

BY STEVEN HADDOCK

PEO Council has discussed software engineering many times in the past, most recently with regard to the External Groups Task Force–Software (EGTF–S) report, which recommended a software designation for practitioners in that field. In parallel, the Enforcement Committee asked PEO staff, in consultation with committee members familiar with software engineering practice, to develop a position paper to assist in dealing with enforcement matters.

The Enforcement Committee recently approved the resulting report, the summary of which is published here:

- (a) to invite feedback on the proposed policy; and
- (b) to solicit examples of software engineering practice, both to include in the proposed software engineering scope of practice and to allow staff to review and investigate examples of work that might breach the licensure requirement provisions of the *Professional Engineers Act* (e.g. examples of software engineering that has been carried out by unlicensed people).

From an enforcement standpoint, PEO's role is to ensure that work that falls within the definition of professional engineering is done only by those legally entitled to do so, and that the use of a title containing the word engineer by any unlicensed person does not mislead anyone into believing the person is a licence holder and can practise professional engineering.

Background

PEO is aware that, increasingly, software-controlled computerized systems are replacing hardware controls and fail-safes in engineering projects. Enforcement staff and the Enforcement Committee are concerned about unlicensed people developing systems that fall within the practice of professional engineering. This position paper focuses on clarifying when software development falls within the practice of professional engineering and proposing courses of action for PEO.

When is software development professional engineering?

Under the direction of the Enforcement Committee, PEO staff recently completed a position paper to clarify when software development falls within the practice of professional engineering. PEO members and others are invited to comment on the paper's proposed definition of software engineering.

Historically, software has been developed by people with a variety of backgrounds and training. It is an unregulated discipline, although there are organizations, such as the Canadian Information Processing Society (CIPS), that have taken steps towards qualifying, registering and regulating practitioners. Most software development, for example software for business systems and video games, does not fall within the practice of professional engineering.

There are three areas in which software development interfaces with the engineering profession:

- (a) designing a product with integral software, where the design falls within the practice of professional engineering;
- (b) designing software, where the design falls within the practice of professional engineering (e.g. process control systems); and
- (c) using proprietary software to design products.

Some definitions of software engineering

To assist stakeholders in clarifying when software development falls within the practice of professional engineering to become software engineering, enforcement staff offer some definitions to consider:

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.”

The EGTF–S Briefing Report dated May 19, 2004 contained the following definitions:

“Software: the instructions executed by a computer, as opposed to the physical device on which they run (the hardware).

“System: an integrated composite that consists of one or more of the processes, hardware, software, facilities and people, that provides a capability to satisfy a stated need or objective.

“Developer: an organization that performs development activities (including requirements analysis, design, testing through acceptance) during the software life cycle process.”

The EGTF–S Final Report presented to Council in September 2006 provided two views for the colloquial use of the term “software engineering”:

- “(a) The engineering profession uses this term to mean the ‘design of products or processes which include software components’; and
- (b) The IT profession uses this term to mean the ‘design of software using discipline and rigour similar to engineering methods.’”

The EGTF–S did not define when software development falls within the prac-

tice of professional engineering, but it did address the issue on page 29 of its report:

“Engineering...is concerned about what practices are part of engineering. PEO is charged with the responsibility of ensuring that the public interest is served and protected when engineering is practised. It must therefore ensure that only P.Engs are engaged in the practice of engineering. [T]he lines of what is engineering are blurred and indeed changing and expanding over time...PEO must strive to find and track these boundaries so it is not derelict in its duties to adequately protect the public interest; or, conversely, so it does not overstep its authority and prosecute unnecessarily.”

When is software development professional engineering?

Enforcement Committee members active in the software engineering field feel the scope of practice for engineers designing software-based systems, when combined with an unacceptable risk of failing to safeguard life, health, property and the public welfare as required by the *Professional Engineers Act*, should include the following tasks:

- definition of formal requirements for software where limited by engineering considerations;
- integration of embedded software, the design of which would fall within the practice of professional engineering;
- preparation of state diagrams (description of all the potential outcomes of a device given the range of inputs possible) and outlining possible program inputs; and
- identification of program states that must never be allowed to occur during the operation of a program.

These tasks should be considered for inclusion in any future defined scope of practice and, in addition, the curricula for Canadian Engineering Accreditation Board-approved undergraduate university software engineering programs should be consulted.

Proposed working definition

The Enforcement Committee has proposed a working definition of software engineering to guide enforcement matters.

Software development becomes software engineering when:

- software is being designed for use, or is being analyzed for use or suitability for a particular application, or is being analyzed for the reason it may have failed;
- the use of the software poses a risk to life, health, property or the public welfare; and
- a design or analysis requires the application of engineering principles within the program (e.g. does engineering calculations), meets a requirement of engineering practice (e.g. a fail-safe system), or requires the application of the principles of engineering in its development.

The Enforcement Committee proposes this working definition be publicized widely, used to identify potential licensure requirement violations in the software engineering field, and enforcement proceedings be commenced in matters where professional engineering is being practised in the software field by those without a licence from PEO.

PEO's jurisdiction and past decisions

Given the definition of the practice of professional engineering in the Act, PEO appears to have jurisdiction over software projects that meet the three criteria in the Enforcement Committee's proposed working definition.

PEO Council approved the following motions relevant to the use of the title “software engineer” at its meeting on February 18-19, 1999:

- “1. PEO recognizes that a specialty exists within engineering with an emphasis on software design, and that there are currently professional engineers who practise engineering within that specialty.
- “2. PEO maintains that the use of the title ‘software engineer’ be restricted to professional engineers, for the same reasons that the use of the title ‘civil engineer’ is restricted to professional engineers.”

On December 9, 1999, Council approved the following practice statements:

“Practice Statement A: Any software component of a product or system whose

development is the practice of professional engineering...must be approved by a licensed professional engineer.

“Practice Statement B: Licensed professional engineers utilizing software in the design process for a device or structure, the design of which constitutes the practice of professional engineering...must either use software approved by a licensed professional engineer or verify that the software used produced acceptable results.”

In September 2006, Council approved the following motions, following discussion of the EGTF-S Final Report:

“That PEO develop a study of a unique designation for software specialty as part of a broader study of disciplines and specialties;

“That Council create a task force to interface with border disciplines to engineering and direct that task force to define the scope of practice for engineers designing software-based systems and prepare a definition for the scope of practice for this specialty with the potential to be used in a future revision of the *Professional Engineers Act*; and

“That Council request the Enforcement Committee to initiate actions consistent with the defined scopes of practice and all future legislation and that, as new demand-side legislation is created, the Enforcement Committee initiate actions that will give more force to the legislation.”

In January 2007, Council assigned the first two actions to a working group under the Professional Standards Committee. The expected completion date of that assignment is December 2010.

How you can help

Feedback is invited on the proposed working definition of software engineering, especially from those who are active in the field and have their own understanding of when software development falls within the practice of professional engineering. In addition, examples are sought of software engineering for the proposed scope of practice, and for investigation of possible licensure requirement violations.

Please direct comments to Steven Haddock at shaddock@peo.on.ca.

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