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INTEGRATING CERTIFICATION & LICENSING FOR ENGINEERS AND RELATED SPECIALISTS

BY THE ENGINEERING CERTIFICATION TASK FORCE OF THE
COUNCIL OF ENGINEERING AND SCIENTIFIC SPECIALTY BOARDS *with the*:

AACE International (AACE)
ASPRS — The Information & Imaging Society
American Academy of Environmental Engineers (AAEE)
American Board of Health Physics (ABHP)
American Board of Industrial Hygiene (ABIH)
American Industrial Hygiene Association (AIHA)
American Society of Agricultural Engineers (ASAE)
American Society of Heating Refrigeration & Air Conditioning Engineers (ASHRAE)
American Welding Society (AWS)
Board of Certified Safety Professionals (BCSP)
Institute of Electrical and Electronics Engineers — USA (IEEE-USA)
Institute of Hazardous Materials Management (IHMM)
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Institute of Transportation Engineers (ITE)
Instrumentation, Systems and Automation Society (ISA)
National Academy of Forensic Engineers (NAFE)
National Council of Examiners for Engineering & Surveying (NCEES)
Society of Fire Protection Engineers (SFPE)

INTEGRATING CERTIFICATION & LICENSING FOR ENGINEERS AND RELATED SPECIALISTS

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EXECUTIVE SUMMARY

This report on integrating certification and licensing, two separate types of credentials available to engineers, is the result of discussions by the Engineering Certification Task Force (ECTF), a multi-organization enterprise convened by the Council of Engineering and Scientific Specialty Boards (CESB) in 2004. The work of this Task Force followed a similar effort initiated in 2001 by the National Council of Examiners for Engineering and Surveying (NCEES) which examined conditions pertinent to the licensing of engineers.

BACKGROUND

Licensing — Credentialing in engineering is nearly 100 years old. In fact, credentialing in all professions is of a similar age. The first licensing of engineers occurred in Wyoming in 1907. Over the next ninety years licensing of engineers became universal throughout the United States and its territories. Changes in licensing practices were routinely made to keep pace with changes in credentialing procedures and practices. In spite of these and related efforts, the number of licensed engineers comprises only about 20 percent of the two million engineers in the United States. The reasons for this condition are many and complex including exemptions permitted by law for engineers working for industry and government, lack of acceptance of licensing as an essential credential by the profession as a whole and the marketplace, the capability to use the title “engineer” in most states by those who are not engineers, and the natural fear of examinations.

Certification — Certification began with licensed physician ophthalmologists in 1911 as a way to distinguish their unique and special training in eye care. By the early 1950s, specialty certification of physicians was an established, accepted practice in medicine. As a consequence, environmental engineers used it to distinguish themselves from other engineers beginning in 1955. The allied health professions, which had been seeking licensure protection, embraced certification in the early 1970s to ensure minimum competency. Certification in many other occupations followed with varying degrees of success. Some certification programs became “the” credential to have in their occupations. Others were accepted by only a few. Overall, there are more than 1000 occupational certification programs available today.

Accreditation of Certification — Several health organizations founded the National Commission for Health Certifying Agencies (NCHCA) in 1977 to develop standards for use in evaluating certification programs. Financial support for the creation of NCHCA was provided by the federal government. In 1987, NCHCA was renamed as the National Organization of Competency Assurance (NOCA) and its mission expanded to be a membership and resource organization for all interested in certification. To address the accrediting function, the original purpose of NCHCA, NOCA created the National Commission for Certifying Agencies (NCCA) in 1989.

The proliferation of certifications in the environmental arena in the late 1980s concerned the whole engineering profession. NSPE organized a conference in 1988 to address this problem. From this meeting and others that followed, the Council of Engineering Specialty Boards (later renamed as the Council of Engineering and Scientific Specialty Boards) (CESB) was formed in 1990. Unlike NCCA, it was not provided financial aid by the government and has had limited support from the engineering profession as a whole. Like NCCA, the mission of CESB is to set standards for certification programs in engineering and related fields and to accredit those programs found to be conforming to those standards. Currently, it accredits more than 20 such certification programs.

