# TEXETHICS NEWSLETTER

COMMUNICATING ENGINEERING PROFESSIONALISM AND ETHICS IN TEXAS

VOLUME 11 NUMBER 1 SUMMER 2001

*Sponsor*

TEXAS BOARD OF PROFESSIONAL ENGINEERS

*Publisher*

MURDOUGH CENTER FOR ENGINEERING PROFESSIONALISM

COLLEGE OF ENGINEERING, TEXAS TECH UNIVERSITY, BOX 41023, LUBBOCK TEXAS 79409-1023


## CONTENTS



# Opportunities for Engineering Educators Regarding Licensure

## *Licensure is Strongly Encouraged for Engineering Faculty!*

The Texas Board of Professional Engineers (TBPE) and the Engineering Deans in Texas strongly encourage all eligible engineering faculty to seek licensure as professional engineers. The TBPE has long promoted faculty licensure as college is usually a student's first introduction to formal concepts of professionalism, including the value and prestige of a professional engineer's license; therefore the need to send a clear message. The TBPE believes the licensure process is a pledge of accountability to the public and strongly encourages licensure for those faculty who teach engineering subjects that are related to the protection of public health, safety and welfare.

This issue of "**TexethicS**" addresses many of the frequently asked questions about licensure of engineering faculty.

## *The Licensure Process Has Been Simplified for Educators!*

The TBPE has always strongly encouraged faculty to be licensed in Texas. In order to promote licensure among engineering faculty, the TBPE has simplified the licensure application process for engineering educators and allowed substitution of some tenure application documentation for portions of the standard application.
Engineering educators who meet certain specified conditions may be exempt from:

1) the normal requirement of taking and passing two national examinations, the Fundamentals of Engineering (FE) and the Principles and Practice of Engineering (PE) examinations;
2) the normal requirement of submitting a detailed Supplementary Experience Record (SER), but allowed to submit certain tenure application materials instead (the forms for the SER more closely correspond to experience the applicant would gain in the practice of engineering outside the university setting), and
3) the normal demonstration of English proficiency requirements.

***The following two pages further explain the licensure process for engineering educators and provide additional information for those wanting to become licensed in Texas.***

## Qualifications to be Eligible to Use the Educator's Application Process

The minimum qualifications to apply for licensure under the engineering educator's application process are:

1. be a full-time faculty member in a program offering an ABET-accredited degree or other Board-recognized school of engineering, and
2. hold an earned doctoral degree in engineering from a program that offers an EAC/ABET-accredited undergraduate or graduate degree, or hold an earned doctorate in engineering or related field of science or mathematics, assessed and approved by the Board, and
3. have a minimum of 6 years of acceptable engineering experience to waive examination requirements.

Engineering educators who do not wish to waive the examinations can qualify to take the examinations with 4 years of creditable engineering experience. Those educators without doctorate degrees may request waiver of the examinations with 12 or 16 years of creditable years of experience, depending on whether their undergraduate degrees are accredited or not.

## What Documentation Do I Submit With My Application?

After the minimum qualifications are met, engineering educators may submit:

(1) materials from the Engineering Dean's approved tenure application (excluding copies of papers, texts, reports, proposals, etc), or, for tenured educators, a current resume containing information normally required in a tenure application in lieu of the Supplementary Experience Record,

(2) a completed abbreviated application form available from TBPE or from their web site:

**www.tbpe.state.tx.us.**

(3) Reference statements or letters that attest to the applicant's character and abilities from five individuals, three of whom must be currently licensed professional engineers (these may be current or former supervisors, colleagues, or licensed engineers from the general public with knowledge of the applicant's character and abilities),

(4) University transcripts,

(5) Questionnaire on Texas Engineering Practice Act (ethics examination);

(6) application fee of $250, and

(7) if desired, a request asking for a waiver of the FE and/or the PE examinations (this request is on the application form).

## What Experience Counts?

The TBPE recognizes that experience gained by faculty extends beyond "teaching." Academic workloads involve higher "education" in many other forms that may be considered acceptable engineering experience in an application for an engineering license by an engineering faculty member.

***What do we mean by experience beyond teaching?*** Experience that may be judged acceptable for licensure application involves work that extends beyond teaching including scholarly activity such as publishing papers in technical and professional journals; making technical and/or professional presentations; publishing books and monographs; performing sponsored research; reporting on research conducted for sponsors; supervising research of undergraduate and graduate students, postdoctoral fellows, or other employees; providing counseling, guidance, and advice for engineering students, and performing certain other types of formal or informal functions in higher education.

## Am I Required to take the FE and PE Examinations?

If you desire, a request for a waiver of either or both the Fundamentals of Engineering (FE) and/or Principles and Practices of Engineering (PE) exams may be submitted if you:

1. hold a doctoral degree and have at least 6 years of experience as an engineering educator in an EAC/ABET-accredited program, or other acceptable, creditable engineering experience, or a combination of these, or
2. do not hold a doctorate but have an ABET-accredited engineering degree, and have 12 years of creditable engineering experience, or
3. do not hold a doctorate but have a non-accredited engineering or related science degree approved by the TBPE, and have 16 years of creditable engineering experience.

## Any Special Language Requirements?

The TBPE assumes that those engineering educators recommended for licensure are proficient in the English language since they are approved to teach at ABET-accredited institutions. Therefore, for faculty meeting the requirements to use the educator's application process, the TBPE will automatically waive any Test of English as a Foreign Language (TOEFL) and Test of Spoken English (TSE) or other proof of proficiency requirements.

## Is This Special Process the Only Path to Licensure for Engineering Educators?

***No !*** – This special process was developed to encourage engineering educators to become licensed. Educators who are interested in gaining licensure have the option to use the standard application process as specified in the Texas Engineering Practice Act and board rules.

## What About Part-time Instructors?

The TBPE recognizes that not all instructors are full-time, especially those teaching some of the newer subjects such as software or biomedical engineering. Since part-time faculty have exposure to the public beyond the classroom, the TBPE encourages them to apply under the standard application process so that adequate documentation is presented to give a complete overview of qualifications. The applicant should include a description of the courses they teach on the application.

## Who Judges Academic Qualifications?

The TBPE does not presume to judge the academic qualifications of professors and relies on the deans and department chairs of the engineering colleges to assess qualifications to teach engineering subjects. If any questions concerning qualifications of an applicant arise, the TBPE will request the assistance of the respective dean and the references to clarify the application.

## How Can I Get Additional Information and/or Advice on Licensure?

We suggest you visit the web site of the Texas Board of Professional Engineers (www.tbpe.state.tx.us) and visit the "Licensing Frequently Asked Questions" page.

You may also call the TBPE (512-440-7723) or write to or visit the TBPE at 1917 IH 35 South, Austin, TX 78741 for any information concerning licensure or the Texas Engineering Practice Act.

## Is Licensure Required for Educators?

### *When Working Outside the University?*

Engineering educators offering engineering services to the public in Texas via consulting or other arrangements are considered the same as any other engineer. That is, they are required to be "**licensed**" to practice engineering in Texas.

Furthermore, in accordance with the Texas Engineering Practice Act, faculty members (and all engineers) offering engineering services to the public are also required to be "**registered**" as a firm, either as a sole proprietor or otherwise.

