontario professional engineers are reviewed as they are defined by Regulation 941 of the Act and PEO's Code of Ethics.

Chapter 3 delivers information about the current practice of drinking water engineering, including an overview of the required academic training for engineers involved in the drinking water industry and a description of the statutory requirements of professional engineers in the provision of these works and

[4] Public Works Historical Society, "An interview with Dr. Albert E. Berry", Public Works Oral History, Interview Number 8, September 1988. P.14

services. The chapter concludes with a section about the various roles and responsibilities of professional engineers involved in the drinking water industry.

Chapter 4 offers a number of commitments identified by PEO to support the long-term sustainability and safety of Ontario's drinking water, in support of the commission's undertaking.

Chapter 5 contains PEO's recommendations to the Walkerton Inquiry, including rationale.

Following Chapter 5 is a glossary of terms, a bibliography, and an appendix containing additional details about various topics presented in the report.

2 PROFESSIONAL ENGINEERING REGULATORY FRAMEWORK

Professional Engineers Ontario (PEO) is responsible for regulating the engineering profession in Ontario. The *Professional Engineers Act* places the onus on PEO to ensure that any individual engaged in activities that are considered to fall within the practice of professional engineering is licensed.

The complete texts of the *Professional Engineers Act*, Regulation 941, and the Code of Ethics are available on-line at www.peo.on.ca. For a complete understanding of the Act and Regulation, refer to the legislation.

2.1 The Rules Governing Professional Engineering

2.1.1 Historical Overview of Engineering Regulation

Engineering can be defined as the "creative use of science, mathematics and technology, to satisfy human needs," and has had a profound influence on the development of modern civilization[5]. Beginning with the military engineers of ancient times, through the evolution of "civil" engineers, to the vast array of disciplines that exist today, engineers continue to strive to provide innovative solutions to society's needs.

Before the Industrial Revolution, when the need for formal training became evident[5] , there was no standard instruction or preparatory procedures for the making of an engineer. The first law related to professional engineering in Ontario was created in 1922 and allowed for the creation of a voluntary association to oversee *registration* of engineers. The Act of 1922 was "'open", meaning that membership in the association was not mandatory for practising engineers.

In Ontario, regulation of engineering practice dates to 1937, when the *Professional Engineers Act* was amended and the engineering profession was "closed" to non-qualified individuals; that is, licensure was made mandatory for anyone practising professional engineering[6]. The provincial government determined that it would be in the public interest to restrict the practice of engineering to those who were qualified, and the right to practise was "closed" to non-engineers as a result of the failures of bridges and buildings, which had been designed by unskilled individuals.[7]

The *Professional Engineers Act* was amended in 1946, 1949, 1960, 1969, and 1984. Each amendment strengthened PEO's ability to regulate professional engineers and professional practice, by, among others:

- expanding the scope of professional engineering to encompass modern developments, including different classes of licensure;
- enabling PEO to pass regulations relating to a Code of Ethics, professional conduct, negligence and incompetence, and detailing sanctions for incompetence and professional misconduct;
- regulating engineering partnerships and corporations;
- recognizing the need to grant licences to practise in Ontario to those living outside the province; and
- defining a formal complaints procedure.

PEO, as the regulator of engineering in the province, continues to be open to ways to improve its goals relating to public safety, as detailed in Section 2 of the *Professional Engineers Act*.

2.1.2 The Professional Engineers Act

In Canada, the title "professional engineer" is restricted by law. In Ontario, only those individuals who have demonstrated that they possess the necessary qualifications and have been licensed by PEO can use the title, which is often abbreviated as "P.Eng.". The requirement for licensure is set out in the *Professional*

[5] Andrews and Kemper (1999).
[6] Andrews and Ratz (1997).
[7] Piper (1997).

Engineers Act, R.S.O, 1990, Chap. P.28. The Act also sets out the framework for self-regulation of the profession, including:

- the legal definition of engineering;
- the purpose, scope, powers, and administrative structure of PEO;
- types of licences, and licensing procedures;
- terms and conditions of licensure;
- a code of ethics; and
- disciplinary procedures.

2.1.3 Regulation 941 of the Act

Regulation 941 of the *Professional Engineers Act*, amended to O.Reg. 286/99, is a regulation made to provide additional details and guidance for implementation of the Act. For example, the Regulation prescribes the process to be followed when electing professional engineers to Council.

With respect to professional practice, the Regulation prescribes a **Code of Ethics**, defines **negligence and professional misconduct**, addresses the requirement for professional engineers to report unsafe situations and unethical practices, and states that all professional engineers shall have a **seal** and describes its use.

2.1.4 Code of Ethics

The Code of Ethics is a basic guide to professional conduct and imposes duties on the practising professional engineer, with respect to[8]:

- society;
- employers;
- clients;
- colleagues, including employees and subordinates;
- the engineering profession; and
- himself/herself.

Section 77 of Regulation 941 states that "it is the duty of a practitioner to the public, to the practitioner's employer, to the practitioner's clients, to other licensed engineers of the practitioner's profession, and to the practitioner to act at all times with,

i. fairness and loyalty to the practitioner's associates, employers, clients, subordinates and employees,
ii. fidelity to public needs,
iii. devotion to high ideals of personal honour and professional integrity,
iv. knowledge of developments in the area of professional engineering relevant to any services that are undertaken, and
v. competence in the performance of any professional engineering services that are undertaken."

Through the Code of Ethics, professional engineers have a clearly defined duty to society, which is to regard the **duty to public welfare** as paramount, above their duties to clients or employers. Their duty to employers involves acting as **faithful agents or trustees**, regarding client information as confidential and avoiding or disclosing conflicts of interest. Their duty to clients means that professional engineers have to **disclose** immediately any direct or indirect interest that might prejudice (or appear to prejudice) their professional judgement.

Professional engineers who are employee engineers and who "freelance" or perform professional engineering work for clients other than their employers must provide their clients with written statements about the nature of their employee status, only accept work that does **not conflict** with their duty to their employers, and inform their employers of the work.

As co-workers and supervisors, professional engineers are required to **cooperate** on project work and must not review the work of other professional engineers who are employed by the same company without the other's knowledge, and must not maliciously injure the reputation or business of other practitioners.

[8] Andrews and Ratz (1997).

Professional engineers are obligated to give **proper credit** for engineering work, uphold the principle of adequate compensation for engineering work, and extend the effectiveness of the profession through the interchange of engineering information and experience.

2.1.5 Professional Engineer's Seal

The *Professional Engineers Act* provides that every professional engineer shall have a seal denoting licensure, including the type of licence held. Section 53 of the Act sets out the use of the engineers seal, which has legal implications. The appearance of the seal on documents and drawings indicates that the documents and drawings are final and have been prepared under the supervision of a professional engineer who is assuming responsibility for them[9]. Since engineers assume technical and ethical responsibilities for work done under their supervision, the use of the seal is the engineer's "stamp of approval"' about the technical accuracy of the materials.

The standard design for the seal is shown in Figure 1[10].

Figure 1. Professional engineer's seal.

2.2 Role of Professional Engineers Ontario

2.2.1 PEO's Legislated Mandate

Professional Engineers Ontario (PEO) regulates the practice of professional engineering and governs those individuals and organizations that PEO licenses in order "that the public interest may be served and protected". PEO is also mandated to carry out the following additional objects under the Act:

1. establish, maintain and develop standards of **knowledge and skill**;
2. establish, maintain and develop standards of **qualification** and **standards of practice** for the practice of professional engineering;
3. establish, maintain and develop standards of **professional ethics**; and
4. promote **public awareness** of the role of PEO.

The Act gives PEO the power to make regulations for administration of PEO (such as fixing the number of professional engineers elected to Council), admission to PEO (such as academic training), and standards of professional engineering practice (such as setting a code of ethics). The Act permits PEO to make by-laws relating to its administrative and domestic affairs, such as defining the duties of the Registrar.

PEO is governed by a council, the composition and operation of which are dictated by the Act. Most councillors are elected by PEO's licensed membership, which currently number more than 65,000. Some councillors are appointed by the Lieutenant-Governor-in-Council of the Province of Ontario. These appointed councillors may or may not be professional engineers. The PEO Registrar and CEO is responsible for staff implementation of PEO council decisions and policies.

2.2.2 Licensing

The *Professional Engineers Act* requires that every individual offering professional engineering services hold one of three types of licence granted by PEO.

[9] Andrews and Ratz (1997).
[10] Note that some seals still in use bear the designation "Registered Professional Engineer".

1. **Full Licence,** which confers all the rights and responsibilities that accompany licensure. To be granted a (full) licence to practise professional engineering in Ontario, an individual must be a Canadian citizen (or have permanent resident status); be at least 18 years old; and have satisfied academic requirements, such as completing an engineering degree from an accredited engineering program; satisfy specific experience requirements; pass a professional practice examination on engineering ethics and law; and be of good character. An engineer who has been granted this licence appends the abbreviation **P.Eng.** after his or her name to denote that he or she is licensed.

2. **Temporary Licence**. PEO currently issues two categories of temporary licences. The first authorizes residents of a province or territory in Canada, other than Ontario, who have membership in an association/ordre (in Canada) to practise in Ontario. The second authorizes non-Canadian citizens and non-permanent residents of Ontario who have qualifications deemed equivalent to those required for PEO membership and/or who have gained wide recognition in the field of professional engineering relating to the work to be undertaken under the temporary licence, and who have at least ten years experience in that field, to practise in Ontario. A temporary licence holder in the latter category may be required to collaborate with a PEO member in respect of the work undertaken, unless he or she satisfies certain criteria stipulated by PEO.

3. **Limited Licence**, which authorizes practitioners who do not hold an undergraduate degree in engineering to practise in a limited area of professional engineering where they have developed professional engineer-verified expertise and competence. This licence to practise is employer- and project-specific and of limited scope.

2.2.3 Certificates of Authorization

Every business entity (sole proprietorship, partnership, or corporation) offering or providing services to the public (that is, to anyone other than the engineer's employer) must hold a Certificate of Authorization. The Act states that "no person shall offer to the public or engage in the business of providing to the public services that are within the practice of professional engineering except under and in accordance with a certificate of authorization". Engineering firms that design water treatment plants must hold a valid Certificate of Authorization.

In addition to licensing individuals to practise engineering and issuing Certificates of Authorization, PEO's Regulation provides for the conferring of the designation of **Consulting Engineer** on practitioners who fulfil additional qualifications. Only those individuals and firms authorized by PEO to do so may call themselves Consulting Engineers.

Details about the licensing process are contained in the Appendix.

2.2.4 Negligence and Professional Misconduct

PEO has the authority to discipline licensed engineers who are shown to be negligent in the discharge of their responsibilities and therefore guilty of professional misconduct.

Regulation 941 defines negligence to be "an act or an omission in the carrying out of the work of a practitioner that constitutes a failure to maintain the standards that a reasonable and prudent practitioner would maintain in the circumstances."[11] Professional misconduct includes:

- failure to make reasonable provisions for the safeguarding of life, health or property of a person who may be affected by the work for which the practitioner is responsible [s.77(2)(b)];
- failure to act to correct or report a situation that may endanger the safety or welfare of the public [s.77(2)(c)];
- failure to comply with applicable statutes, regulations, standards, codes, by-laws and rules in connection with work for which the engineer is responsible [s.77(2)(d)];
- non-disclosure of conflicts of interest;

[11] Regulation 941, s.72 (1).

- sealing documents that an engineer did not prepare or check; and

- harassment or any other conduct or act relevant to the practice of professional engineering that would be regarded as disgraceful, dishonourable, or unprofessional.

2.2.5 Complaints and Disciplinary Procedures

With the privilege of a right to practise conferred on those who are licensed as professional engineers, there are assigned responsibilities, namely, to discharge their duties proficiently, honourably and competently. The Act sets out processes and procedures for dealing with professional misconduct, negligence and incompetence. In this context, incompetence means either a lack of knowledge, skill or judgement, or the suffering from a physical or mental condition that renders the individual unable to maintain the necessary standards of professional practice.

PEO relies on two statutory committees, the Complaints Committee the Discipline Committee, to assist in making determinations about individual and corporate professional practice and adherence to due diligence. The Complaints Committee considers and investigates complaints from the public, or PEO-licensed engineers, regarding the conduct or actions of individual practitioners or Certificate of Authorization holders. If the Complaints Committee determines there is sufficient evidence to pursue disciplinary action, the complaint is forwarded to the Discipline Committee. It is the responsibility of the Discipline Committee to hear evidence and determine the validity of allegations, and impose disciplinary action, such as revoking or suspending a licence or imposing fines.