Recently, the International Standards Organization, an organization with international scope, promulgated ISO Standard 17024. This standard defines quality standards for personnel credentials of all types; both licensing and certification are included. In the US, this Standard is being implemented by the American National Standards Institute (ANSI) as a result of an agreement between ISO and ANSI. Like NCCA and CESB, ANSI accredits credentialing programs which voluntarily submit to its oversight and regulation.

CONCERNS, ISSUES, AND PROBLEMS WITH ENGINEERING CREDENTIALING

The Engineering Certification Task Force assessed the current state of credentialing in engineering including both licensing provided by state licensing boards and certification provided by many technical and professional not-for-profit organizations. Importantly, it noted that in many areas licensing and certification are complementary and pursue the same objectives. In other instances, licensing and certification programs unnecessarily compete with one another.

Areas of Compatibility — *Accredited* certification programs and licensing are similar in several ways. Both types of credentials:

- use similar methods and processes to identify those individuals to whom credentials are granted.
- do not discriminate, except as to qualifications.
- objectively assess an individual's capabilities versus a defined body of knowledge and set of professional practice skills.
- provide procedures for disciplining credential holders who engage in illegal and/or unprofessional practices.
- intend to protect the public from the incompetent and unethical practice and to enhance the professional stature of those credentialed.

In engineering disciplines and engineering-related scientific and technical practice specialties not covered by licensing (there are many more disciplines and specialties where licenses are not available than where they are available), certification provides a mechanism for identifying those possessing the education and experience necessary to be minimally-competent practitioners.

Areas of Competition — Licensing laws clearly define areas of practice limited to those licensed. However, that does not prevent the market (employers of professionals) and professionals themselves from using various ways to circumvent these laws. Sometimes, in these instances certification is used as an alternative credential. This practice and extensive promotion of each type of credential creates competition between licensing and certification where it might not otherwise exist.

Credentialing Concerns and Problems — Several problems exist with the current credentials for engineers and engineering related specialists. A striking observation of the ECTF was that these problems are viewed commonly by practicing professionals, those who employ them, and the public.

- **Limited Understanding of Credentials —** Credentialing, both licensing and certification, employs complex, little-understood processes.
- **Limited Acceptance of Credentials —** Generally, engineers and employers of engineers seek to avoid licensing except where required by law. Certification is also poorly accepted in most specialties.
- **Technology Complexity —** The very nature of engineering practice complicates engineering credentials. The ever increasing complexity of technology spawns more and more specialties. There is no sign that this “splintering” will abate.
- **Restraints on Practice —** Because engineering licenses are issued by states they hinder the

freedom of licensed engineers to practice in modern business that regularly transcends state boundaries.

- Variable Requirements — Although the NCEES Model Law prescribes a uniform set of prerequisites and procedures for obtaining an engineering license, each state applies those recommendations differently. Variability is an even greater problem in certification in part because of the various categories of certification available. Although CESB accreditation guidelines impose minimum standards, the majority of certifications available to engineers and related professionals and technicians are not accredited by CESB or any other certification accrediting body.

CONCLUSIONS

Engineering licensing and certification of engineers and related specialists have many of the same problems and concerns. Both forms of credentials have the same objectives. Competition between the two, particularly exclusionary efforts where none are warranted, is detrimental to the profession and exists primarily because of incorrect understanding of each type of credential by the organizations granting them, those credentialed, those employing them, and the public.

Licensing will not become universal for all engineers at anytime in the foreseeable future, if ever. Certification is a dynamic enterprise governed principally by market forces — if there is sufficient demand or perceived need for a certification, some organization will try to address that need. These two forms of credentialing for engineers and related specialists will exist for years to come. Therefore, devising mechanisms by which they can co-exist so as to benefit the engineering profession is desired.

The ECTF identified four basic problems affecting the integration of licensing and certification. These are, in priority order:

1. Lack of understanding within the engineering profession and its leading professional societies regarding the role of certification vis-à-vis licensing
2. Lack of acceptance within the engineering profession and its leading professional societies of certification
3. Lack of acceptance that accreditation of certification programs assures their integrity
4. Lack of widespread recognition by the profession and by those who employ engineers and engineering-related specialists that valid credentials can measure competence

RECOMMENDATIONS

The ECTF devised five recommendations to address the basic problems identified. While NCEES, NSPE, and CESB should lead, all engineering and engineering related organizations need to participate in implementing these recommendations for maximum impact.