### *When Working Within the University?*

Engineering colleges establish all requirements for the engineering faculty at their particular University, including whether or not the college has a requirement that their faculty be licensed.

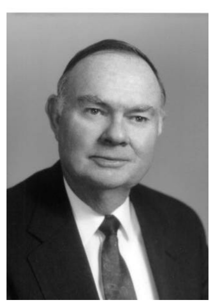
## New Legislation Regarding Licensure

Recent legislation relates to licensure of engineering faculty. Senate Bill 1797 enacted during the 77th Legislative Session provides that "persons employed by an institution of higher education or a private or independent institution of higher education … who are performing research or instructional work within the scope of their employment by the institution are exempt from the licensure requirement in the Texas Engineering Practice Act."

Amendments to this legislation indicate that "teaching" may not be construed as active practice in engineering work and applies if you begin teaching September 1, 2001 or thereafter. However, if you have taught engineering at any institution before September 1, 2001 you come under the former laws and rules regarding licensure.

## Comments from Outgoing Chairman, E. D. "Dave" Dorchester, P.E.

On September 1st I will complete my term as Board Chair. I thank the Board Members for their faithful and helpful service to the Board and its activities. Victoria Hsu began in February of 2000 as Executive Director and has brought many new and innovative ideas to the Board.



It has been a strenuous but productive year in many ways. The legislature was in session and legislative matters concerning the Board required us to testify before various committees. The most important bill that was passed was the one establishing TBPE as one of the three state agencies to become semi-independent, self-directed agencies. Now we must demonstrate the benefits of this type of operation to the legislature, the public and the profession.

Significant progress has been made in the Board's continuing involvement in helping develop national licensure of software engineers. Last Spring, I was invited to attend the annual meeting of the Alberta, Canada Professional Engineering Society to discuss licensure mobility and software engineering. A letter received from their President after the meeting said "the work of the Texas Board in a number of areas was indeed a 'breath of fresh air' in the United States licensing scene." I think it is clear the Texas Board is widely recognized as a very innovative and progressive Board. I thank our Board and Executive Director for creating this progressive atmosphere. I know the Board will continue to be nationally recognized under Jim Nichols capable leadership.

***Dave Dorchester, P.E.***

## Texas Board of Professional Engineers Elects New Officers for 2001-2002

September 1, 2001, **James R. Nichols, P.E. (**Fort Worth) will become Chairman; **Brenda Bradley Smith, P.E. (**Spring) will become Secretary, and **Robert M. Sweazy, Ph.D., P.E. (**Lubbock) will become Secretary of the Texas Board of Professional Engineers.

## Meet Two New Staff Members of the State Board

### Thomas H. "Buddy" Richter, P.E.

*Director of Licensing, Texas Board of Professional Engineers*

"Buddy" graduated from Texas A&M University in 1972 with a B.S. degree in Petroleum Engineering. He has worked with the Texas Railroad Commission Oil & Gas Division and for First National Bank of Longview, where he became Senior Vice President.

In addition to a consulting business, Buddy has worked for T.H. Richter & Associates, Inc., Federal Deposit Insurance Corporation (FDIC), and the Texas Railroad Commission in Austin. He has presented papers for the Society of Petroleum Engineers and American Institute of Mining Engineers.

He became Director of Licensing in April 2001 at the Texas Board. Buddy is married to Cathy and they have two sons, Kyle and Evan.

### David J. Lusk, P.E.

*Technical Specialist, Texas Board of Professional Engineers*

David joined the Texas Board of Professional Engineers in March of 2001 as a technical specialist. He has a B.S. degree in Agricultural Engineering from Texas A&M and an M.S. in Environmental Engineering from the University of Texas at Austin.

David has worked in the food production industry, for a design/build wastewater firm, and, most recently, for the Texas Natural Resource Conservation Commission as an air-permitting specialist.

In his current role, David works on various Board's projects, including strategic planning, rules for streamlining the licensing process, and policy statements and advisories. He also serves as a resource for the Enforcement Division.

## Canadian Council of Professional Engineers and Microsoft Corp. Agree on use of "Engineer" Title

*Ottawa, Ont., May 11, 2001* - After discussions with Canada's engineering profession, Microsoft Corp. will advise Canadian holders of its MCSE certification not to call themselves engineers or use the full title Microsoft Certified System Engineers.

Microsoft's decision should prevent Canadian holders of the MCSE certification from inadvertently breaking provincial and territorial laws, which protect the public by restricting the use of the titles "engineer" and "engineering" and the practice of engineering in Canada to licensed professional engineers.

It should also ensure that the engineering profession's licensing bodies will not be required to take enforcement action against MCSE holders who mistakenly use the title engineer or otherwise hold themselves out as having been qualified to practice engineering.

"We are very pleased by Microsoft's decision," said Marie Lemay, P.Eng., CEO of the Canadian Council of Professional Engineers (CCPE). "Microsoft has demonstrated corporate leadership by acting in the best interest of the MCSE community. Holders of the MCSE certification are not licensed or regulated by the engineering profession. If they mistakenly use the title "engineer" and "engineering" the provincial or territorial engineering associations/ordre would have to take enforcement action against them. Its decision is good for the information technology industry, good for MCSE holders, and good for the engineering profession."

The engineering profession, represented by CCPE and several provincial engineering regulatory associations, met with Microsoft in Seattle late last year to explain the legal issues surrounding the use of the title "engineer" in Canada, and to ask the corporation to stop referring to holders of the MCSE credentials as engineers.

Canadian MCSEs have received certification as Microsoft Certified Systems Engineers, which could lead them to mistakenly misuse the term "engineer."

"We are very pleased to have reached an agreement with the engineering profession and to support it," said Anne Marie McSweeney, the acting Director of Microsoft Certification and Skills Assessment.

"It opens the door for close cooperation among all organizations in the information technology industry and the engineering profession in Canada. As the Microsoft credentials continue to evolve, it is our goal to ensure they maintain the highest level of relevance to the industry and represent leaders in cutting-edge technology."

Microsoft is currently researching alternatives for the MCSE credential worldwide, which could result in a new name for the credential later this year.

* * *

CCPE is the national organization of the provincial and territorial associations/ordre that govern the practice of engineering in Canada and license the country's 157,000 professional engineers.

Established in 1936, CCPE serves the associations/ordre, which are its constituent and sole members, through the delivery of national programs which ensure the highest standards of engineering education, professional qualifications and ethical conduct.

For More Information Contact:Terence Davis, Manager, Communications, CCPE; 613-232-2474, ext. 238

# “Great Achievements and Grand Challenges”

**By Wm. A. Wulf, President of the National Academy of Engineering**

*This article is a revised version of the talk Dr. Wulf gave 22 October 2000 at the NAE Annual Meeting.*
*Reproduced in TexethicS by permission from Dr. Wulf*

***Poised as we are between the twentieth and twenty-first centuries, it seems to me that this is the perfect moment to both reflect on the accomplishments of engineers in the last century and ponder the challenges facing them in the next.***

## Great Engineering Achievements of the 20th Century

This past February, working with the engineering professional societies, the NAE selected the 20 greatest engineering achievements of the twentieth century. The main criterion for selection was *not* technical “gee whiz,” but how much an achievement improved people’s quality of life. The result is a testament to the power and promise of engineering to improve the quality of human life worldwide.