Details about PEO's enforcement processes are presented in the Appendix.

2.2.6 Demonstrating Duty to Public Welfare

PEO as the regulatory body of the engineering profession holds its duty to public welfare as paramount. PEO publishes guidelines and consults with other agencies, including government, to improve the ability of the profession and individual engineers to safeguard the public welfare.

To help engineers understand the purpose and operation of PEO and their professional responsibilities, PEO publishes guidelines. PEO has also developed guidelines to assist the general public in their dealings with engineers. Appendix A.6 presents a listing of PEO's guidelines.

An "Environmental Guideline for the Practice of Professional Engineering in Ontario" was developed by a PEO task force in 1992 to highlight the value of environmental protection to public welfare and to emphasize the responsibility of all engineers for stewardship of the environment. The guideline complements PEO's definition of professional misconduct and Code of Ethics. It identifies protection of the environment as part of safeguarding public welfare.

The Environmental guideline outlines professional engineers' responsibilities for stewardship of the environment. It state that: "Each and every member of Professional Engineers Ontario has a duty to use knowledge not only of engineering, but also of the sciences, law, and economics, to have proper regard for the environment as it is affected by the engineer's work". The guideline's nine guiding principles for engineers are:

- Develop and maintain a realistic level of understanding of environmental issues related to the engineer's field of expertise.

- Seek out and use as necessary the supplemental expertise of specialists to assess the environmental implications of engineering activities.

- Apply professional and responsible judgement with respect to environmental considerations.

- Ensure that environmental planning and management is integrated into all the engineer's professional activities.

- In the evaluation of an engineering project, consider the cost of environmental protection for the entire life of the project including its final closure.

- Strive to have pollution prevention implemented at the production source and to manage wastes appropriately.
- Cooperate with public authorities and strive to respond to environmental concerns in a timely fashion.
- Comply with legislation and consider, where feasible, additional environmental protection.
- Work actively with others to improve environmental understanding and practices.

PEO has a history of consulting with other agencies, particularly the provincial government, during development of regulations, policies, and guidelines that may impact the practice of professional engineering. PEO is recognized as an "objective and authoritative source,"[12] and is provided advance notice of proposals by, for example, the Ontario Ministry of the Environment (MOE).

Liaison with external agencies is facilitated through PEO's departments of government relations and professional affairs. Review of the technical content of proposals and analysis of potential impacts on PEO, practitioners, and the *Professional Engineers Act* are undertaken by PEO committees, such as PEO's Environment Committee. These committees and professional staff review technical content of proposals and advise PEO Council about potential impacts on PEO, practitioners, and the *Professional Engineers Act*.

2.2.7 PEO Environment Committee

The PEO Environment Committee was established in 1995 with a mandate to provide advice to PEO Council on environmental issues. It comprises practitioners working in the environmental field, and one of its main activities is to comment on proposed regulatory changes that may affect professional engineering practice.

The Environment Committee has provided input to the provincial government on a number of issues including:

- Policy-level MOE documents, such as "Three Year Plan for Standard Setting" and "Responsive Environmental Protection";
- MOE's draft "Record of Site Condition", which is a document that is signed by practitioners to certify that a site has been appropriately decommissioned; and
- Regulation 903 under the *Ontario Water Resources Act*, which deals with water wells. PEO's suggestions included strengthening construction requirements for potable water supply, and clarifying those sections of the Regulation dealing with well abandonment.

Most recently, PEO provided input during development of the *Drinking Water Protection Regulation, O. Reg. 459/00*, and was instrumental in arguing the need for professional engineers, whose primary objective is protection of the public, to assess and report on the integrity and performance of Ontario's drinking water plants. The legislation states the owner of a water works is required to provide the Ministry of Environment with written reports prepared by a professional engineer.

2.3 The Licensed Professional Engineer

Once licensed, professional engineers are expected to practise in accordance with the dictates of the *Professional Engineers Act* and Regulation 941, particularly the Code of Ethics, and any other applicable statutory requirements. The onus is on the practising professional engineer to ensure compliance with these obligations.

[12] Hawthorne (1999), citing comments by former Environment Minister Norm Sterling.

2.3.1 Continuing Competence

Under PEO's Code of Ethics, practitioners are required to be competent "by virtue of their training and experience". Ensuring continued competence is the responsibility of each professional engineer. PEO does not use prescriptive professional requirements for competence.

To find our how other provincial engineering organizations manage technical competence and life-long learning, PEO's Professional Excellence Program (PEP) Review Task Group is mandated to examine professional development programs, management of licensed engineer data and professional development information in other jurisdictions. This will provide PEO with options for tracking and recording licensed engineer professional development data.

Individual engineers remain competent by taking technical courses and participating in learned societies such as the Engineering Institute of Canada, a non-profit organization that promotes learning by partnering with universities, colleges, technical institutes and others[13].

PEO's chapters provide a forum for individual practitioners from various disciplines to meet informally and exchange information.

2.3.2 Professional Conduct and Liability

Acceptable professional conduct means that professional engineers must practise only within their area of expertise, must accept responsibility for their actions, and cannot assign legal responsibility for their work under contractual obligations. The onus is on the engineer to undertake only those assignments for which the engineer is competent, or for which the engineer can become competent without undue delay. When there is a question about the ability to undertake an assignment, practitioners are expected to engage a suitable "expert" to take responsibility for the areas in question. Engineers who proceed on any other basis are not being honest with their clients or employers, and may put the public at risk as a result.

Professional engineers who knowingly accept responsibility for and, specifically, sign or seal documents that they did not prepare, check, or supervise may be found guilty of professional misconduct and open to liability for fraud or negligence, if such misrepresentation results in damage to some party. This is because the Law of Tort protects an individual's person, property and reputation from wrongful harm. If a member of the public is injured, by or through the carelessness of a professional engineer involved in the practice of professional engineering, that person has the right to collect compensation for the injury. Examples of torts are slander, trespass, theft, deception, and negligence, of which negligence is of most concern to engineers, and to PEO.

2.3.3 Conflict of Interest

The Code of Ethics contained in Regulation 941 states that "a practitioner shall act in professional engineering matters for each employer as a faithful agent or trustee and shall regard as confidential, information obtained by the practitioner as to the business affairs, technical methods or processes of an employer and avoid or disclose a conflict of interest that might influence the practitioner's actions or judgement."

2.3.4 Duty to Report

Professional engineers have obligations both to their clients and to the public. When an engineer finds unsafe or unethical practices in the workplace, **PEO's definition of professional misconduct includes failure to report a situation that an engineer believes may endanger the safety or welfare of the public.**

Professional engineers are expected to "regard the practitioner's duty to public welfare as paramount". This overriding principle is intended to guide the actions of individual engineers. If individual practitioners need guidance and support, PEO, through the office of the Registrar, will cooperate with any engineer who reports a situation that the engineer believes may endanger the safety or welfare of the public.

[13] Hawthorne (1999).

3 THE CURRENT PRACTICE OF ENGINEERING IN THE PROVISION OF DRINKING WATER

Design of water treatment plants and distribution systems, construction management, commissioning, and operations and maintenance, are just a few of the responsibilities involving engineers in the provision of drinking water. Professional engineers also participate, as regulators (at the provincial and municipal levels of government), as owners (when employed by municipalities to oversee water infrastructure), and in applying new technologies.

3.1 Academic Training

There are a number of engineering disciplines that may be involved in the provision of drinking water; the five most common are: environmental, chemical, civil, geological, and mechanical.

Chemical, civil, geological and mechanical engineering are traditional engineering disciplines and are offered by most universities that provide engineering undergraduate programs. Recent additions include environmental engineering and bioengineering. The number of accredited programs in environmental engineering, or leading to a notation that environmental engineering was the major area of study, is increasing.

For the most part, engineering undergraduate programs at Canadian universities include:

- fundamental principles and theories;
- technical courses related to an area of specialization (discipline);
- non-technical courses related to topics such as economics and management; and
- non-technical electives in the humanities.

Although graduates from each of these disciplines may be involved in drinking water projects, the nature of involvement is usually different from one discipline to the next, resulting from differences in the undergraduate curriculum for each program. It is important to note that the public health component varies among the disciplines. There is typically more in-depth training in environmental engineering than in mechanical engineering.

3.1.1 Environmental Engineering

Environmental engineering focuses on managing resources and protecting the environment, as well as developing engineered solutions that minimize threats to human health. Environmental engineers play a major role in developing technically sound and economically feasible solutions to air, land, and water pollution, noise pollution, and hazardous and toxic waste management. They deal with issues related to landfills and solid waste management, remediation of contamination, ecosystem protection and preservation, and the development of sustainable and environmentally safe methods for the allocation, development, and utilization of natural and renewable resources, including drinking water.

Environmental engineering is a multidisciplinary activity, and environmental engineers work closely with professionals from other disciplines, including professional geoscientists, hydrogeologists, biologists, chemists, economists, sociologists, lawyers, political scientists, urban and regional planners, and others who play an integral role in defining and designing sustainable developments.

3.1.2 Chemical Engineering

Chemical engineering combines the principles of mathematics, chemistry and physics with engineering practices to improve the human environment for a wide range of industries. Chemical engineers work with processes and physical aspects of materials. Undergraduate programs in chemical engineering include instruction in chemicals and processes for water treatment systems. Chemical engineers working in the water industry are involved in: development and implementation of processes (from laboratory scale-up to full-size) used in water treatment; pollution control; automatic control of processes, such as programming chlorinators for flow-based dosing; computer simulation of plants for optimum operation; and design of in-

plant improvements for more economical operation. Chemical engineers often work with electrical and software engineers, especially with respect to process control and monitoring.

3.1.3 Civil Engineering

Most of society's infrastructure is the work of civil engineers. They are responsible for designing and building airports, bridges, roads, buildings, irrigation channels, pipelines, as well as water distribution systems and treatment plants. In addition to such traditional courses as structural analysis and design, undergraduates are trained in hydraulics and geotechnical engineering, making them ideally suited to deal with pollution transport in rivers, lakes, and the atmosphere.

Because of their heightened awareness of the consequences of past activities, many civil engineers are now primarily concerned with environmental protection, energy conservation, and infrastructure restoration, including drinking water treatment plants and distribution systems. Civil engineers also mitigate the effects of air and water pollution, soil contamination and industrial waste by designing treatment and control processes. Civil engineering can include elements of geological engineering. These broad applications make civil engineering one of the largest engineering disciplines.

Civil engineers who work on water and wastewater systems are usually involved in the design and construction of physical infrastructure for growing urban populations and industries, and incorporate ecosystem restoration, waste reduction, recycling, and air pollution abatement into their designs, as appropriate. Chemical engineers often work with electrical and/or software engineers to develop and design monitoring and control systems.

3.1.4 Geological and Geotechnical Engineering

Geological engineering focuses on the engineering properties of soil and rock and their interaction with water in the subsurface. Course work usually includes mineralogy and petrology, hydrogeology, sedimentation and stratigraphy, structural geology, rock mechanics, and soil mechanics. Optional courses provide exposure to contaminant hydrogeology, engineering site evaluation, environmental geology, resource geology, and petroleum and mineral geology.

Geological engineers participate in exploration and development for mineral or petroleum deposits, and undertake studies and designs for the strength characteristics of soil and rock and their ability to support structures. They also study the characteristics of earthen impoundments for containment of solid or liquid wastes. With respect to drinking water, geological engineers may be involved in studying the characteristics and management of groundwater resources as a source of safe water supply.

3.1.5 Mechanical Engineering

Mechanical engineers are concerned with materials and manufacturing. In the environmental field, they focus on pollution prevention by designing clean products, manufacturing processes and alternative energy systems. In water treatment and supply, mechanical engineers assist with the design of the mechanical aspects of water infrastructure, such as pumps and flow measuring devices. Like chemical engineers, mechanical engineers often work with electrical and/or software engineers to develop and design monitoring and control systems.

3.2 Legal Requirements

The statutes of primary importance to the provision of safe drinking water and/or sewage treatment and disposal are the *Ontario Water Resources Act*, the *Environmental Protection Act*, the *Environmental Assessment Act*, and *the Drainage Act*. The *Ontario Building Code Act*, which affects septic (individual sewage) systems, is also included in this section.

With the exception of the Drainage Act and the Drinking Water Protection Regulation, for the most part, laws governing drinking water infrequently reference engineers or engineering. For instance, the *Ontario Water Resources Act* does not explicitly require professional engineers to perform many of the activities arising from this regulation (such as the design of systems to treat and distribute water) that involve engineering. As well, development of applications for approval of waterworks under the *Environmental Protection Act* are largely engineering, but are not formally recognized as such.