- **Licensing and certification must cooperatively exist —** As long as disputes exist within the profession regarding the juxtaposition of licensing and certification, both licenses and certifications will be compromised and the profession as a whole will be encumbered by unnecessary confusion and counterproductive competition. Therefore, the profession's many societies and organizations need to agree upon a universally acceptable policy regarding these two credential types.

- **Certification must be accepted —** Properly performed, certification can effectively measure an individual's capability to perform a specific task(s). It has the ability to transcend the problem posed by the legislative and regulatory hurdles required of licensing and can be implemented by national or international organizations in response to market needs. It also has the ability to focus on narrow specialties that do not involve large segments of the profession as is commonly required of licensing.

- **Accreditation of certification programs must be required —** The quality and integrity of certification programs can only be assured by accreditation, an independent, third-party evaluation of a certification program's operations. All engineering organizations should only recognize and recommend recognition by others of accredited certification programs. CESB exists to serve the engineering profession in this need much as ABET serves the profession's needs for accrediting of university education programs.

- **Credentials must be supported to promote quality in practice —** Each organization involved in engineering and related fields should have a policy supporting the use of appropriate credentials regardless of whether they are licenses, certifications, or both. By creating a climate of uniformity across the profession regarding credentials, an important instrument will have been established for advancing the quality of practice in the profession.

- **Education about credentials must be provided —** NCEES, NSPE, and CESB should collaborate to prepare a comprehensive tutorial which explains credentials for the profession, including the role of licenses, the role of certifications, the relationship between licenses and certifications, the appropriate uses of credentials, the limitations of credentials, the benefits of credentials to practitioners, employers, and consumers, and a comprehensive glossary of credentialing terms. Once developed, this generic document should be published by the three organizations in print and electronically and widely disseminated on a continuum.

INTRODUCTION

This report on integrating certification and licensing, two separate types of credentials available to engineers, is the result of discussions by the Engineering Certification Task Force (ECTF), a multi-organization enterprise convened by the Council of Engineering and Scientific Specialty Boards (CESB) in 2004 and 2005.

The work of this Task Force followed a similar effort initiated in 2001 by the National Council of Examiners for Engineering and Surveying (NCEES) which examined conditions pertinent to the licensing of engineers. The NCEES Engineering Licensure Qualifications Task Force (ELQTF) issued a report in 2003 which proposed revisions to the current practices for licensing engineers and suggested that certification could be a post-licensing credential to identify engineers' expertise in specialties. However, the ELQTF Report offered no details regarding integration of licensing and certification. The ECTF addressed that need.

The ECTF was composed of representatives from CESB and from organizations within the engineering and technology community. The Participating Organizations were those who funded a representative to participate in ECTF meetings. Consulting Organizations were those who monitored ECTF work based on written reports and provided comments as appropriate.

The Participating Organizations included:

AACE International (AACE)
ASPRS — The Information & Imaging Society
American Academy of Environmental Engineers (AAEE)
American Board of Health Physics (ABHP)
American Board of Industrial Hygiene (ABIH)
American Industrial Hygiene Association (AIHA)
American Society of Agricultural Engineers (ASAE)
American Society of Heating Refrigeration & Air Conditioning Engineers (ASHRAE)
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Board of Certified Safety Professionals (BCSP)
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Institute of Transportation Engineers (ITE)
Instrumentation, Systems and Automation Society (ISA)
National Academy of Forensic Engineers (NAFE)
National Council of Examiners for Engineering & Surveying (NCEES)
Society of Fire Protection Engineers (SFPE)

The Consulting Organizations included:

Academy of Board Certified Environmental Professionals (ABCEP)
American Society of Civil Engineers (ASCE)
The Construction Specifications Institute (CSI)
NACE International — The Corrosion Society
National Society of Professional Engineers (NSPE)

The Engineering Certification Task Force sought to define ways to integrate the use of certification and licensing of engineers and engineering related specialists that will be accepted by all in the profession and which recognize that:

- inclusion of all engineers within the framework of engineering licensure adopted by NCEES is a desirable goal;
- licensure by government boards and certification by independent, not-for-profit entities are complementary objectives for engineers;
- certification of engineers using properly administered procedures that are consistent with gener-

ally recognized credentialing criteria is complementary to licensing and can benefit the public;

- certification of engineering-related specialties, including engineering technicians, benefits the practice of engineering and the public; and
- CESB accreditation of certification programs provides a recognized method for assuring the quality of certification programs in engineering and related fields of practice.