Reviewing the list, it’s clear that if *any* of its elements were removed our world would be a very different place—and a much less hospitable one. The list covers a broad spectrum of human endeavor—from the vast networks of the electric grid (no. 1) to the development of high-performance materials (no. 20). In between are advancements that have revolutionized virtually every aspect of the way people live (safe water, no. 4, and medical technologies, no. 16); the way people work (computers, no. 8, and telephones, no. 9); the way people play (radio and television, no. 6); and the way people travel (automobile, no. 2, and airplane, no. 3).

In announcing the achievements, former astronaut Neil Armstrong noted that, “Almost every part of our lives underwent profound changes during the past 100 years thanks to the effort of engineers, changes impossible to imagine a century ago. People living in the early 1900s would be amazed at the advancements wrought by engineers.” He added, “As someone who has experienced firsthand one of engineering's most incredible advancements—space exploration—I have no doubt that the next 100 years will be even more amazing.” Given the immediacy of their impact on the public, many of the achievements seem obvious choices, such as the automobile and the airplane. The impact of other achievements are less obvious, but nonetheless introduced changes of staggering proportions. The no. 4 achievement, for example, the mechanisms to supply and distribute safe and abundant water, together with sanitary sewers, literally changed the way Americans lived and died during the last century. In the early 1900s, waterborne diseases like typhoid fever and cholera killed tens of thousands of people annually, and dysentery and diarrhea, the most common waterborne diseases, were the third largest cause of death. By the 1940s, however, water treatment and distribution systems devised by engineers had almost totally eliminated these diseases in America and other developed nations. *This article appears as published in *The Bridge* (vol. 30, no. 3 & 4, Fall/Winter 2000).

Engineering is all around us, so people often take it for granted. Engineering develops consumer goods, builds the networks for highway, air, and rail travel, creates innovations like the Internet, designs artificial heart valves, builds lasers for applications from CD players to surgical tools, and brings us wonders like imaging technologies and conveniences like microwave ovens and compact discs. In short, engineers make our quality of life possible. The NAE’s full list of engineering achievements, with an expanded explanation of each item, can be found on the Web at www.greatachievements.org. The short form of the list appears below:

1. Electrification—Vast networks of electricity provide power for the developed world.
2. Automobile—Revolutionary manufacturing practices made cars more reliable and affordable, and the automobile became the world’s major mode of transportation.
3. Airplane—Flying made the world accessible, spurring globalization on a grand scale.
4. Water Supply and Distribution—Engineered systems prevent the spread of disease, increasing life expectancy.
5. Electronics—First with vacuum tubes and later with transistors, electronic circuits underlie nearly all modern technologies.
6. Radio and Television—These two devices dramatically changed the way the world receives information and entertainment.
7. Agricultural Mechanization—Numerous agricultural innovations led to a vastly larger, safer, and less costly food supply.
8. Computers—Computers are now at the heart of countless operations and systems that impact our lives.
9. Telephone—The telephone changed the way the world communicates personally and in business.
10. Air Conditioning and Refrigeration—Beyond providing convenience, these innovations extend the shelf-life of food and medicines, protect electronics, and play an important role in health care delivery.
11. Highways— 44,000 miles of U.S. highways enable personal travel and the wide distribution of goods.
12. Spacecraft—Going to outer space vastly expanded humanity’s horizons and resulted in the development of more than 60,000 new products on Earth.
13. Internet—The Internet provides a global information and communications system of unparalleled access.
14. Imaging—Numerous imaging tools and technologies have revolutionized medical diagnostics.
15. Household Appliances—These devices have eliminated many strenuous, laborious tasks, especially for women.

16. Health Technologies—From artificial implants to the mass production of antibiotics, these technologies have led to vast health improvements.
17. Petroleum and Petrochemical Technologies—These technologies provided the fuel that energized the twentieth century.
18. Laser and Fiber Optics—Their applications are wide and varied, including almost simultaneous worldwide communications, noninvasive surgery, and point-of-sale scanners.
19. Nuclear Technologies—From splitting the atom came a new source of electric power.
20. High-performance Materials—They are lighter, stronger, and more adaptable than ever before.

**Challenges for the 21 st Century**

So much for the achievements of engineering in the twentieth century; now let's look forward to the challenges of the twenty-first. I am an optimist. I believe 2100 will be "more different" from 2000 than 2000 was from 1900. I believe that the differences will bring further improvements in our quality of life, and that these improvements will be extended to many more of the people on the planet! But that is a belief, not a guarantee—and there are profound challenges twixt here and there. Some of those challenges are reflected in the NAE program initiatives: megacities, Earth systems engineering, technological literacy of the general public, and so on. Rather than talk about all of these challenges, I want to talk in depth about just one. It's a challenge that I haven't written or spoken about yet, that I believe may be the greatest challenge for the twenty-first century, that I want to start an NAE program on, and that I want to begin a dialogue with you about.

***"The challenge is engineering ethics!"***

## The challenge is *engineering ethics!*

Let me start by being clear that I believe engineers are, on the whole, very ethical. Indeed, ethics is a subject of great concern in engineering, reflecting the profession's responsibility to the public. There are ethics courses at many engineering schools. There is a bewildering array of books on the subject. Every engineering society has a code of ethics—most start with something like "… hold paramount the health and welfare of the public."[1] These codes typically go on to elaborate the engineer's responsibility to clients and employers, the engineer's responsibility to report dangerous or illegal acts, the engineer's responsibility with respect to conflicts of interest, and so on.

Beyond the codes are the daily discussions that occur in the work of engineering. I have vivid memories of discussions with my father and uncle, with my professors, and with many colleagues—about everything from design margins to dealing with management pressure to cases where tough choices had to be made.

All of that is still in place. It's part of why I am proud to be an engineer!

So—why do I want to talk about engineering ethics? Why do I believe it may be the greatest challenge of the twenty-first century? Why do I think we need to start an NAE program activity on the topic? The reason is the confluence of two intertwined issues—briefly: (1) Engineering is changing; specifically, it is changing in ways that raise new ethical issues, and (2) these new issues are, I believe, "macro-ethical" ones that are different in *kind* from those that the profession has dealt with in the past.

The literature on engineering ethics, the professional society codes, and the college ethics courses all focus on the behavior of *individual* engineers; these have been called "micro-ethical" issues. The changes I will discuss pose new questions for the *profession* more than for the individual; such issues are called "macro-ethical" ones.

In medicine the individual ethical issues are very similar to those in engineering. But, in addition, there are many macro-ethical issues. For example, the individual medical doctor cannot and should not make broad policy decisions about "allocation"—who should receive scarce organs for transplant, or doses of a limited stock of medicine, or even the doctor's attention when there are more ill than can be accommodated. The profession, or better, society *guided* by the profession, needs to set these policies.

Several things have changed to create these new macroethical questions in engineering, but I am going to focus on one—complexity. Moreover, I will focus specifically on complexity arising from the use of information technology and biotechnology in an increasing number of products. The key point is that we are increasingly building engineered systems that, because of their inherent complexity, have the potential for behaviors that are impossible to predict in advance.