As discussed in section 1.2, the design of these systems, under the Professional Engineers Act, is included in the definition of the practice of professional engineering and is required to be done under the direct supervision of a professional engineer who takes responsibility for the work. PEO's licensing requirements ensure that licensed practitioners have the academic training, work experience and knowledge of the PEO Code of Ethics to be capable of assuming responsibility and accountability in areas related to drinking water and water supply management.

3.2.1 Ontario Water Resources Act

The *Ontario Water Resources Act* is the provincial government's principal legislative instrument for the management of water resources.[14] This Act is typical of Ontario's legislative practice in that it does not preclude the *Professional Engineers Act* in respect of the responsibilities of a professional engineer.

The main purpose of the Act is protection of Ontario's water resources, and it includes a general prohibition against the discharge of substances or materials into water that "may impair the quality of the water". Under the Act, "water" means surface and groundwater. This prohibition applies to lakes, rivers, springs, streams, reservoirs, wells and any other water or watercourse, or on the banks of the watercourse. Impairment is defined in the Act as any discharge of substances or materials into the water that causes, or may cause, injury to any person, or other living things. The Act prescribes actions that the Ontario Ministry of the Environment (MOE) can take to control discharges, and penalties that MOE can apply in the event that water is impaired.

To ensure the quantity of Ontario's water resources, Section 34 of the Act requires any person who wants to take more than 50,000 litres of water a day from the ground or from surface water to obtain a "water-taking permit". Some exceptions apply, such as for water to be used for fire fighting or for domestic use.[15]

The Act stipulates that approval is required from the MOE to build, upgrade or extend water, and sewage[16], works:

- Section 52(1) states that: "No person shall establish, alter, extend or replace new or existing waterworks except under and in accordance with an approval granted by a Director."

- Section 52(2) states that: "The Director may require an applicant ... to submit plans, specifications, engineer's report and ...".

The Ministry has established a formal process and an entire department for the purpose of reviewing plans, specifications and reports submitted in support of approvals. As specified in the regulations under the Act, the MOE Director may require that engineering documents, including sealed drawings, be submitted. While not an explicit requirement, it is common practice that once water or sewage projects are approved, the MOE issues a Certificate of Approval. This document is used by the MOE to judge the integrity and performance of the works. If the MOE determines that certain conditions are required, for example a specific testing frequency or chlorine dosage, these conditions become part of the Certificate of Approval.

Well construction is also regulated under the *Ontario Water Resources Act*. Sections 39 to 50 require any person who constructs wells, or carries on a well construction business, to be licensed by the MOE. Proper well construction is important to ensure that wells do not provide a pathway for contaminants into a drinking water supply. [17]

The *Ontario Water Resources Act* allows the provincial government to pass regulations specifying standards for the quality of potable and other water supplies, as well as for the quality of ambient water and sewage treatment plant effluent.

[14] Estrin and Swaigen (1993).
[15] ibid, p. 537.
[16] This statement applies to municipal sewage treatment plants. Certain other sewage facilities, such as large capacity holding tanks that are pumped out and transported to treatment plants or sewage systems that discharge into the ground, must receive approval under the *Environmental Protection Act.*
[17] ibid, p. 537.

PEO has determined the following deficiencies with this legislation:

- The onus to obtain a Certificate of Approval is on the proponent, but there has not been (until just recently) an effective audit program to determine compliance with this requirement.
- There is no explicit requirement that a waterworks be designed, or that the Application for a Certificate of Approval be reviewed and approved, by a professional engineer.
- There is no expiry date for Certificates of Approval, nor is there a legislated requirement for ongoing review. (This may be addressed to some degree by the recent requirements of the Ontario Regulation regarding drinking water protection.)

3.2.2 Ontario Regulation 459/00 Drinking Water Protection

The provincial government passed the Drinking Water Protection Regulation, O. Reg. 459/00, under the *Ontario Water Resources Act,* in August 2000. This regulation sets out minimum levels of water treatment, contaminants to be tested in the water and the frequency for testing, procedures for notifying the Medical Officer of Health and the Ontario Ministry of the Environment about test results, reporting on the waterworks, and reporting to the public.

Professional engineers are specifically named in Section 13 of the regulation, as is PEO and the *Professional Engineers Act*. Professional engineers are given particular duties in respect of waterworks, including preparation of an "Engineer's Report" to include a compilation of all existing Certificates of Approval, along with recommendations for inclusion in an updated and consolidated Certificate of Approval. As well, there is a requirement for on-going review of the waterworks by a professional engineer. MOE has published *Engineer's reports for waterworks*[18] to guide professional engineers in preparing the engineer's reports, which must include:

- a description of the waterworks;
- a compilation of MOE Certificates of Approval for the works available within the municipality;
- an assessment of the potential for microbiological contamination;
- a characterization of the raw water supply source;
- an assessment of operational procedures and recommendations;
- an assessment of existing physical works and recommendations;
- recommendations for a monitoring regime for the entire waterworks system to ensure compliance with the Ontario Drinking Water Standards and the Drinking Water Protection Regulation; and
- the signed seal of the professional engineer responsible for the report.

3.2.3 Regulation 435/93

This regulation requires that the owner of a waterworks must ensure that the overall operation of the facility is placed with an operator who holds a licence issued by the Ministry.

There is no requirement that the operation and maintenance of the waterworks be overseen or supervised by a professional engineer; however, engineers who operate and maintain water or sewage works they have designed can be exempt for up to six months from conforming with the qualifications established for licensed operators. Specifically, Section 6 states that "the experience qualifications established by this Schedule for a class of licence and type of facility do not apply to a **professional engineer** if the engineer obtains a mark that the Director considers above average in an examination approved by the Director relating to the functions performed by operators with that class of licence for that type of facility." This specific reference in the regulation recognizes that during the start-up and commissioning phase, professional engineers may be required to operate these facilities in order to ensure performance meets the design specifications. Professional engineers are not allowed to act as operators on an ongoing basis unless also licensed under this regulation.

[18] Ontario Ministry of the Environment (2000).

3.2.4 Environmental Protection Act

Ontario's *Environmental Protection Act* broadly defines environment to include "air, land, and water, or any combination or part thereof, of the Province of Ontario." The *Ontario Water Resources Act* prohibits discharges to the province's waters. The *Environmental Protection Act* prohibits the discharge of contaminants into the province's natural environment, which includes water (per Section 6 of the Act).

The Environmental Protection Act covers systems that do not discharge directly into waterways, but discharge into, for example, the soil or other sewage systems. This is in contrast to the *Ontario Water Resources Act,* which covers systems that discharge directly to provincial waterways.

Engineers are not named in the Act, but are given specific responsibilities in some of the regulations made under the Act.

Industrial Wastewater Discharges

In the early- to mid-1990s, the provincial government passed laws to control the wastewater discharged by industries as a means of protecting Ontario's surface waters. These "effluent regulations" apply to a number of industries.[19]

In each of these regulations, engineers are specifically named as having responsibility for ensuring that flow measurement methods produce accurate results. The intent of this legislation is to prevent false reporting of test results. The engineer's responsibility for the accuracy of the flow measurement method(s) used by the industrial discharger is important because flow measurements are used to determine the quantity of pollutants being discharged. Currently, there are no similar provisions to ensure the validity of tests conducted at municipal water or sewage treatment plants.

The wording in each of the regulations is identical. [20] Shown here is the petroleum refining regulation.[21]

"(7) Each discharger shall, no later than the day that this section comes into force, determine by calibration or confirm by means of a certified report of a **registered professional engineer** of the Province of Ontario that each flow measurement method used under subsections (2) and (3) meets the accuracy requirements of subsection (4) and that each flow measurement method used under subsection (5) meets the accuracy requirements of subsection (6)."

"(8) Where a discharger uses a new flow measurement method or alters an existing flow measurement method, the discharger shall determine by calibration or confirm by means of a certified report of a **registered professional engineer** of the Province of Ontario that each new or altered flow measurement method meets the accuracy requirements of subsection (4) or (6), as the case may be, within two weeks after the day on which the new or altered method or system is used."

Landfill Sites

Professional engineers are required to confirm that there is no seepage of leachate from the landfill by reporting on the integrity of the landfill liner and/or the absence of materials in the soil that is in contact with the liner that may affect the liner's integrity. Specifically, Ontario Regulation 232/98, amended to O. Reg. 483/98, states in Section 5 that "the report of a suitably qualified geotechnical **engineer** must confirm that there is no evident cracking in the constructed liner or significant occurrence of clods, stones, branches or other material that could shorten the service life of the constructed liner or significantly increase the hydraulic conductivity." The engineer's responsibility in this case has important repercussions, because the quality of groundwater, which may be used as the source for drinking water, could be adversely affected should the landfill liner leak.

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[19] These include: electric power generation (O.R. 215/95, amended to O. Reg. 174/99); inorganic chemicals (O. Reg. 64/95, amended to O. Reg. 51/98); iron and steel manufacturing (O. Reg. 214/95); metal casting (O. Reg. 562/94, amended to O. Reg. 526/95); metal mining (O. Reg. 560/94, amended to O. Reg. 169/96); minerals processing (O. Reg. 561/94, amended to O. Reg. 170/96); organic chemicals manufacturing (O. Reg. 63/95, amended to O. Reg. 50/98); petroleum refining (O. Reg. 537/93, amended to O. Reg. 524/95) and pulp and paper (O. Reg. 760/93, amended to O. Reg. 645/98)

[20] The section numbers may differ.

[21] Section 26 of O. Reg. 537/93, amended to O .Reg. 524/95

As an aside, the approval process for a landfill site includes a hearing at which geological and traffic engineers are called upon to provide their expert advice about the public safety of the proposed site. This process is currently missing from the drinking water system approvals process.

3.2.5 Environmental Assessment Act

The planning, designing and building of water and sewage works are governed, in part, by the *Environmental Assessment Act*. Engineers are not specifically named in the *Environmental Assessment Act*, but must adhere to the requirements of the Act in undertaking water supply projects. The Municipal Engineers Association has created a guideline to explain the environmental assessment process and assist municipal engineers implement its requirements. Environmental assessment supports sustainable development by integrating technical, social and economic considerations.

The Act identifies two types of assessment:

- Individual Environmental Assessments, which are typically unique projects that are undertaken infrequently; for example planning, designing and building a power generating station; and
- Class Environmental Assessments (Class EAs), which apply to projects that are undertaken routinely, including water supply and sewage treatment projects, among others.

3.2.6 Drainage Act

Under the *Drainage Act*, a professional engineer's report is required for a new municipal drain, or for repair or improvement of existing drains. [22] The engineer is required to follow accepted drain design standards as well as the design standards of the affected municipality. The professional engineer must know the *Drainage* Act thoroughly, be familiar with common law and other provincial statutes respecting drainage, and understand drainage as well as design and construction of drainage facilities. [23]

Major categories of work for the professional engineer involved with new municipal drains include field surveys, design, plan, and profile preparation, reporting, detailed design, contract tendering, construction supervision, and post construction attendance. The responsibilities of the engineer appointed under the *Drainage Act* are stipulated in the Act.

3.2.7 Ontario Building Code Act

Ontario's *Services Improvement Act* has changed the way septic systems and hauled sewage are regulated. As of April 2000, based on volume, most on-site systems, including septic tanks and tile beds, are now regulated under the *Building Code Act*. Large and communal septic systems are considered to be sewage works and are covered by the *Ontario Water Resources Act*. It is important to note that the Ontario Building Code Act requires professional engineers to approve specific types of buildings, which is in contrast to the legislation governing water treatment plants (where professional engineers are not specifically designated).

3.2.8 Other Legislation Impacting Water Supply

With respect to **federal statutes**, water and sewage projects may be subject to the *Canadian Environmental Assessment Act* if the project requires the provision of federal lands, is funded, in whole or in part, by the federal government, or requires federal authorization under the Law List Regulation of the Act[24]. Any water or sewage works that occur at or near water may require authorization under the *Fisheries Act*, should there be a potential for the works to cause harmful alteration, disruption or destruction of fish habitat[25]. Further, any project that has the potential to affect the navigability of a navigable waterway requires a permit under the *Navigable Waters Protection Act*.[26]

Although the primary **provincial legislation** governing the process by which water and sewage works are planned is the *Environmental Assessment Act*, in certain circumstances, such as when preparing an overall plan for water supply in a municipality (typically known as a "master plan"), the *Planning Act* may take precedence. In such cases, complying with the requirements of the *Planning Act* may fulfil some of the

[22] A professional engineer's report may be required for construction of new "mutual agreement" drains, a new "requisition" drains, or to report on abandonments, land subdivisions or maintenance of drains.
[23] This includes familiarity with the Design and Construction Guideline prepared by the Ministry of Agriculture and Food.
[24] MEA (2000), p. A-49.
[25] ibid, p. A-51.
[26] ibid, p. A-51

requirements of the *Environmental Assessment Act*. For other issues related to planning and development of water and sewage works, certain aspects of the *Municipal Act* may apply, such as for public notification of proposed projects. As well, the *Municipal Act* grants municipalities the power to make by-laws, which may impact the design of water and sewage works. For example, some municipalities have sewer use by-laws that specify the quality and quantity of sewage that may be discharged to the collection system. For water supply projects that abut private property, the *Local Services Improvement Act* requires proponents to petition the property owners prior to implementation. Sometimes, hearings about a water supply project may be required, according to the terms and conditions of individual statutes. If hearings are required under more than one statute, proponents may apply to have the individual hearings combined under the *Consolidated Hearings Act*.

Some Ontario **municipalities** have passed Sewer Use By-Laws as a means of controlling discharges to sanitary (sewage) sewers. These by-laws protect surface waters.

3.3 The Professional Engineer's Role

3.3.1 Municipal Responsibilities

Municipalities[27] are legally responsible for the provision of safe drinking water.

The role of professional engineers in assisting municipalities meet this responsibility includes: design, supervision management and technical consultation to municipal staff in planning, management, operational or maintenance activities related to the engineered drinking water infrastructure[28].

While municipal engineers and consultants who design water and wastewater facilities and systems are normally required to be licensed professional engineers, the same requirements do not exist for utility managers, water department directors, water treatment facility operators, or maintenance operators. Profession engineers only sometimes still perform and supervise these activities. In the past, however professional engineers routinely performed and supervised these activities, which provided a greater level of statutory accountability to the public.

Professional engineers provide numerous services to municipalities, whether as employers or through contract, related to infrastructure provided to the public by the municipality. In respect of water supply and treatment, professional engineers provide a range of services such as:

- capital works planning, including new works, rehabilitation, and replacements;
- estimating drinking water needs and planning water supply systems;
- water treatment process selection and optimization;
- design of water treatment plants and distribution systems;
- design and specification of equipment and supplies used for water treatment;
- tendering, construction supervision, and water system commissioning;
- characterization and evaluation of water supplies (groundwater and surface water);
- water resource management;
- technical or process related support for the operation of treatment systems (as distinct from contract operations);
- ensuring that potable water use by commercial and industrial sectors (including agricultural) does not pose potential contamination of the water supply;
- upgrading water distribution and treatment facilities; and
- estimating usage and setting water rates;

Under the Professional Engineers Act, the licence to practise does not distinguish between the public and private sectors. Regardless of employer, professional engineers are equally subject to the Act and equally accountable to the public. Municipalities may use the services of both public- and private-sector engineers. Both have the same professional liability under the *Professional Engineers Act*.

[27] For the purposes of this report, "municipalities" is taken to mean the local water authority, which may be a public utility commission in some cases.

28 Professional engineering is the act of designing, overseeing, commenting on, or managing, engineered works that directly or indirectly affect the life, health, safety, environment or financial integrity of a municipality or its residents.

3.3.2 Public Sector Engineers

Most municipalities or utilities serving populations greater than 50,000 have one or more municipal engineers on staff.

The Municipal Engineers Association has approximately 600 members representing approximately 150 Ontario municipalities. For larger municipalities, there may be several municipal engineers, each overseeing particular aspects of the municipality's infrastructure.

The smaller the municipality or utility commission, the greater the responsibilities of the staff engineer. In these cases, the municipal engineer can be involved in all aspects of municipal infrastructure, including agriculture practises, transportation, waste disposal, as well as water supply and sewage collection.

The engineering functions related to drinking water, commonly filled by engineers employed by the municipality, are:

- maintains knowledge of relevant regulations;
- provides reports to other staff or directly to municipal council;
- provides technical review of operations;
- identifies needs or deficiencies through appropriate analysis of information, system modelling, and trend analysis;
- is responsible for setting broad priorities with respect to works; and
- detail design or consultant coordination.

3.3.3 Private Sector Engineers

Municipalities may have professional engineers on staff, but they often hire private sector engineers to help with specific projects. Private sector engineers perform duties for which a municipality may not have dedicated staff engineers or where in-house expertise is not available.

Small municipalities with no permanent municipal staff engineer frequently retain a private sector engineer to fill this role. Under these circumstances, the private sector engineer fulfils the duties of the municipal engineer.

The role of private sector engineers in the water industry was recently increased by the introduction of the Drinking Water Protection Regulation, which requires the regular review and evaluation of municipal waterworks by a professional engineer. Reporting every three years by a licensed engineer should help ensure that proper engineering principles are applied to the design and operation of public water supply systems. This is an example of demand-side legislation clearly defining the role of professional engineers in the water supply sector.

Growth of the consulting engineering sector in Ontario can be attributed to the need for more specialized services, a trend toward contracting-out, and the propensity of municipalities responsible for supplying drinking water to shift risk to the private sector. As treatment processes continue to become more complex, and the list of contaminants that must be controlled grows, consulting engineers are likely to be called on more frequently to provide advice and assistance on matters related to water supply.

Staff engineers, because of their expertise, are often involved in making recommendations regarding the selection of private sector consultants.

Regardless of whether the engineer is resident or on contract, where engineering deficiencies that may affect the life, health, safety or financial integrity of a municipality or its residents are identified, a mechanism must be established which binds the municipality or owner to rectify the situation.

The private sector engineer, in offering engineering services to the public, is required by the *Professional Engineers Act* to operate under a corporate licence called a Certificate of Authorization. Private sector professional engineers may also hold the Consulting Engineer designation issued by PEO under the *Professional Engineers Act.*

Certificate of Authorization

Companies and individuals may only offer engineering services to the public if they obtain a Certificate of Authorization from PEO.[29] There are approximately 3,800 Certificate of Authorization holders in Ontario. PEO processes and evaluates applications for Certificates of Authorization for offering and providing professional engineering services to the public.

Under the Professional Engineers Act, to obtain a Certificate of Authorization, the business must assign at least one employee who is a licensed professional engineer to supervise and be responsible for the professional engineering services provided.

Consulting Engineer Designation

The Consulting Engineer designation allows a licensed practitioner to use the words "consulting engineer" after his or her name. It is a right to a title and not a licence to practise.

To obtain the designation "Consulting Engineer", a PEO licensee must: have been licensed by PEO for at least five years, been listed as a responsible engineer on a Certificate of Authorization issued by PEO for the past two years; provide five references (including two clients and three licensed professional engineers, one of whom is a designated consultant, and only one of whom is employed by the same firm); provide a list of projects, and submit to a review by a regional subcommittee.

The Consulting Engineer designation indicates the experience of professional engineers working in the consulting sector, since the requirements include five years of PEO membership and practice with a firm that holds a Certificate of Authorization. The engineer must also have been listed as a responsible engineer on the firm's C of A application for at least two years. The Consulting Engineer designation must be renewed every five years.

3.3.4 Involvement of Professional Engineers in Regulation and Governance

In addition to responsibilities at the municipal level, professional engineers working in the water industry are involved in the governance (administration) of provincial and agency statutes. For example, there are currently 94[29] professional engineers employed at the Ministry of the Environment to review applications for Certificates of Approval and undertake other technical reviews, such as for funding for waterworks. Conservation Authorities and other ministries, which are charged with managing water resources, may also employ Professional engineers.

Historically, the provincial government made greater use of the training and talents of professional engineers. Up until the mid-1980s, the provincial government using in-house MOE engineers undertook many functions related to water supply and treatment, including planning, development, and construction management. From the 1980s, there has been a shift away from proactive activities, such as involvement of professional engineers in water supply development and operation, toward reactive activities such as increased water quality enforcement activities. Changes in provincial government policy have placed greater responsibility for water projects on municipalities and other proponents, so there is now less need for in-house professional engineers at the provincial level. Further, few senior management or supervisory jobs within the public service require a professional engineer licence, particularly in the Ministry of the Environment, the body that oversees the major pieces of legislation regarding water and sewage treatment and supply.[30]

3.3.5 Research and Development

An early example of the relationship between research and application is the use of chlorine in the treatment of drinking water. In the late-1800s, scientists began to realize the bactericidal effects of chlorine. But it was Ontario engineers, in particular Dr. Albert Berry, P.Eng., in the early part of the 1900s who insisted on chlorinating water supplies as a means of reducing the incidence of typhoid fever and other water-borne diseases[31].

[29] This number is down from 154 professional engineers employed by MOE in 1991.
[30] Corneil (1987).
[31] Ontario Sewer and Watermain Construction Association (2001).

A contemporary example of the application of research results to drinking water is the development of ultraviolet (UV) irradiation as an alternative to chlorination. Scientists discovered that UV light inactivates micro-organisms present in water, providing a form of disinfection. Engineers used the results of the research to develop special UV lamps that could be used to disinfect municipal drinking water supplies. Another example is the development of large-scale membrane technologies, such as micro-filtration equipment for the removal of micro-organisms from water supplies. Such equipment can be used for removal of species, such as *Chryptosporidium* and *Giardia lamblia*, which are associated with gastrointestinal illness in humans. Not all research and development involves "high-tech" innovations; a highly effective "low-tech" method of treating low strength sewage is by using "engineered" wetlands to assimilate the effluent into the natural environment.

Research and development in the water industry is usually conducted at universities by non-profit and government organizations, and by private firms.

For university research, the Canadian Engineering Accreditation Board requires that engineering faculty be involved and the research be current. For non-university research, including non-profit organizations such as the American Water Works Association Research Foundation and government agencies such as Environment Canada's National Water Research Institute, the majority of researchers are chemists, microbiologists, and other scientists rather than professional engineers.

Engineers involved in research and development typically work in the private sector and are either employed by companies or are entrepreneurs. Research is an opportunity for engineers to safeguard life and health by designing equipment and processes through the application of engineering principles to scientific knowledge. Primarily, professional engineers translate the results of scientific research into products or processes that are technically feasible and commercially viable.

4 PEO'S COMMITMENTS TO SAFE DRINKING WATER

The *Professional Engineers Act* places responsibility on each licensed professional engineer to ensure that life, health, property, and the public welfare are protected, and places the onus on Professional Engineers Ontario to ensure that any individual engaged in activities defined as professional engineering under the Act is licensed.

The Act empowers PEO, in theory, as the final arbiter of what constitutes the practice of professional engineering. It is also important that PEO recognizes that this authority is to be exercised in the broader public interest.

This means that the public, users of engineering services, the regulatory community, and licensed engineers need to work together to build a framework for the provision for safe drinking water that integrates the skills and advice of all three groups, to create a process similar to the Occupational Health and Safety Act.

The commitments that PEO makes primarily involve working with professional engineers, users of engineering services, regulatory agencies, and non-governmental organizations to identify needs related to ensuring on-going safety of drinking water, and how engineers can help fulfil those needs.

4.1 Increase Public Health Training

PEO will promote greater emphasis on public health training, through consultation and discussion with individual Ontario universities, the Council of Ontario Deans of Engineering, and the Canadian Engineering Accreditation Board.

PEO will ensure that licence applicants who pass the Professional Practice Examination (PPE) demonstrate an appropriate knowledge of issues surrounding protection of public health and the environment, including resource conservation.

Professional engineers involved in providing drinking water are trained in environmental, chemical, civil, geological and mechanical engineering. Public health issues are covered in many of the engineering undergraduate courses for these disciplines; however, PEO believes stand-alone courses in public health should be more wide-spread.

4.2 Raise Awareness of the Role of PEO through Outreach

PEO will consult with stakeholders[32] to:

- **Identify and reach consensus on what activities require a professional engineer within both the meaning and spirit of the *Professional Engineers Act.* This will include developing clear scopes of practice and responsibilities for professional engineers in these areas.**
- **Identify the needs and expectations of the public that PEO serves, the users of engineering services, the broader regulatory community, and licensed practitioners with respect to what activities related to providing safe drinking water should be regulated.**

Since PEO regulates the profession on behalf of the public interest, consultation with affected stakeholders, including the public, users of engineering services, the broad regulatory community, and licensed engineers will also help clarify the role of professional engineers in the provision of safe drinking water. The outcome of the consultations would be identification of which attributes are most valued by stakeholders for professional engineers and for others accountable for public drinking water systems. Another outcome would be the identification of what activities should be regulated using the *Professional Engineers Act*. PEO would then work toward ensuring that these attributes are achieved. To aid in ensuring stakeholder needs can and will

[32] Stakeholders include regulatory bodies, users of engineering services and the public.

be met, PEO will develop an accurate profile of its membership, including what they do, how they maintain currency, and how they upgrade/augment their skills.