Let me stress what I just said. It isn't just *hard* to predict the behavior of these systems, it isn't just a matter of taking more into account or thinking more deeply—it is *impossible* to predict all of their behaviors.

There is an extensive literature on engineering failures—the Titanic, Three Mile Island, etc. Engineering has, in fact, advanced and made safer, more reliable products because it has been willing to analyze its failures. I found two books on such failures particularly interesting: *Normal Accidents*, by Charles Perrow (1985, Basic Books [2]) and *Why Things Bite Back*, by Ed Tenner (1997, Vintage Books).

I found them interesting because of the progression in thinking in the 13 years between them about why systems fail and what engineers should do about it. For Perrow, the problem is that we don't think about multiple failures happening at once in "tightly coupled systems"—and the clear implication is that the solution is to think about them! For Tenner, there is a beginning of a glimmer that very complex systems have behaviors that are *really* hard to predict. But one still gets the feeling that if we just thought about it harder, if we just thought in the larger context in which the system is embedded, we would anticipate the problems.

Perrow and Tenner are not engineers—they are a historian and a sociologist—and they use the tools of their disciplines to analyze why failures happen. Mathematics isn't one of those tools, and so they are unlikely to have encountered the technical explanation I am about to give you. And, of course, they are partly right about the earlier failures they analyze—those systems may not yet have crossed the threshold beyond which prediction is impossible.

Over the last several decades a mathematical theory of complex systems has been developing. It's still immature compared to the highly honed mathematical tools that are the heart of modern engineering, but one thing is very solid—*a sufficiently complex system will exhibit properties that are impossible to predict a priori!*

I said the theory was "immature"—unfortunately, it also carries some undeserved baggage. The term used for these unanticipated behaviors is "emergent properties," a term that originally arose in the 1930s in "soft" sociological explanations of group behaviors. Some postmodern critics of science have also tried to use the work to discredit reductionist approaches to scientific research. Despite this baggage, there are solid results, and the impossibility (or "intractability," to use a more technical term) is one of them.

I don't want to get technical, but I need to give you a flavor of why I say "impossible." Consider the question of why software is so unreliable. There are many reasons, but one of them is not "errors" in the sense that we usually use the term. In these cases the software is doing exactly what it was designed to do; it is running "to spec." The problem is that the implications of the specified behavior were not fully understood because there are so many potential circumstances, and the software designers simply couldn't anticipate them all. Not didn't, but *couldn't*! There are simply too many to analyze!

Let me just give you an idea of the magnitude of the numbers. The number of atoms in the universe is around $10^{100}$. The number of "states" in my laptop, the configuration of 1s and 0s in its memory, is about $10^{10,000,000,000,000,000,000}$. That's just the number of states in the primary memory, and doesn't count those on the disk.

If every atom in the universe were a computer that could analyze $10^{100}$ states per second, there hasn't been enough time since the Big Bang to analyze all the states. When I say that predicting the behavior of complex systems is impossible, I don't mean that there isn't a process that, given enough time, could consider all the implications—

So, that's what has changed. We can, and do, build systems not all of whose behaviors we can predict. We do, however, know that there will be some such unpredicted behaviors—we just don't know what they will be. The question then is: How do we *ethically* engineer when we know this—when we know that systems will have behaviors, some with negative or even catastrophic consequences—but we just don't know what those behaviors will be? Note that it wouldn't be an ethical question if we didn't anticipate that systems would have these negative properties. Ethicists and the courts alike have long held that if an engineer couldn't reasonably know the consequences of his or her actions, that's okay. But here we know! So how should we behave? How should we "engineer"?

A concrete example is the programmatic theme the NAE has embarked on—Earth Systems Engineering. Clearly the ecosystem, our planet, is not fully understood, and is a very complex, interconnected system. It's a clear example of a system where "everything is connected to everything." Every action will have an effect on the whole, albeit perhaps not a large one in most cases (but we have many examples where we thought that an action wouldn't have a large negative impact, but it did). It's a system where, even if we did understand all the parts, we would not be able to predict all of its behaviors.

We … build systems not all of whose behaviors we can predict.

The question then is: How do we ***ethically*** engineer when we know this—when we know that systems will have behaviors, some with negative or even catastrophic consequences—but we just don't know what those behaviors will be?

Note that it wouldn't be an ethical question if we didn't anticipate that systems would have these negative properties. Ethicists and the courts alike have long held that if an engineer couldn't reasonably know the consequences of his or her actions, that's okay. But here we know! ***So how should we behave? How should we "engineer"?***

***William Wulf, President, National Academy of Engineering***

Moreover, we must recognize that the Earth is already a humanly engineered artifact! Whether we consider *big* engineering projects, as in the proposed restoration of the Everglades, or simply paving over a mall parking lot that happens to feed an aquifer vital to a community hundreds of miles away, we have changed the planet.

Consider the case of the Everglades—either we do something or we don't; both are conscious acts. Either way, knowing that we can't predict all of the consequences, how do we proceed ethically? How do we behave? How do we choose? Clearly these are deep issues, and issues for the whole profession, not the individual engineer. The kind of ethics embodied in our professional codes doesn't tell us what to do.

This spring, Bill Joy, cofounder and chief engineer of Sun Microsystems, raised a somewhat related, but different, issue. In what I thought was an irresponsibly alarmist article in *Wired* magazine (8.04), Joy mused that the interaction of information technology, nanotechnology, and biotechnology would lead to self-replicating systems that would "replace" human beings. He then raised the question of whether we should stop research on some or all of these technologies. I abhor the way that Joy raised the question, but I think we have to deal with the fact that something like it is at the root of the public's concerns over cloning, genetically modified organisms, etc. We are meddling with complex systems; how can the public be assured that we know all of the consequences of that meddling?

I am personally repelled, however, by the notion that there is truth that we should not know. I can embrace the notion that there are ways we should not *learn* truth, research methods we should not use—the Nazi experiments on humans, or perhaps even fetal tissue research, for example. I can embrace the notion that there are unethical, immoral, and illegal ways to *use* our knowledge. But I can't embrace the notion that there is truth, knowledge, that we should not know.

It's ironic that the first academies in the seventeenth century were created because science, this new way of knowing truth, was not accepted by the scholastic university establishment. Even more than a hundred years later, Thomas Jefferson was making a radical assertion, when, in founding the University of Virginia, the first secular university in the Americas, he said, "This institution will be based on the illimitable freedom of the human mind. For here we are not afraid to follow the truth wherever it may lead …"

That's the spirit of the pursuit of knowledge that I teethed on. Yet here I am in the Academy asking whether there is truth we should not know.

Alas, I also have to admit that the history of the *misuse* of knowledge is not encouraging. I do not know the answer to Joy's question, but it is also a macroethical one; it is not an issue for each of us individually. You might reasonably ask why we engineers need to ponder this as *our* ethical question? It's because science is about discovering knowledge; engineering is about *using* knowledge to solve human problems. So, while I can't bring myself to agree with the implied answer in Bill Joy's question, I do believe it raises a deep question for engineers about the use of knowledge.