During the 2001-2002 Council term, PEO will undertake a communications program on the *Professional Engineers Act*, especially as it pertains to the responsibility of professional engineers to protect life, health, property and the public welfare.

The responsibilities of engineers are defined in the *Professional Engineers Act*, but are not always clearly understood. Efforts will be targeted to specific audiences: the broad regulatory community, the public, the users of engineering services, and licensed engineers. PEO intends to ensure that all water systems owners and operators and the regulatory community, including the provincial government and individual municipalities, understand the powers of the *Professional Engineers Act*, the powers of the PEO Registrar and PEO's admissions, complaint, discipline, and enforcement processes.

The proposed communication and education efforts will be open to and encourage two-way communication so PEO can determine and be responsive to the needs and expectations of the public it serves and protects, the users of engineering services, the broad regulatory community, and licensed engineers.

4.3 Partner with Regulatory and Non-Governmental Organizations

PEO will work with the provincial government and non-governmental organizations to develop and recommend defined scopes of practice and responsibilities for professional engineers involved with the provision of safe drinking water.

Using its authority under the *Professional Engineers Act*, PEO is prepared to work with the Ministry of the Environment toward amending existing regulations to reflect the regulated scopes of practice and responsibilities for professional engineers. Further, PEO will actively seek opportunities to participate in the development of broader regulations, by-laws, policies, and guidelines affecting drinking water, such as on protection of groundwater resources, which feed the majority of public water systems in Ontario.[33]

PEO's commitment to raise public awareness of the existing professional responsibilities of licensed professional engineers is reinforced by the need to pursue PEO's cooperative efforts with other agencies, particularly the provincial government. The fruits of this cooperation, which has been in place for a number of years, have included the requirement for professional engineers to take responsibility for reporting on waterworks as part of the Drinking Water Protection Regulation. PEO will continue to advise the MOE, with the aim of clarifying the role engineers play in safeguarding the environment. PEO is currently working with the MOE and the Association of Professional Geoscientists of Ontario to develop qualifications for professionals responsible for contaminated site assessment and remediation work.

In addition to the provincial government, PEO has opportunities to partner with other regulatory and non-governmental agencies with interests in drinking water. These include the Municipal Engineers Association, the Ontario Water Works Association, the Association of Municipalities of Ontario, the Canadian Water and Wastewater Association, the Association of Professional Geoscientists of Ontario, the Ontario Association of Certified Engineering Technicians and Technologists, the Ontario Municipal Water Association, the Water Environment Association of Ontario, Conservation Authorities and other professional (and para-professional) groups.

PEO is continually available to advise the government on its role in regulating the practice of engineering and on the availability of engineering expertise with respect to source water protection, water treatment and supply. The ability of PEO to respond to public concerns about safety has been successfully demonstrated in the past, when the provincial government requested PEO to facilitate a review of the design of Highway 407 prior to its opening[34].

33 Ontario Ministry of the Environment 2000 database.

34 In 1997, at the request of the Ontario government, the PEO Highway 407 safety review committee was mandated to carry out a review of the planned Highway 407 from a safety perspective. The committee's report is available under Briefs and Reports on the PEO website: www.peo.on.ca.

4.4 Promote Continuing Excellence

PEO will incorporate feedback from its outreach activities and membership profiling, users of engineering services, the broader regulatory community, and licensed practitioners into its Professional Excellence Program (PEP).

PEO will be able to better identify the needs and expectations of the public and the regulatory community. This is in accordance with PEO's Principal Object under the *Professional Engineers Act* that PEO "regulate the practice of professional engineering … in order that the public interest may be served and protected".

Professional engineers have a regulatory requirement and an ethical obligation not to practise engineering in areas beyond their training and expertise. Combined with the disciplinary process, this provides the fundamentals of a system of continued competence.

Currently, the onus is on individual practitioners to demonstrate competence prior to licensure and to maintain competence or face disciplinary action. For example, undertaking work that an engineer is not qualified to perform by virtue of the engineer's training or experience is professional misconduct under the *Professional Engineers Act*.

Through its Professional Excellence Program, PEO can examine and consider alternative approaches that will increase the level of assurance that a practitioner's expertise remains current. This may lead to consideration of additional training and educational requirements in specific areas of practice or possibly a specialist designation with requirements above and beyond those required for licensure.

4.5 Provide Guidance and Advice to Practising Engineers

PEO will produce Professional Practice Guidelines relevant to the provision of safe drinking water, such as guidelines on design approaches and quality assurance methods.

As part of its responsibilities to regulate the practice of professional engineering, PEO already develops Professional Practice Guidelines. These documents are prepared by PEO to assist professional engineers (as well as the public and users of engineering services) in fulfilling their legal and ethical obligations under the *Professional Engineers Act* when engaging in specific areas of practice. They are written to be relevant to the public and municipalities as well as engineering practitioners involved in water conservation initiatives.

PEO has successfully worked with regulatory agencies on the development of proposals affecting the professional responsibilities of engineers and the delivery of engineering services. The PEO Environment Committee comprises experienced practitioners working in the broad range of engineering disciplines whose primary area of expertise relates to environmental matters, including water treatment and supply.

5 RECOMMENDATIONS TO THE INQUIRY

The prime purpose of the Walkerton Inquiry is to make findings and recommendations that will lead to the long-term sustainability and safety of the water supply system in Ontario[35].

Safety and protecting public health are the primary goals in the provision of drinking water. Professional engineers are well positioned to play a leadership role and provide greater accountability in the provision of safe drinking water for Ontario because their licence requirements specify academic qualifications, professional experience, and a commitment to a Code of Ethics. As a result of their obligations to protect the public, professional engineers can play a major role in ensuring safety in the production and distribution of drinking water.

PEO makes the following recommendations so that the Province of Ontario can more fully utilize the accountability that engineers have, in practice and in legislation, for protecting the public in the provision of safe drinking water.

5.1 Refine the Definition of Engineering in Regard to Safe Drinking Water

The provincial government and affected stakeholders should work with PEO to define specific activities and areas of practice that constitute the practice of professional engineering within the meaning and spirit of the *Professional Engineers Act.* This should include considering whether current activities and regulations are consistent with PEO's statutory mandate, specifically with respect to the evaluation of water supplies and the design of treatment and distribution systems.

The *Professional Engineers Act* defines the "practice of professional engineering" as:
"any act of designing, composing, evaluating, advising, reporting, directing or supervising wherein the safeguarding of life, health, property or the public welfare is concerned and that requires the application of engineering principles, but does not include practising as a natural scientist".

In determining whether an activity constitutes the practice of professional engineering, PEO assesses whether it:

- is any one of designing, composing, evaluating, advising, reporting, directing or supervising; and
- concerns the safeguarding of life, health, property or the public welfare; and
- requires the application of engineering principles, as distinct from being natural science.

If an activity meets all three criteria, it is considered to fall within the practice of professional engineering.

The design of water and wastewater treatment facilities and systems is generally accepted, both in theory and in practice, to be the practice of professional engineering and thus to require the involvement of professional engineers. However, the need for the involvement of professional engineers is less clear in other activities related to providing safe drinking water. This is apparent in three key areas, namely:

- management and operation of facilities and systems, especially in the municipal sector;
- policy setting and regulatory oversight; and
- supervision of construction of engineered works, particularly from a quality control perspective.

[35] Canada News Wire (2001).

5.2 Increase Professional Engineers Participation in Waterworks Operations and Management

PEO recommends that participation of professional engineers in the operation and management of water treatment works be defined and identified in order to provide greater accountability, based on engineers' duty to the public welfare.

The Inquiry should recommend the provincial government identify appropriate situations or circumstances where professional engineers should be required to supervise and be responsible and accountable for the management and operations of engineered infrastructure, including water works and water systems.

According to O.R. 435/93, the owner of a waterworks must ensure that the overall operation of the facility is placed with an operator who holds a licence issued by the Ontario Ministry of the Environment. Despite the fact that water works and water systems are engineered infrastructure, there is no requirement for a professional engineer to have any involvement in the operation and management of the water works (other than the review required by O.R. 459).

In the recent past, engineers have not only provided design and construction services, but also have been very involved in operation and management of systems and facilities. Over the past 20 years, there has been a trend to declining involvement of professional engineers in all municipal infrastructure operation and management. This is despite the fact that treatment processes have become more complex technically and monitoring has become more critical in order to maintain the highest standards of operation.

5.3 Specify Roles of Engineers through Demand-side Legislation

To ensure a higher level of accountability in the quality of Ontario's drinking water, the provincial government should use regulations to clearly define roles and responsibilities for professional engineers in aspects of drinking water supply, including design and construction, operation and water resource management. Such demand-side legislation should reflect the outcome of Recommendations number 1 and 2.

There are currently numerous references to professional engineers in provincial legislation related to water supply and treatment; however, many references do not make mandatory the need for engineers to be involved. For example, the *Ontario Water Resources Act* makes reference to, and recognizes, the role of the engineer in the design of public water supply systems, but does not make it mandatory.

For new water works, it is common practice for the Director to require plans, specifications and an engineer's report. However, this is not a legislated requirement, and it is conceivable that engineering advice may not be requested, particularly for smaller systems, such as those that rely on groundwater, which make up the majority of public water supply systems in Ontario. Similarly, under the *Municipal Act*, a municipality is required to name a "municipal engineer", but there are no requirements for that individual to perform any functions within the water and sewage field.

The definition of the practice of engineering is very broad in existing legislation. PEO would be able to more effectively regulate the profession, if the *Professional Engineers Act* were supported by demand-side legislation. Effective uses of demand-side legislation related to water quality used by the Ministry of the Environment are illustrated by the regulatory requirements under the Environmental Protection Act for professional engineers to be responsible for flow measurement of industrial effluent discharges and the new drinking water protection regulation 459.

At present, professional engineers clearly have a mandate in the design of water supply, treatment and distribution systems. As suggested under Recommendation No. 1, the mandate needs to be clarified for construction and operational elements that may draw on engineers for technical support. PEO believes that should the government wish to make greater use of the engineering profession in these areas, a clear mandate provided through demand-side legislation is the most definitive route to achieve this goal. If it is defined by a Scope of Practice as being within the definition of engineering, demand-side legislation would provide a clear mandate for engineering involvement and assist PEO in fulfilling its regulatory mandate.

5.4 Strengthen Provincial Regulation of Water Systems

The Minister of the Environment should use section 5 under the Ontario Water Resources Act (OWRA) to appoint qualified professional engineers as directors for the purposes of issuing director's orders, director's reports, certificates of approval and other instruments prescribed under the OWRA.

The powers being exercised by directors under the OWRA involve scientific and technological knowledge necessary to review and understand engineering documents. Also, the orders and reports issued by directors frequently involve engineering decisions and directing engineering work.

Directors should support municipal engineers and/or their engineering consultants that exercise their duty to report risks to public health and safety related to drinking water using section 62 of the OWRA.

There is provision under section 62 of the Ontario Water Resources Act concerning implementation of the Director's Report to a municipality as follows:

> 62. (1) Where a Director reports in writing to the clerk of a municipality that he or she is of the opinion that it is necessary in the public interest that water works or sewage works or any part thereof be established, maintained, operated, improved, extended, enlarged, altered, repaired or replaced, it is not necessary to obtain the assent of the electors to any by-law for incurring a debt for any such purpose and the municipality shall forthwith do every act and thing in its power to implement the report of the Director. R.S.O. 1990, c. O.40, s. 62 (1).
>
> (2) If the municipality fails to do everything in its power to implement the report forthwith after receiving it, and the time for taking an appeal has passed or there has been a final disposition of an appeal confirming or altering the report, the Director, with the approval of the Board, may direct that whatever is necessary to implement the report or the report as confirmed or altered be done at the expense of the municipality, and may arrange for the Agency to do it.

Such actions by the directors complements and reinforces a professional engineer's accountability and duty to the public. It would effectively restore the authority of what was once called the provincial sanitary engineer who, under the authority of the provincial board of health, was able to take appropriate steps to rectify identified deficiencies in the public infrastructure before health-related hazardous situations occurred. This included ordering measures, such as the commissioning of water treatment or sewage facilities. Mandatory Orders were also issued to institute chlorination to prevent outbreaks of such diseases as typhoid. If a Municipal Council was reluctant, delaying or refusing to institute chlorination, the provincial Board of Health could issue a Mandatory Order[36].

PEO suggests the issuance of a Director's Report to a municipality under section 62 of the OWRA can constitute the practice of professional engineering for the following reasons:

- the act of issuing the report "directs" a municipality to undertake certain works;
- the establishment, modification, etc. of waterworks usually includes the application of engineering principles, as mandated by the submission of engineers' reports for all water works under O. Reg. 459/00; and
- these works safeguard life and health and benefit the public welfare.

PEO suggests that since issuance of such Director's Reports likely constitutes the practice of professional engineering, Directors appointed under section 5 of the OWRA should be licensed by Professional Engineers Ontario.

The directors under the OWRA are separate and discrete from the position of "regional director" within the Ministry of the Environment hierarchy. Administratively, it would be beneficial for the Ministry to clearly delineate between the responsibilities of directors under Section 5 (issuing approvals and orders) and regional directors (management and administration).

[36] Source: An interview with Dr. Albert E. Berry, Public Works Historical Society, 1988.

5.5 Clarify and Enhance Duty to Report

The Attorney General should amend *The Professional Engineers Act* to clarify engineers' obligations to report and provide a measure of protection for those who exercise them.

PEO believes that for this concept to be effective, the engineer must be indemnified and protected from reprisal as a result of public notification of such conditions. In this way, the engineer would be provided with protection similar to that clearly defined in the *Occupational Health and Safety Act,* under which an individual has the right to refuse work without fear of reprisal by the employer.

Currently, no Ontario legislation offers protection to "whistleblowers". This includes the *Professional Engineers Act* that, despite the regulation requirement to report, offers no protection to Professional Engineers who exercise their duty to report engineering-related situations that may endanger the public. PEO is committed to increasing awareness about the duty of an engineer to report situations that are found to be unsafe and/or are not in the interests of the public welfare in matters relating to the environment.

Professional engineers have regulatory and ethical obligations both to their clients and to the public. Sometimes these obligations may be in conflict. Consider the situation in which an engineer finds unsafe practices at a workplace that is a water treatment plant. According to the Code of Ethics, engineers are obliged not to disclose clients' or employers' confidential information and must avoid the use of such information to clients' or employers' disadvantage. At the same time, PEO's definition of professional misconduct provides that failure to report a situation that an engineer believes may endanger the safety or welfare of the public constitutes professional misconduct on the part of the engineer.

In such situations, professional engineers are expected to "regard the practitioner's duty to public welfare as paramount". This is the overriding principle that is intended to guide the actions of individual engineers. In certain situations, such as that alluded to above, the individual practitioner may need guidance and support. To that end, PEO, through its Registrar, cooperates with any engineer who reports a situation that the engineer believes may endanger the safety or welfare of the public.

GLOSSARY

Academic Requirements Committee – statutory committee under the *Professional Engineers Act, R.S.O. 1990, Chapter P.28*, with the mandate to assist PEO to determine the academic qualifications of applicants for licensure.

Canadian Council of Professional Engineers (CCPE) – confederation of provincial regulatory bodies.

Canadian Engineering Accreditation Board (CEAB) – CCPE committee that accredits Canadian engineering education programs.

Canadian Engineering Qualifications Board (CEQB) – CCPE committee that develops national guidelines on qualifications and standards of practice for engineers in Canada, e.g. national syllabus of examinations, agreements of inter-provincial and international mobility, continuing competence guideline.

Certificate of Authorization – a licence that permits PEO members or business entities, including sole proprietorships, which have met certain requirements to offer and provide professional engineering services (directly) to the public.

class environmental assessment – the environmental assessment process to be used for a particular type (class) of undertaking, such as a water treatment plant.

closed profession – an occupation for which a licence to practise is mandatory.

CODE – Council of Ontario Deans of Engineering.

Code of Ethics – a basic guide to professional conduct, enshrined in Regulation 941 of the *Professional Engineers Act, R.S.O. 1990, Chapter P.28*, that imposes duties on the practising engineer with respect to society, employers, clients, colleagues, the engineering profession and the individual.

competence – the knowledge, skills, judgement, and ability to perform a service in a professional, effective and ethical manner consistent with the individual's position and responsibilities; continuing competence implies that the ability is kept current.

Complaints Committee – statutory committee under the *Professional Engineers Act, R.S.O. 1990, Chapter P.28*, with the mandate to receive, consider and investigate complaints.

Complaints Review Councillor – PEO volunteer who reviews the handling of complaints when the complainant is dissatisfied with the outcome [e.g. the complaint has been dismissed by the Complaints Committee and does not go forward to the Discipline Committee] to ensure that the process was administered correctly.

conservation – the process or practice of preventing harm, decay or loss.

Consulting Engineer – a protected title used by licensed practitioners and firms who have met certain requirements and have been granted permission to use the term “Consulting Engineer” by PEO.

demand-side legislation – prescriptive federal and provincial acts and regulations that require specific actions to be undertaken; may make reference to professional engineers, and may require engineers to undertake specific actions, such as in the *Drinking Water Protection Regulation*.

Discipline Committee – statutory committee under the *Professional Engineers Act, R.S.O. 1990, Chapter P.28*, with the mandate to hear and determine allegations, and impose disciplinary actions, about individual and corporate professional practice.

distribution system (water) – network of underground pipes that carry drinking water produced at a water treatment plant to consumers; may include aboveground reservoirs and pumping (lift) stations.

efficiency – ratio of finished product output to raw material input.

Engineering Dimensions – official journal of Professional Engineers Ontario; published six times a year.

***Engineering-Intern-Training* Program** – provides applicants, who have satisfied PEO's academic requirements but have not yet completed the experience requirement, access to some of the benefits normally reserved for licensed engineers.

environmental assessment – a process for identifying and evaluating the possible impacts that could result from the implementation of an individual project, such as a water treatment plant; codified in the *Environmental Assessment Act*.

Escherischia coli – bacteria found in the intestines of warm-blooded animals, and which can cause gastrointestinal illness in humans; a specific strain of *E. coli* contaminated the drinking water supply at Walkerton, Ontario, in May 2000.

Experience Requirements Committee – statutory committee under the *Professional Engineers Act, R.S.O. 1990, Chapter P.28*, with the mandate to assist PEO to determine the experience qualifications of applicants for licensure.

govern – to strongly influence action and conduct of the membership in order that the public may be served and protected; to exert a determining or guiding influence over the membership.

guideline (PEO) – publications produced by Professional Engineers Ontario to (1) assist the public to understand various aspects of professional engineering practice, and/or (2) assist engineers with the discharge of duties; not legally binding.

incompetence – practitioners who lack knowledge, skill or judgement, or show disregard for the welfare of the public of a nature, or to an extent, that demonstrates they are unfit to carry out the responsibilities of a professional engineer; can also mean suffering from a physical or mental condition.

licence (full) – granted to individuals who have satisfied all the requirements for licensure set out by Professional Engineers Ontario.

limited licence – authorizes practitioners who do not hold an undergraduate degree in engineering to practise in a limited area of professional engineering where they have developed professional engineer-verified expertise and competence. This licence to practise is employer- and project-specific and of limited scope.

Link (The) – publication of Professional Engineers Ontario sent to engineers to provide details about association business; published three times a year.

misconduct (professional misconduct) – any one of a number of acts or omissions, including failure on the part of a professional engineer to: make reasonable provision for the safeguarding of life, health or property; act to correct or report a situation that may endanger the safety or the welfare of the public; make responsible provision for complying with applicable statutes, regulations, standards, codes, by-laws, and rules; sign or seal a final drawing, specification, plan, report or other document not actually prepared or checked by the practitioner; present clearly consequences of deviating from proposed work when overruled by non-technical authority; breach the Act or regulations; undertake work for which the practitioner is not competent to perform; make prompt, voluntary and complete disclosure of a real or perceived conflict of interest; act in a matter that would be regarded as disgraceful, dishonourable or unprofessional; abide by terms and conditions of licensure; permit, counsel or assist a person who is not licensed to engage in the practice of professional engineering; also includes negligence.

Mutual Recognition Agreement (MRA) – CCPE has several MRAs in place that recognize that the Canadian engineering educational system is substantially equivalent to that in the other party to the agreement.

negligence – an act or an omission in the carrying out of the work of a practitioner that constitutes a failure to maintain the standards that a reasonable and prudent practitioner would maintain in the circumstances.

Ontario Society of Professional Engineers (**OSPE) –** advocacy/member services organization for Ontario engineers.

open profession – an occupation for which a licence to practise is not required.

professional engineer (P.Eng.) – an individual who has been licensed by Professional Engineers Ontario.

PEO (APEO) – abbreviation for Professional Engineers Ontario (Legal name: Association of Professional Engineers of Ontario).

professional excellence (professional development) – These terms are closely related and refer to training or practise devoted to enhancing the professional engineer's skills, knowledge and ability to practise engineering in terms of the application of theory, management of engineering, communication or understanding the social implications of engineering. By enhancing one's talents, professional excellence is achieved.

Professional Practice Examination (PPE) – PEO admission examination on law and ethics to be taken by all applicants for licensure.

regulate – to bring under control of law or constituted authority.

safety – freedom from danger or risks.

temporary licence – PEO currently issues what may be described as two categories of temporary licences: (1) authorizes residents in a province or territory in Canada other than Ontario who have membership in an association/ordre (in Canada) to practise in Ontario; or (2) authorizes non-Canadian citizens and non-permanent residents of Ontario who have qualifications at least equal to those required for PEO membership and/or have gained wide recognition in the field of professional engineering that relates to the work to be undertaken under the temporary licence, and have at least ten years experience in that field. A temporary licence holder in the latter category may be required to collaborate with a PEO member in respect of the work undertaken unless he or she satisfies certain criteria stipulated by PEO.

tort law – legal principles that protect an individual's person, property and reputation from wrongful harm.

Walkerton Inquiry, The – independent commission set up by the provincial government to examine the contamination of the water supply in Walkerton, Ontario, and to look into the future safety of Ontario's water supply.

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APPENDIX

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A.2 Definition of Professional Engineering

In Ontario, the definition of professional engineering is codified and the title "professional engineer" is restricted, by law, to those individuals who have demonstrated that they possess the necessary qualifications and have been licensed by PEO. The definition and use of the title are set out in the *Professional Engineers Act, R.S.O, 1990, Chap. P.28*.

Section 12(3) of the Act includes specific exclusions from the requirement to be licensed to do an act that is the practice of professional engineering. Subsection 12(3)(a) grants an exception from the requirement to be licensed to individuals who design machinery and equipment, other than of a structural nature, to be used within their employer's facility to produce products. This exception is colloquially referred to as the "industrial exemption" as befits its intended application in the manufacturing industry. Although PEO's position is that drinking water and public infrastructure are not products within the meaning of 12(3)(a), and thus those designing machinery or equipment to produce them must be licensed, this position is potentially arguable, because the 12(3)(a) exception is difficult to understand, and is widely misunderstood.

Up until 1984, the *Professional Engineers Act* defined the practice of professional engineering as "the doing of one or more acts of advising on, reporting on, design of or supervising of the construction of, all public utilities, industrial works, railways, tramways, bridges, tunnels, highways, roads, canals, harbour works, lighthouses, river improvements, web docks, dry docks, floating docks, dredges, cranes, drainage works, irrigation works, waterworks, water purification plants, sewerage works, sewage disposal works, incinerators, hydraulic works, power transmission systems, steel, concrete or reinforced concrete structures, electric lighting systems, electric power plants, electric machinery, electric or electronic apparatus, electrical or electronic communication systems or equipment, mineral property, mining machinery, mining development, mining operations, gas or oil developments, smelters, refineries, metallurgical machinery, or equipment or apparatus for carrying out such operations, machinery, boilers or their auxiliaries, steam engines, hydraulic turbines, pumps, internal combustion engines or other mechanical structures, chemical or metallurgical machinery, apparatus or processes, or aircraft, and generally all other engineering works including engineering works and installations relating to airports, airfields or landing strips or relating to town and community planning."

It is noteworthy that this definition explicitly covered "advising on, reporting on, designing of or supervising of the construction of … all public utilities … river improvements … drainage works … waterworks, water purification plants, sewerage works, sewage disposal works … or equipment or apparatus for carrying out such operations…" (Section 1(I) of the *Professional Engineers Act*, RSO 1980, Chapter 394).

In addition to generalizing the definition of engineering, the amendments to the Act in 1984 focus on activities that concern life, health, property and the public welfare. However, there is no reason to assume that the amended definition was intended to further restrict or limit the practice of professional engineering. On the contrary, the amendment was premised on the need to address the concern that if an activity was not included in the previous definition, it was not the practice of engineering. By providing flexibility, it was hoped that PEO would have the authority to ensure that those applying new and emerging areas of science and technology were qualified to do so, if the application affected life, health, property or the public welfare.