How should we behave to ensure proper use of knowledge? Again, it's a question for the profession, not the individual. While an individual engineer perhaps should object to improper use of knowledge, such an act by itself will not prevent misuse. We need a guideline.

**Conclusion**

I could give other examples of new macroethical issues that engineering must face, but let me just summarize.

Engineering — no *engineer*s — have made tremendous contributions to the quality of life of citizens of the developed world. There have been missteps, and there is much to be done even to bring the benefit of today's technology to the rest of the world. But I am unabashedly optimistic about the prospects for further increasing our quality of life in the twenty-first century and for spreading that quality of life around the globe.

However, that is not guaranteed. There are significant challenges, and, in fact, those challenges are not a bad operational definition of what the NAE program should be. One of these challenges, and perhaps the greatest one, is a class of macroethical questions that engineers must face. There are many such issues, but I chose two to illustrate the point.

Projects such as the further modification of the Everglades will be done with imperfect knowledge of all of the consequences. They *should* be done with the certainty that some of the consequences will be negative—perhaps even disastrous. At the same time we do not have the luxury of "opting out." Not to act is also an action—so we must address the question of what constitutes ethical behavior under such circumstances. Does the current nature of the engineering process support, or even allow, such behavior?

A separate but related question is how we ethically use the increasing knowledge we have of the natural world, and the power that knowledge gives us to modify nature—which I think is the substantive question raised by Bill Joy's article.

Both of these are questions on which society must give us guidance—our professional codes do not address them. But we must raise the issue and provide society with the information to help it decide, and we had better do it soon!

I happened on a quote from John Ladd, emeritus professor of philosophy at Brown, that captures part of the point I have tried to raise. He said, "Perhaps the most mischievous side effect of [ethical] codes is that they tend to divert attention from the macro-ethical problems of a profession to its micro-ethical ones." Our ethical codes are *very* important, but now we have another set of issues to address. Let's not let our pride in one divert us from thinking hard about the other.

**Notes**

1. This particular wording is from the National Society of Professional Engineers code, but many others are derived from it and use similar language.

2. Charles Perrow released an updated edition of *Normal Accidents* in 1999 (Princeton University Press)

# Union Forged Between NIEE and Texas Tech University

The Board of Directors of the **National Institute for Engineering Ethics (NIEE)** voted on July 20, 2001 to accept the proposal from **Texas Tech University** to provide a permanent home and assume financial, administrative, management and leadership responsibilities of the Institute; the Board also approved the development of a Memorandum of Understanding to be approved by the NIEE Board and Texas Tech University and signed by the Presidents of NIEE and Texas Tech. The following are excerpts from the Memorandum of Understanding:

**Name**: The name of the Institute shall remain the National Institute for Engineering Ethics (also known as the Institute).

**Creator and Commitment:** The National Society of Professional Engineers (NSPE) shall be forever recognized as the original creator of the Institute. Engineering Ethics is an important part of NSPE's mission and its leadership is supportive of the NIEE - Texas Tech University relationship. NIEE is committed to maintaining a close professional relationship with NSPE.

**Status within the University**: NIEE shall be an official part of Texas Tech University and will be included as an important component of the College of Engineering's strategic plans.

**Mission**: The mission* and purpose of the Institute shall remain unchanged. In all its endeavors, NIEE shall work toward the best interest of practicing engineers, engineering students, and the engineering profession as a whole.

The Mission of the Institute shall be to provide opportunities for education in the field of engineering ethics and to promote the understanding and application of ethical processes within the engineering profession and with the public. In implementing this mission, the Institute will:

*Provide a recognized forum for technical & professional societies, corporations, firms and individuals to exchange educational and other information on ethics activities; Serve as a coordinator for ethics conferences, workshops, etc; Serve as the coordinator of joint and/or special projects in connection with education and understanding of ethical issues in which several of the participating societies and organizations determine to develop together; Serve as a resource for educational and other materials on ethics and various databases for those societies and employers of engineers requesting such assistance; and Provide a forum for participation in international ethics issues and activities.*

**Texas Tech's Initial Commitment**: The University commits $45,000/year for five years for a total of $225,000 toward the operation of the Institute to assure the success of this transition.

**Endowment Effort**: To help ensure that the Institute will exist and flourish forever, providing valuable services to the engineering profession, both in education and industry, the College of Engineering will make a concerted effort to establish a permanently endowed fund of approximately $2 million within 5 years.

**Leadership and Administration**: The initial leadership of NIEE shall consist of a Director and a Deputy Director, both of whom will be university employees reporting administratively on NIEE matters to the Dean of Engineering. The Director of NIEE shall be responsible for the successful operation of NIEE.

**Advisory Board**: For guidance, promotion, and/or support of programs and projects, the Engineering Dean and Institute Director will appoint an Advisory Board. The initial Board will consist of current members of the NIEE Board of Directors who are willing to serve. Subsequent appointees will continue to include representatives from technical and/or professional societies, engineering firms, corporations, universities and/or individuals desiring to be actively involved in guiding the future of NIEE. As the original founder of NIEE, NSPE will always have a representative on the NIEE Advisory Board.

The Advisory Board will not only provide guidance to the Institute, it will also be involved in critical activities such as providing liaison, communication, and coordination between the Board member's respective organization, society, or company affiliations and NIEE, and identifying and promoting methods of actively leveraging information and resources from organizations, including engineering societies, engineering firms, corporations, universities and/or individuals in order to provide a greater benefit to the profession than either the

## NIEE Invites Joint Ventures in Engineering Ethics

***"…individuals or groups … including universities, engineering societies, engineering firms, and corporations who desire to enter into joint ventures and/or team efforts with NIEE are strongly encouraged to do so."***

*A recent example is a proposal by NIEE to the National Science Foundation for funding a new ethics video, a sequel to Gilbane Gold. This project is a joint effort of five engineers and two philosophers: Jimmy Smith, Bill Lawson, and Fred Suppe (Texas Tech), Steve Nichols (The University of Texas at Austin), Michael Loui (The University of Illinois at Urbana/Champaign), Phil Ulmer, NIEE Immediate Past President, and Vivian Weil (Illinois Institute of Technology).*

organization or NIEE could do alone.

**Anticipated Type of Institute:** A "Program" oriented Institute rather than the current "Membership" oriented organization is envisioned for NIEE. However, the individual, corporate, and institutional categories are expected to be maintained to recognize those who financially support Institute activities and/or who want to actively promote engineering ethics utilizing the Institute's name and resources. Former categories of membership will be known as "*NIEE Advocates*" or similar descriptive name.

**Involvement of Others in NIEE**: The Institute's programs and projects shall not be conducted only by NIEE staff or TTU employees; other individuals or groups not directly associated with Texas Tech, including universities, engineering societies, engineering firms, corporations and individuals who desire to enter into joint ventures and/or team efforts with NIEE will be strongly encouraged to do so. At times, engineering societies, engineering firms, corporations, universities and/or individuals may take the lead role in joint ventures with NIEE.

**Outside Programs**: Participation by members of the Board of Advisors, Advocates and Affiliates in the Ethics Hot Line project sponsored by Case Western Reserve University, and participation in other outside ethics programs such as the Ethics Case of the Month Club at the University of Washington will continue if desired by members.

**Quality/Reputation Control**: All future efforts of the Institute, including those with Affiliates and/or Advocates, shall only be undertaken with reputable individuals and/or groups interested in developing research areas and programs that are consistent with the mission of the Institute.

**Schedule of Transition:** Texas Tech University shall assume responsibility for NIEE on September 1, 2001.

# Gonzaga University Grants Ethics Award to Jimmy H. Smith, P.E.

***Editors Note:*** *Gonzaga University, Spokane, Washington, sponsored their first Conference on Ethics and Social Responsibility in Engineering and Technology at Coeur d'Alene, Idaho on May 31-June 1, 2001. The University granted its first Engineering Ethics Award with the following information and citation.*

**Information**: The Gonzaga University Engineering Ethics Award will be made each year to an individual or business that has excelled in principle-based, ethical commitment. The recipients are singled out by the University because they share the same vision of ethics as being integral to an individual's or organization's identity. Gonzaga University expresses pride in being identified with people and organizations of like mind in the pursuit of ethics, integrity, and social responsibility in engineering and technology fields. Appreciative that their lives of integrity contribute to purposes beyond themselves, these people and organizations make a difference to other people, local organizations and society. These people of Spirit inspire and energize others with their vision and values. Gonzaga University is proud to be associated with them.

**Citation:** This evening Gonzaga University is presenting this award for the first time. In doing so, we seek to honor a man who has helped spearhead the effort to make the practice of ethics a central concern in the engineering profession not only in this country, but internationally. He is an accomplished teacher and researcher in the field of civil engineering. But throughout his career he has also demonstrated a keen awareness of the need for engineers to use their skills for the larger good of their communities and of society as a whole. Furthermore, he has always clearly recognized – his own professional life is a testament to that recognition – that the practice of ethical engineering ultimately depends on the willingness of individual engineers to commit themselves to the service of others.

Not content with being an exemplar of good ethics in his own professional practice, the man on whom we are conferring this award tonight has dedicated more than a decade of his life to encouraging the engineering profession at large to embrace its high ethical calling. This mission has taken him to all parts of the United States; more recently he has been carrying his message beyond our borders to engineers in other countries. He is a true leader in his profession. In fact, as we contacted various people across the nation to put together this conference, and asked for recommendations for the top names in engineering ethics as potential speakers, his was almost always the first one mentioned.

This evening Gonzaga University takes great pride in conferring the Engineering Ethics Award on a man whose name is practically synonymous with engineering ethics: Dr. Jimmy H. Smith.

The award is a piece of crystal designed as a symbol of life. The artists of Waterford Crystal catch both the reflective glories of the past and the steady light of those wishes which have endured for tens of centuries and which will continue to illuminate the ways forward. With this crystal we offer the five universal wishes for Happiness, Love, Health Prosperity and Peace, which lie at the heart of every eloquent life. We join the artist in his/her own words:

- **Happiness** – "May you be poor in misfortune, rich in blessings, slow to make enemies, quick to make friends. But rich or poor, quick or slow, may you know nothing but happiness wherever you go."
- **Love** – "May love be the first awareness of your life and the last. And may all that lies between be filled with discovering its many faces."
- **Health** – "To your health, then. May it be the blessing that unlocks the way to all other blessings in your life. May it be a window opening always to a world of morning and springtime and hope."
- **Prosperity** – "May you enjoy the prosperity that lies within, beyond misfortune's reach. And may its power bring to life the deepest wishes of your heart."

- **Peace** – “May peace take root in your heart and give wings to your dreams. May it begin as hope in your soul and radiate to every corner of your world.”

Jimmy, we are honored to award to you this first Gonzaga University Engineering Ethics Award.

# An Engineering Student's View of Ethics

*This is the text of a presentation made at the recent Central Region Meeting by West Virginia University engineering student, Daniel Tomley, who kindly gave us permission to reprint his remarks. It was sent to Dave Dorchester, P.E., Chair, NSPE Board of Ethical Review, from Tito Marzotto, P.E.*

***Good Morning***, distinguished members of the faculty and Professional Engineers. I have been waiting for four years to say this: I hope all of you were paying attention this morning because now we are going to have a test.

On a more serious note, I would like to personally welcome all of you to Morgantown on this wonderful Friday the 13th. I would like to talk to all of you this morning about what it means to me, as a student to become a Professional Engineer.

When I came down here from Pittsburgh a little over four years ago, I was not sure what major that I wanted to get into. I knew that I was decent in Math and Science, so I figured why not go into Engineering. Little did I realize what I was about to embark upon in the College of Engineering and Mineral Resources at West Virginia University.

It was then that the College of Engineering now became my new family for the next four years. A family that always pointed me in the right direction, when I needed to make a choice between majors or study with on the weekends. It was also this family that I could call late at night to figure out a calculation in thermo or a calculation on life. One of the most important elements that this family taught me was Ethics.

Personally, I feel the most important class that I have had at WVU is PNGE 225, Ethics. Not only did I learn how to make clear decisions, but it taught me about the Professional Engineers Creed. In which it clearly states:

"I dedicate my professional knowledge and skill to the advancement and betterment of human welfare."

The statement "betterment of human welfare" and ethics seem to go hand in hand. It was this West Virginia University family that taught me this key piece of information in all of my studies. Because they are trying to produce not just a Professional Engineer, but a Professional "Ethical" Engineer. One that the human race puts their trust in, to make their best professional judgement on each and every problem that one might come across. I always knew that it would be my family that would teach me personal and professional ethics. I just did not know that my family would grow by a couple of thousand overnight.

Now that I am in my last semester here, I feel that both of my families have prepared me equally to become a professional engineer. A professional engineer that knows that it is the extra night of calculations that might save someone's life and, I would like to think, that advances human welfare. You see, it is us, as professional engineers, that will make that big difference in tomorrow's world if we take that extra time today.

***This newsletter and previous ones, along with numerous other references relating to engineering ethics, are available in electronic form on the Murdough Center for Engineering Professionalism web site:***

---

**The following four pages of this newsletter contain ethics case studies that may be copied and shared with your students or colleagues. There are over 140 other NSPE/BER engineering ethics cases available on the National Institute for engineering Ethics web site: <u>www.niee.org</u>**

# Cases from National Society of Professional Engineers' Board of Ethical Review

## Misrepresentation/Misappropriation Of Another Engineer's Work

**National Society of Professional Engineers Board of Ethical Review *Case No. 00-1***

**Facts:**

Warren, a CEO of a small engineering corporation, teams up with another small firm in the development and delivery of highway/rail intersection database management systems for various public and private enterprises. Warren is the co-author and the program is patented/copyrighted.

Rick (who owns a private firm from State X) calls Warren and informs him that State X's Department of Transportation (XDOT) is interested in the highway/rail system and has asked Rick to evaluate the system. Rick requests and Warren agrees to visit with Rick in State X. Prior to the visit, Rick requests that Warren prepare a project proposal which Warren submits. Later, at Rick's request, Warren visits Rick's offices and demonstrates the systems. Project managers, as well as programmers, from Rick's firm are present at the meeting. Warren describes in great detail the technical aspects of the system. Following the meeting, Rick requests that Warren prepare a new proposal with a detailed breakdown of all costs. Following the passage of time, Warren receives a phone call from a subordinate of Rick advising that Rick will not need Warren's firm's services because Rick's firm now has the capability to design their own system.