The complete text of the *Professional Engineers Act* is available at www.peo.on.ca.

A.3 Code of Ethics

The Code of Ethics is a central tenet of professional engineering in Ontario, and is reproduced below; the duties imposed by the Code are indicated, as appropriate.[37]

Regulation 941, Section 77 – Code of Ethics:

2. It is the duty of a practitioner to the public, to the practitioner's employer, to the practitioner's clients, to others of the practitioner's profession, and to the practitioner to act at all times with,
   i. fairness and loyalty to the practitioner's associates, employers, clients, subordinates and employees,
   ii. fidelity to public needs,
   iii. devotion to high ideals of personal honour and professional integrity,
   iv. knowledge of developments in the area of professional engineering relevant to any services that are undertaken, and
   v. competence in the performance of any professional engineering services that are undertaken.

Duty to Society

2. A practitioner shall,
   i. regard the practitioner's **duty to public welfare** as paramount, endeavour at all times to enhance the public regard for the practitioner's profession by extending the public knowledge thereof and discouraging untrue, unfair or exaggerated statements with respect to professional engineering, not express publicly, or while the practitioner is serving as a witness before a court, commission or other tribunal, opinions on professional engineering matters that are not founded on adequate knowledge and honest conviction, endeavour to keep the practitioner's licence, temporary licence, limited licence or certificate of authorization, as the case may be, permanently displayed in the practitioner's place of business.

Duty to Employers

3. A practitioner shall act in professional engineering matters for each employer as a **faithful agent or trustee** and shall regard as confidential information obtained by the practitioner as to the business affairs, technical methods or processes of an employer and avoid or disclose a conflict of interest that might influence the practitioner's actions or judgement.

Duty to Clients

4. A practitioner must **disclose** immediately to the practitioner's client any interest, direct or indirect, that might be construed as prejudicial in any way to the professional judgement of the practitioner in rendering service to the client.

5. A practitioner who is an employee engineer and is contracting in the practitioner's own name to perform professional engineering work for other than the practitioner's employer, must provide the practitioner's client with a written statement of the nature of the practitioner's status as an employee and the attendant limitations on the practitioner's services to the client, must satisfy the practitioner that the work will **not conflict** with the practitioner's duty to the practitioner's employer, and must inform the practitioner's employer of the work.

Duty to Colleagues, including employees and subordinates

6. A practitioner must **cooperate** in working with other professionals engaged on a project.

7. A practitioner shall,
   i. act towards other practitioners with **courtesy and good faith**,
   ii. not accept an engagement to review the work of another practitioner for the same employer except with the knowledge of the other practitioner or except where the connection of the other practitioner with the work has been terminated,

[37] Andrews and Ratz (1997). Taken from *R.R.O. 1990, Reg. 941, s. 77; O. Reg. 48/92, s. 1.*

iii. not maliciously injure the reputation or business of another practitioner,
iv. not attempt to gain an advantage over other practitioners by paying or accepting a commission in securing professional engineering work, and
v. give **proper credit** for engineering work, uphold the principle of adequate compensation for engineering work, provide opportunity for professional development and advancement of the practitioner's associates and subordinates, and extend the effectiveness of the profession through the interchange of engineering information and experience.

Duty to the Engineering Profession

8. A practitioner shall maintain the **honour and integrity** of the practitioner's profession and without fear or favour expose before the proper tribunals unprofessional, dishonest or unethical conduct by any other practitioner.

The Code of Ethics is meant to protect the public from dishonest practitioners. At the same time, the high standards of professional conduct which the Code imposes on practitioners assures the public that competent engineers strive for excellence in their performance and in their dealings.

A.4 PEO's Admissions Process

To be granted a licence to practise professional engineering, individuals must:

- be a Canadian citizen, or have permanent resident status;
- be at least 18 years old;
- satisfy the academic requirements set out by PEO;
- satisfy the experience requirements set out by PEO;
- pass a professional practice examination (PPE) on engineering ethics and law; and
- be of good character.

Licensing by PEO is open to any Canadian citizen, or anyone with permanent resident status in Canada. Residency in Ontario is not a requirement.

Applications for licensure are made to PEO, to the attention of the Registrar. Two statutory committees, the Academic Requirements Committee and the Experience Requirements Committee, provide advice and assistance to the Registrar on matters relating to individuals' academic credentials and engineering experience, respectively.

To satisfy the academic requirements for licensure[38], individuals must hold an undergraduate engineering degree from a university program that is accredited by the Canadian Engineering Accreditation Board (CEAB), or possess equivalent training and/or experience.

With respect to experience, individuals must demonstrate at least 48 months of verifiable, acceptable engineering experience, of which at least 12 months must be acquired in a Canadian jurisdiction under the supervision of a licensed professional engineer, before a licence is granted. The specific requirements are contained in Regulation 941.

Applicants for an Ontario licence that have been licensed in another Canadian jurisdiction for at least five years may be exempt from submitting transcripts and from writing PEO's PPE; this is based on the assumption that in order to be granted a licence in another province, those requirements would necessarily have had to have been met.

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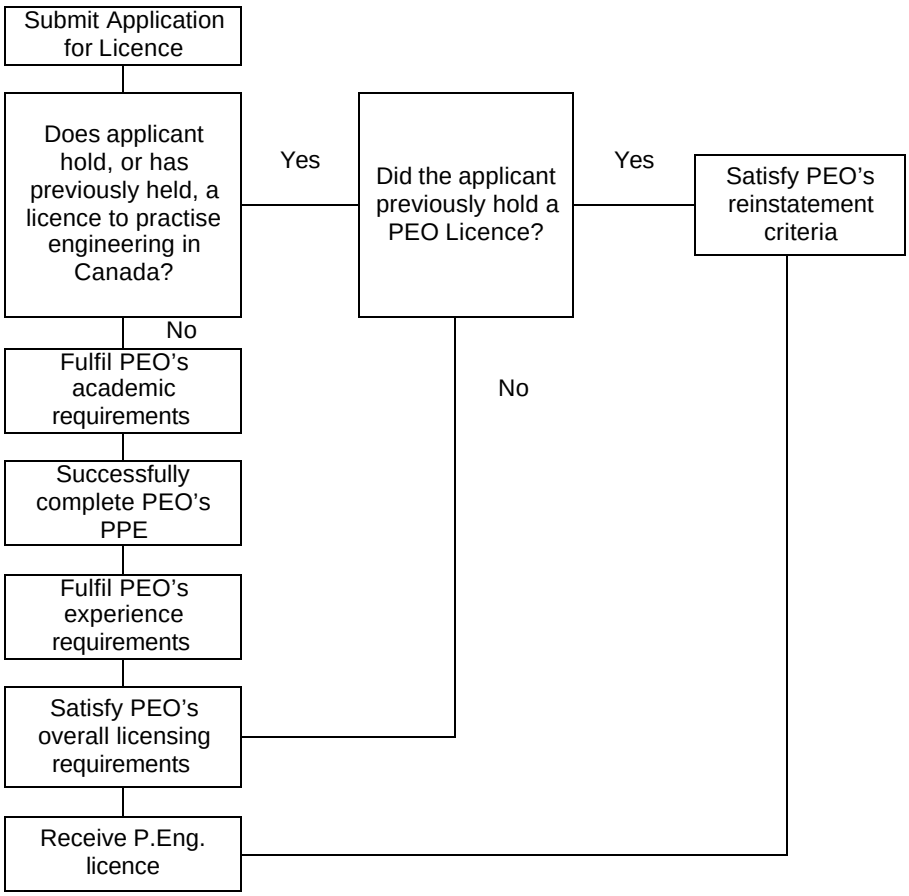
[38] In this case, licence refers to a full licence.

The flowchart below shows the process that PEO follows when evaluating applications for licensure.



Overview of PEO Admissions process.

The first step for all applicants is to submit an application for licensure to PEO, along with certified copies of academic transcripts detailing the courses taken and the marks achieved. Undergraduate engineering programs typically span four years and most engineering programs offered by Canadian universities are accredited by the Canadian Engineering Accreditation Board (CEAB). The CEAB, along with the Canadian Engineering Qualifications Board (CEQB), are the two entities that oversee the quality of undergraduate engineering education across Canada. Both the CEAB and the CEQB are under the jurisdiction of the Canadian Council of Professional Engineers (CCPE), the national organization of the provincial and territorial associations that regulate the practice of engineering in Canada and license the country's 157,000 professional engineers. CCPE serves the associations, which are its constituent and sole members, by delivering national programs that ensure the highest standards of engineering education, professional qualifications and ethical conduct.

For applicants who do not hold CEAB-accredited degrees, such as foreign-trained engineers or graduates of natural sciences or technology programs, PEO compares the applicant's academic training with the CEQB syllabus to determine whether PEO's academic requirements have been met. In undertaking the review, the PEO Registrar may rely on the Academic Requirements Committee. The two main outcomes of the review are either that the applicant's academic training is: (1) satisfactory, in which case the applicant is deemed to have satisfied the academic requirement for licensure; or (2) unsatisfactory, and the applicant must either prove academic requirements have been satisfied by completing a limited number of technical examinations to confirm that the content of the applicant's engineering studies is equivalent to the comparable CEAB-accredited engineering program, or make up deficiencies by completing an individual program of technical examinations.

Applicants whose academic training is considered by PEO to be unsatisfactory can be referred to PEO's Experience Requirements Committee. This committee evaluates the applicant's work experience to determine if there is sufficient engineering content to warrant relief from examinations.

Possible exceptions to the need for non-Canadian engineering graduates to demonstrate academic equivalency to CEAB-accredited programs are those applicants from countries with which the CCPE has signed mutual recognition agreements (MRAs). While PEO recognizes MRAs and their value in assessing applicants, PEO's policy is that the ARC is still ultimately responsible for approving the academic qualifications of applicants. Countries that have signed a MRA with CCPE are: Australia, Hong Kong, Ireland, New Zealand, South Africa, the United Kingdom and the United States.

All applicants for licensure must pass PEO's PPE. The PPE is a closed-book examination that covers ethics, professional practice, engineering law and professional liability. Successful completion of the PPE is required before a licence is granted.

As stated above, applicants for licensure are required to demonstrate 48 months of verifiable acceptable engineering experience gained following graduation, and must acquire at least 12 months of engineering experience in a Canadian jurisdiction under the supervision of a licensed professional engineer. In addition, applicants are eligible to receive credit of up to 12 months of pregraduation experience toward the 48 months of required experience, and normally receive credit for the successful completion of postgraduate engineering degree(s).

PEO examines the nature, quality, duration and currency of each applicant's experience. Individuals and firms are expected to provide experience opportunities, act as referees in the licensure process, or serve as mentors where required. Normally, engineering experience is compatible with the applicant's particular area of academic qualification. If there is incompatibility between the academic and experience qualifications (for example, a mechanical engineering graduate whose experience has been acquired working mainly in the civil engineering field), PEO may require the applicant to gain additional experience.

The suitability of an applicant's experience for licensure is assessed against five criteria that specifically define acceptable engineering experience:

- Application of Theory;
- Practical Experience;
- Management of Engineering;
- Communication Skills; and
- Social Implications of Engineering.

Application of Theory

PEO considers skilful application of theory to be the hallmark of quality engineering work. Experience must therefore include meaningful participation in at least one aspect of the following applications of theory:

- **analysis**, including scope and operating conditions, performance assessment, safety and environmental issues, technology assessment, economic assessment, reliability analysis;
- **design** and synthesis, including functionality or product specification, component selection, integration of components and sub-systems into larger systems, reliability and maintenance factors, environmental and societal implications of the product or process, quality improvements;
- **testing** methods, including devising testing methodology and techniques, verifying functional specifications, new product or technology commissioning and assessment; and
- **implementation** methods, including applying technology, engineering cost studies, optimization techniques, process flow and time studies, implementing quality control and assurance, cost/benefit analysis, safety and environmental issues and recommendations, maintenance and replacement evaluation.

Practical Experience

Practical experience provides applicants with an appreciation of the fundamental roles of function, time, cost, reliability, reparability, safety and environmental impact in their work. PEO evaluates practical experience to ensure applicants have been provided opportunities to experience and understand:

- the function of components as part of the larger system, including, for example, opportunities to experience the merits of reliability, the role of computer software, or the relationship of the end product to the equipment and to the equipment control systems;
- the limitations of practical engineering and related human systems in achieving desired goals, including, for example, limitations of treatment methods, operating and maintenance philosophies, ergonomics;
- the significance of time in the engineering process, including difficulties of work flow, scheduling, equipment wear out, corrosion rates and replacement scheduling; and
- the importance of codes, standards, regulations and laws that govern applicable engineering activities.

Management of Engineering

Engineers are also expected to be experienced managers. Engineering management includes supervising staff, managing projects, being exposed generally to an engineering business environment, and managing technology from a societal perspective. Acceptable management components involve:

- **planning**, from identifying requirements, developing concepts, evaluating alternative methods and assessing required resources, to planning for the social ramifications;
- **scheduling**, from establishing interactions and constraints, developing activity or task schedules, allocating resources, and assessing the impact of delays, to determining and assessing projects' interactions with other projects and the marketplace;
- **budgeting**, from developing conceptual and detailed budgets identifying labour, materials and overhead, to assessing risk of cost escalation, and reviewing budgets in light of change;
- **supervision**, including leadership and professional conduct, organizing human resources, motivating teams, and managing technology;
- **project control**, requiring understanding of the elements of a greater whole, coordinating phases of project work, and monitoring expenditures and schedules and taking corrective action; and
- **risk assessment**, relating to operating equipment and system performance, technological risk, product performance, and social and environmental impacts.

Communication Skills

An opportunity to develop communication skills is an important experience requirement. This applies to all areas of the work environment, including communication with supervisors, co-workers, government regulators, clients, and the general public. For an applicant's experience in this area to be acceptable, PEO examines whether the applicant has had regular opportunities to participate in:

- preparing **written work**, including day-to-day correspondence, design briefs, and participating in preparing major reports;
- making **oral reports** or presentations to co-workers, supervisors and senior management, and to clients or regulatory authorities; and
- delivering **presentations** to the general public as such opportunities arise.

Social Implications of Engineering

PEO considers the social implications of engineering to be an important aspect of engineering practice. PEO intends that experience in this area should foster an awareness of an engineer's professional responsibility

to guard against conditions dangerous or threatening to life, limb, property, or the environment, and to call such conditions to the attention of those responsible. While not every project or activity will have direct or immediate social consequences, an applicant's work experience should, nevertheless, instil an awareness of the:

- **value** or benefits of engineering works to the public;
- **safeguards** in place to protect employees and the public and mitigate adverse impacts;
- **relationship** between engineering activity and the public at large; and
- **significant** role of regulatory agencies on the practice of engineering.

The Engineering Internship Training (EIT) Program

PEO offers Engineering Internship status for those applicants who have satisfied PEO's academic requirements but have not yet completed the experience requirement. PEO's EIT program provides participants with an annual review of their work experience and provides guidance on professional practice and ethics issues.

In order to verify experience, PEO requires applicants to provide references who are familiar with their work, and can comment on their capabilities and suitability for licensure. At least two of the references must be professional engineers licensed by PEO or another provincial professional engineering association.

In addition to the academic and experience requirements, the *Professional Engineers Act* requires that, in order to be granted a licence, applicants must be of good character.

Once applicants have satisfied all admission requirements, PEO grants a licence and confers the title of professional engineer to indicate licensed status.

A.5 Complaints, Discipline and Enforcement Processes

Professional Engineers Ontario is empowered under the *Professional Engineers Act* to enforce the requirement for licensure on individuals illegally taking responsibility for professional engineering or misleading the public through misuse of the professional engineers seal or the professional engineer title. PEO can take legal action regarding individuals and business entities offering and providing professional engineering services to the public without being licensed by PEO. PEO can make recourse to the courts. PEO also prosecutes offences such as improper advertising of engineering services, improper use of titles, or an engineer's professional seal[39].

Overview of PEO's discipline process.

In dealing with individual professional engineers, the Act gives PEO authority to discipline any licensed engineer who is shown to be incompetent or guilty of professional misconduct. PEO's discipline process is similar to the processes used by other Ontario self-regulated professions, in that the organization that administers licensing also selects those who will judge disciplinary matters. In both cases, the processes are intended to help maintain high professional standards in engineering work and to deal with and resolve situations in which the public's safety or welfare may be endangered.

PEO's disciplinary process follows procedures to ensure fair treatment and full disclosure. The process typically proceeds through three phases: filing of complaint and gathering of evidence; peer review of complaint; and discipline hearing

To ensure impartiality, each stage of the complaints and discipline process is handled by a different group. PEO staff assist with the first stage, where evidence is gathered. In the second stage, PEO's Complaints Committee considers whether there is sufficient evidence of the complaint to proceed. If the Complaints Committee determines there are sufficient grounds, the matter is referred to the Discipline Committee, which is responsible for holding a formal hearing. Both the Complaints and Discipline committees are made up of members of PEO's governing Council and other licensed engineers. All complaints are kept confidential by PEO staff and Complaints and Discipline Committee members. Information about the engineer's conduct becomes public knowledge only if the Discipline Committee orders that its Decision and Reasons be published at the end of a formal hearing.

PEO Council has recently approved changes to the disciplinary process, including making the hearings open to the public[40].

The disciplinary process begins when the Registrar of PEO receives a written complaint. PEO staff gathers information about the complaint for assessment by PEO's Complaints Committee. Once sufficient information is gathered about a complaint, the information is forwarded to the PEO Complaints Committee, a PEO statutory committee. Actions that the Complaints Committee can take include:

- dismissing the complaint;
- interviewing the complainant who has complained about the PEO member;
- directing that a letter of advice, warning or caution, be sent to the practitioner; or
- referring the complaint to the Discipline Committee.

The complainant and practitioner are notified of the committee's decision. Complainants who are unsatisfied with the decision of the Complaints Committee can request a review by the Complaints Review Councillor, a statutory position with responsibility for reviewing the processing of the complaint. The Complaints Review Councillor's responsibilities do not include reviewing the merits of the decision of the Complaints Committee.

Once a complaint is referred to the Discipline Committee, a formal hearing takes place. PEO is the prosecutor and the practitioner is the defendant. PEO typically appoints legal counsel to fulfil its role as prosecutor. A notice of hearing is prepared, setting out precisely the allegations as referred by the

[39] In addition to the authority given under the Professional Engineers Act, the association is empowered to proceed under the *Trademark Act* to protect the PEO seal and insignia.
[40] Task Force on Admissions, Complaints, Discipline and Enforcement (1999).

Complaints Committee. A five-person discipline panel is assembled from the members of the Discipline Committee. The hearing takes place at PEO's offices and follows court procedure, with a court reporter present.

Following the hearing, the discipline panel gives a written decision, including reasons, as to innocence or guilt, to the complainant and the practitioner.

Section 28(4) of the Act lists the range of penalties available to a discipline panel that finds a licensed engineer guilty of incompetence or professional misconduct, including suspending or revoking the engineer's licence or imposing of fines and costs. Disciplinary matters are published in PEO's *Gazette*, to provide public release of the results of hearings in the circumstances of a revocation or suspension of licence or when ordered by the discipline panel.

A.6 Professional Responsibility

There are a number of general guidelines regarding engineers' professional liability for negligence:

- If an employer incurs liability as a result of the negligence of an employee, the employer (and/or the insurer) may sue the employee for the recovery of damages;
- The failure of an engineer to sign and seal an engineering document does not affect the civil liability for negligence;
- Engineers who knowingly sign and seal engineering documents that they did not prepare, supervise or check may be found guilty of professional misconduct negligence, if the misrepresentation results in some party suffering damages; and
- It is generally not possible to contract out of liability for negligence. Clients have a right to expect competent, careful service from professional engineers providing professional services.

A.7 PEO Communications and Resource Materials

The primary method of communication between licensed professional engineers and PEO is via PEO's journal, *Engineering Dimensions*. This journal, published every two months, presents a range of topics of interest to licensed engineers, including association business, PEO committee reports, technical articles, discussions of law and ethics, and the *Gazette* (which documents disciplinary actions). Every licensed engineer receives a copy of *Engineering Dimensions* and copies of the journal are sent to public libraries, universities and other institutions. To provide engineers with additional details about association business, PEO publishes *The Link*. PEO also maintains a website at www.peo.on.ca, which can be accessed by the public, and contains the *Professional Engineers Act* and Regulation 941, electronic versions of guidelines, and news about PEO initiatives and events.

To assist engineers to understand the purpose and operation of PEO and their professional responsibilities, PEO publishes guidelines; these are listed in the table below.

PEO Professional Practice Guidelines

Acting as Contract Employees (2001)
Acting Under the Drainage Act (1988)
Acoustical Engineering Services in Land-Use Planning
Building Projects Using Manufacturer-Designed Systems & Components (1999)
Commissioning Work in Buildings (1992)
Communications Services (1993)
Engineering Services to Municipalities (1986)
Environmental Site Assessment, Remediation and Management (1996)
General Review of Construction as Required by the Ontario Building Code (1996)
Geotechnical Engineering Services (1993)
Guideline to Professional Practice (1998)
Human Rights in Professional Practice (2000)
Land Development/Redevelopment Engineering Services (1994)
Mechanical and Electrical Engineering Services in Buildings (1997)
Professional Engineer as an Expert Witness (1997)
Professional Engineer's Duty to Report
Project Management Services (1991)
Reports as Required by S.7 & S.8, Reg. 851, Ontario Occupational Health & Safety Act (1999)
Roads, Bridges and Associated Facilities (1995)
Selection of Engineering Services (1998)
Solid Waste Management (1993)
Structural Engineering Services in Buildings (1995)
Temporary Works (1993)
Transportation and Traffic Engineering (1994)
Use of Agreements Between Clients and Engineers (2000)
Use of Computer Software Tools Affecting Public Safety or Welfare (1993)

PEO has also developed guidelines to assist the general public in their dealings with engineers, including *Making a Complaint: A Public Information Guide* and *Guide to the Required Experience for Licensing a Professional Engineer in Ontario*.

PEO is involved in a number of public outreach activities, such as providing speakers to schools for the purpose of assisting with career planning, and a job advisory service. PEO is also a sponsor of, and participant in, Canada's annual Engineering Week.

A.8 Policies and Guidelines Related to Drinking Water

In addition to the various Acts and regulations governing water treatment and supply, there are a number of policies and guidelines. Engineers involved in the treatment and supply of drinking water, and sewage treatment and disposal, are obliged to follow these policy directives.

Guideline B-1: Water Management – Guidelines and Procedures of the Ministry of the Environment

This policy document sets out the overall goals and objectives that the provincial government has for maintaining water quality and quantity, and is closely tied to the "Blue Book" of Provincial Water Quality Objectives.

MOE Water Use and Sewage Production Standards

To assist with determination of capacity required for water, and sewage, treatment plants, the MOE issues water consumption guidelines. Currently, the guideline requires that water treatment plants be sized on the basis of up to 450 litres per person per day[41].

Class Environmental Assessment for Municipal Projects

The Municipal Engineers Association has prepared a document, titled *Municipal Class Environmental Assessment*, on behalf of municipalities, as a guide to fulfilling the requirements of the *Environmental Assessment Act* for municipal undertakings, including water supply and treatment. The main principles of environmental assessment are:

- consultation;
- consideration of a reasonable range of alternatives, including both functional alternatives and alternative methods;
- identification and evaluation of potential impacts of each alternative;
- traceable decision-making; and
- clear, concise documentation,[42]

and these principles are articulated throughout the guidance document. As well, the document lays out a step-by-step process, beginning with problem definition and statement of objectives, through evaluation of alternatives and identification of a preferred option, and gives detailed instructions about what is required for each step.

[41] MOE (1985).
[42] MEA (2000). p. A-2.

A.9 Federal and Provincial Legislation

While the statutory obligations of a professional engineer are set out in the Professional Engineers Act, there are a number of statutes that define specific areas of engineering practice, including:

Federal Statutes	Provincial Statutes
1. The Canada Corporations Act 2. The Canadian Health and Safety Regulations 3. The Competition Act 4. The Labour Code 5. The National Building Code Act	1. Amusement Devices Act 2. Architects Act 3. Boiler and Pressure Vessels Act 4. Business Corporations Act 5. Community Recreation Centres Act 6. Day Nurseries Act 7. Drainage Act 8. Drinking Water Protection Act 9. Elevating Devices Act 10. Energy Act 11. Environmental Protection Act 12. Environmental Assessment Act 13. Fire Marshals Act 14. Health Act 15. Homes for the Aged and Rest Homes Act 16. Labour Relations Act 17. Municipal bylaws 18. Occupational Health and Safety Act 19. Ontario Building Code Act 20. Ontario Water Resources Act 21. Operating Engineers Act 22. Petroleum Resources Act 23. Public Transportation and Highway Improvement Act 24. Vocational Rehabilitation Sources Act

A.10 Correspondence from Professional Engineers Ontario to the Ministry of the Environment