**Question:**

Was it ethical for Rick to obtain Warren's technology in the manner herein described?

## Reconciling Design Drawings And Record Drawings

**National Society of Professional Engineers Board of Ethical Review *Case No. 00-2***

**Facts:**

Bernie, a licensed engineer, prepares a set of drawings for a client for the design and construction of a building. The Owner contracts with Contractor X, not an engineer, for construction, but does not retain Bernie for construction phase services. Bernie is paid in full for his work. Bernie's drawings are filed with town code officials and a building permit is issued. Contractor X builds the building, but does not follow Bernie's design, relying upon Contractor X's own experience in construction. Following construction, Contractor X, with the assistance of another engineer, Charles, prepares a set of record "as built" drawings based upon the actual construction of the building as reported by Contractor X. Because the design and the construction drawings are not reconciled, the building official refuses to issue an occupancy permit to the Owner. The Owner asks Bernie to "reconcile" the original design and the record drawings. Bernie, not wanting to perform additional studies, agrees to perform the "reconciliation."

**Questions:**

1. Was it ethical for Bernie to perform the design reconciliation?

2. Was it ethical for Charles to prepare a set of record drawings based on the construction without notifying Bernie?

## Services – Same Services For Different Clients

**National Society of Professional Engineers Board of Ethical Review *Case No. 00-3***

**Facts:**

Susan, a professional engineer, performs a traffic study for Client X as part of the client's permit application for traffic flow for the development of a store. Susan invoices Client X for a complete traffic study.

Later, Client X learns that part of the traffic study provided by Susan to Client X was earlier developed by Susan for a developer, Client Y, at a nearby location and that Susan invoiced Client Y for the complete traffic study. The second study on a new project for Client X utilized some of the same raw data as was in the report prepared for Client Y. The final conclusion of the engineering study was essentially the same in both studies.

**Question:**

Was it ethical for Susan to charge Client X for the complete traffic study?

## See what the NSPE Board of Ethical Review Said about these cases

Find a full discussion and conclusions for these and other NSPE-BER cases on the web site of the National Institute for Engineering Ethics

www.niee.org

## Confronting Former Employee For Improper Conduct

**National Society of Professional Engineers Board of Ethical Review *Case No. 00-4***

**Facts:**

Jack, a licensed engineer, owns his own small engineering firm. Tony, a licensed engineer formerly employed by Jack's firm, makes calls to Jack's employees (at home and at work) requesting that they make him copies of their company's proprietary schematics. Tony's request specifically instructs these individuals to not mention these conversations to Jack. Jack's employees alert Jack to the problem. However, Jack is concerned about Tony's activities and the potential threat these requests could have on the health of Jack's company (if their proprietary information were to fall into competitor's hands).

Jack confronts Tony at a seminar and, in front of many other engineers, architects, contractors, clients, and others, makes several accusations and angry comments to Tony. Tony denies the accusations, and both Jack and Tony exchange a series of derogatory comments. Following this exchange, Jack and Tony both leave the seminar.

**Questions:**

1. Was it ethical for Tony to contact Jack's employees?

2. Was it ethical for Jack to confront Tony in the manner described?

## Public Welfare – Bridge Structure

**National Society of Professional Engineers Board of Ethical Review *Case No. 00-5***

**Facts:**

Robert was an engineer with a local government. Robert learned about a critical situation involving a bridge 280 feet long, 30 feet above the stream. This bridge was a concrete deck on wood piles built in the 1950's by the state. It was part of the secondary roadway system given to the county many years ago.

In June 2000, Robert received a telephone call from the bridge inspector stating this bridge needed to be closed due to the large number of rotten piling. Robert had barricades and signs erected within the hour on a Friday afternoon. Residents in the area were required to take a 10-mile detour.

On the following Monday, the barricades were in the river and the "Bridge Closed" sign was in the trees by the roadway. More permanent barricades and signs were installed. The press published photos of some of the piles that did not reach the ground and the myriad of patch work over the years.

Within a few days, a detailed inspection report prepared by a consulting engineering firm, signed and sealed, indicated seven pilings required replacement. Within three weeks, Robert had obtained authorization for the bridge to be replaced. Several departments in the state and federal transportation departments needed to complete their reviews and tasks before the funds could be used.

A rally was held, and a petition with approximately 200 signatures asking that the bridge be reopened to limited traffic was presented to the County Commission. Robert explained the extent of the damages and the efforts under way to replace the bridge. The County Commission decided not to reopen the bridge.

Preliminary site investigation studies were begun. Environmental, geological, right-of-way, and other studies were also performed. A decision was made to use a design build contract to avoid a lengthy scour analysis for the pile design.

A non-engineer public works director decided to have a retired bridge inspector, who was not an engineer, examine the bridge, and a decision was made to install two crutch piles under the bridge and to open the bridge with a 5-ton limit. No follow-up inspection was undertaken.

Robert observes that traffic is flowing and the movement of the bridge is frightening. Log trucks and tankers cross it on a regular basis. School buses go around it.

**Question:**

What is Robert's ethical obligation under these circumstances?

## Expert Witness: Agreement To Refuse To Testify

**National Society of Professional Engineers Board of Ethical Review *Case No. 00-7***

**Facts:**

Company ABC is involved in the manufacturing of consumer products including certain industrial tools. Claire, a licensed mechanical engineer, has performed research and has experience in the design and manufacture of these specialized industrial tools. Claire is now an engineering faculty member at a private university. Claire also has an independent consulting engineering practice. Company ABC contacts Claire and requests that Claire agree to a consulting contract whose sole purpose is to prevent her from speaking out in public or testifying in any future litigation involving industrial tools manufactured by Company ABC.

**Question:**

Would it be ethical for Claire to agree to a consulting contract (with Company ABC) for the sole purpose of preventing Claire from speaking out in public or testifying in any future litigation involving industrial tools manufactured by Company ABC?

## Modification Of Code Report Relating To Nuclear Facility Chiller Design

**National Society of Professional Engineers Board of Ethical Review** ***Case No. 00-8***

**Facts:**

John is a mechanical engineer in Company XYZ and responsible for the design of liquid chillers to be used in a nuclear power plant operated by the Customer. The pressure vessels used are manufactured in accordance with mechanical engineering standards. John's responsibilities include specifying the design parameters to manufacturers.

A utilities quality assurance program specifies that for their records, a pressure vessel code report stamped and signed by a professional engineer must accompany each vessel.

John received an initial code report from Manufacturer B entitled "Revision 0" for submission to Customer C for review. This code report contained numerous errors and was not stamped or generated by a professional engineer. John returned it to Manufacturer B, authorizing the manufacturer to "Proceed with manufacture with exceptions noted." John's engineering superiors support John's actions in requiring Manufacturer B to fix the errors and to hire a consulting professional engineer to review and rewrite the report as necessary.

Thereafter, Manufacturer B submits Revision 1 of the code report to Company XYZ for submission to Customer C, but the report is returned to Manufacturer B because the text on the drawing contained in the code report was not entirely legible. The drawing insert of the code report is clearly titled with the code report number.

The vice president of Company XYZ requests that John replace the text on the drawing with more legible text and resubmit the code report to Customer C. John responded that this would not be proper. Following a contentious discussion, John called the director of engineering and left a voicemail message that he needed to discuss with him the fact that he was being asked to do an improper act. Thereafter, John was called into the vice president's office. After a contentious discussion, the vice president acknowledged that "it was technically improper to substitute text." He also explained that this was "only text on a drawing so that a department secretary would do it" if John continued to refuse to prepare text on the drawing. The vice president indicates that he does "not want to put Manufacturer B through the exercise of rewriting another code report requiring a minor correction."

**Question:**

Would it be ethical for John to make the text in the code report legible and resubmit the code report to Customer C?

# Employment – Offer Of Employment By Vendor

**National Society of Professional Engineers Board of Ethical Review *Case No. 00-9***

**Facts:**

Upon graduation from an ABET/EAC-accredited civil engineering program, Stewart is employed by U&I Construction Co., which is owned and operated by David and Tom, both licensed professional engineers. Stewart is soon delegated the responsibility of preparing bills of materials for designs to be constructed, with appropriate allowance for waste, and negotiating the material procurement with suppliers. Stewart negotiates quantity, schedule, specifications, and price, then submits a recommendation to his highly experienced, non-degreed supervisor to arrange for appropriate company approval authority for the procurement contract if the financial commitment to a supplier on a project exceeds $250. After two years, Stewart expresses concern to his supervisor that his job seems repetitive and lacks the variety of experiences and challenges that draw on the breadth of his education. Stewart is informed that he is providing an essential service to the company with exceptional proficiency, for which he seems very well paid, and that he will be considered for opportunities should they become available -- if a replacement to cover his current activities can be found. Stewart's financial authority is increased to $500 for any one supplier of the project.

Another year passes and Stewart is still performing the same level of assignments. Stewart wants to remain in the locality, but there are limited alternative employment opportunities in engineering available. Stewart has developed a highly respected reputation for knowledge, fairness, and integrity among the suppliers of U&I Construction Co. Margaret, an employee of ACE Supplies, a frequent supplier to U&I, has developed a familiarity with Stewart. When ACE has an opening for a civil engineer, Margaret lets Stewart know about it. Stewart interviews for the position and after an evaluation period, Stewart learns that he will receive an offer of employment with ACE.

The offer letter states that ACE is "looking forward to having Stewart on its team commencing on a mutually agreed upon date…that Stewart is not an employee of ACE until Stewart physically reports to work at ACE's facilities, executes patent and proprietary information agreements at that time, and that the employer's physician confirms that Stewart has no pre-existing health condition that would prevent Stewart from performing the requirements of the position." In a subsequent discussion with Stewart, Margaret mentions to Stewart that the position was one that the ACE Vice President of Engineering has the prerogative of filling, but on occasion the ACE CEO has eliminated the position opening even with outstanding offers pending until business conditions improved or when a major customer had expressed displeasure with the hiring of one of its employees.

Stewart submits his resignation with a customary two weeks notice to U&I. Stewart's supervisor, Joe (also an engineer), is disturbed by the resignation and expresses a desire that Stewart stay with U&I, saying that if he could prevent Stewart's leaving he would. Stewart insists that his decision is firm. Stewart is not asked and does not believe it is in his interests to mention that he will be employed by ACE. Joe requests that Stewart should bring all of his work assignments to a point of completion that will facilitate his making an orderly transfer to other U&I employees and to conclude as many assignments as possible before departing. For the next two weeks before leaving U&I, Stewart continues to negotiate and prepare recommendations on bids including those that had been submitted by ACE.

**Questions:**

Question 1: Was it ethical for Stewart not to volunteer to U&I the information that he would be employed by ACE within two weeks?

Question 2: Was it ethical for Margaret to entice Stewart to consider employment with ACE?

Question 3: Was it ethical for Stewart to interview with a supplier of U&I without first advising U&I of his intent?

Question 4: Was it ethical for the ACE Vice President of Engineering to offer employment to Stewart without first divulging the risk that the offer might be withdrawn by the ACE CEO?

Question 5: Would it have been ethical for U&I to have interfered in Stewart's employment change had U&I become aware of the identity of the future employer and ACE's susceptibility to pressure from U&I?

Question 6: Would it have been ethical for ACE to have withheld an offer to Stewart if ACE had become aware of U&I's displeasure?

Question 7: Was ACE's policy of withdrawing employment offers after they are made ethical?

## Contingency Fees – Engineer/Attorney Hiring Engineering Expert

**National Society of Professional Engineers Board of Ethical Review Case No. 00-10**

**Facts:**
Wallace is both an attorney and an engineer. Wallace is retained by Client X on a contingency basis to perform legal services in connection with an accident in which Client X alleges that a manufactured product caused the accident. Wallace interviews a number of experts familiar with the product and the reasons for similar accidents and hires Grommet, an expert in the product in question. No written agreement is executed between Wallace and Grommet for the services in question. Grommet reviews the facts and circumstances surrounding the accident, conducts and completes study, and issues a report to Wallace. Wallace reviews Grommet's report and informs Client X that it appears that no basis exists for a lawsuit. Grommet bills Wallace for his professional services. Wallace refuses to pay, indicating that since Wallace was not paid for his services, Wallace has no obligation to pay Grommet.

**Question:**
Was it ethical for Wallace to refuse to pay Grommet for Grommet's services?

## Review By Engineer Of Work Of Design Engineer For Client

**SEE WHAT THE NSPE-BER SAID**

Find a full discussion and conclusions for these and other BER cases on the web site of the National Institute for Engineering Ethics
**www.niee.org**

**National Society of Professional Engineers Board of Ethical Review** ***Case No. 00-12***

**Facts:** Customer X (a cellular phone company) asks Corporation Y (a tower manufacturer) to design and manufacture a 300' antenna tower. Andrew, as an employee of Corporation Y, performs a structural design of the tower and provides signed/sealed drawings of the design.

Customer X wants to make sure it receives a good product, so it engages Corporation Z, a tower manufacturer that competes with Corporation Y, to analyze Corporation Y's tower design and manufacture. Steve, as an employee of Corporation Z, performs a structural analysis of Corporation Y's design and puts together a report of his findings. Steve then signs and seals his own report and submits it to Customer X.

**Question:**
Was it ethical for Steve to perform a structural analysis of Corporation Y's design and put together a report of his findings?

**TexethicS** is distributed at no charge to engineering faculty members within the State of Texas and to others within the engineering profession who request to be included on the mailing list. **TexethicS** is one element of the Professional Development Program of the Texas Board of Professional Engineers and is sponsored by that Board. However, opinions and/or articles in **TexethicS** do not necessarily represent the position of the Texas Board of Professional Engineers.





**Murdough Center for Engineering Professionalism**
**College of Engineering, Texas Tech University**
**Box 41023**
**Lubbock, Texas 79409-1023**


NON-PROFIT ORG.
U.S. POSTAGE
**PAID**
LUBBOCK, TEXAS
PERMIT NO. 719

**TO:**