The first meeting of the ECTF focused on the history of credentials in engineering and technology, the current status of such credentials, and the problems, concerns, and issues related to credentialing generally and to licensing and certification in particular. Detailed information was provided by experts in the field. The ECTF then created committees which undertook detailed discussions of credentials from the perspective of practicing professionals and from the perspective of the market. A third committee worked to identify areas where licensing and certification were complementary and where they are competitive. Following two days of discussions, the ECTF convened en masse to discuss the committees' findings and reach consensus on problem identification

The second meeting of the ECTF used the same approach described above to develop solutions to the identified problems and provide recommendations to address the ECTF goals.

BACKGROUND

Credentialing in engineering is nearly 100 years old. In fact, credentialing in all professions is of a similar age. Before the beginning of the 20th century, regulation of all occupations was believed to be undemocratic in that it restricted how a person could earn a living. College training for vocational practice was the exception rather than the norm in that laissez-faire world.

The formation of professional societies was the first effort to prevent those without the appropriate expertise from practicing a profession. These efforts were not successful and, therefore, leaders of medical societies were first to appeal to their legislators to regulate the practice of medicine. Compliant legislatures invoked their police powers to justify licensure of physicians as the most practical way to safeguard the health, safety, and welfare of the citizens they represented. Lacking the necessary expertise to set entry qualifications, practice standards, and ethical guidelines specified in the licensing laws, the legislatures created licensing boards to implement the new laws. To populate these boards, they turned to the leaders of the medical societies who had advocated the licensing laws. Thus was born the concept of self regulation, a tradition that continues to the present day.

LICENSURE IN ENGINEERING

The first licensing of engineers occurred in Wyoming in 1907 to address problems that had and were occurring in land surveying, water rights, and water diversion. The first all-inclusive engineering licensing law was adopted by Florida in 1917. Other states followed the lead of these pioneers and by 1920 there were 10 licensing boards. Some of these boards formed the Council of State Boards of Engineering Examiners (CSBEE), the predecessor of today's National Council of Examiners for Engineering and Surveying (NCEES). These beginning licensure efforts emphasized experience as the primary qualification and varied from state to state reflecting the particular needs and political considerations of each state.

In 1929, the American Society of Civil Engineers (ASCE) proposed a model law for licensing of engineers in an attempt to establish some uniformity. NCSBEE (the successor to CSBEE) adopted the first model law for engineering licensing in 1932 following much discussion and revision to that proposed by ASCE. Adoption of licensing laws governing the practice of engineers continued over the next two decades and by 1950 all states and Alaska, Hawaii, the District of Columbia and Puerto Rico had passed licensing or registration laws of some kind governing the practice of engineering. Generally, these early laws included exemptions for engineers working for industry, utilities, and in many governmental positions and focused on only those offering to perform engineering services for the public, establishing a pattern that continues to the present.

The format of the current licensing system began to take shape with the administration of the first NCSBEE Fundamentals of Engineering examination in 1965. The first Principals and Practice of Engineering (PE) examination was administered the following year. Although there were national examinations, not all states used them. It took another 20 years before uniform national examinations were employed to license engineers. During this period the NCEES Model Law was modified on several occasions to keep pace with changes in credentialing procedures and practices. In spite of these changes, the number of licensed engineers comprises only about 20 percent of the 2 million engineers in the United States. The reasons for this condition are many and complex. These reasons, in summary form, include exemptions permitted by law for engineers working for industry and government, lack of acceptance of licensing as an essential credential by the profession as a whole and the marketplace, the capability to use the title "engineer" in most states by those who are not engineers, and the natural fear of examinations.

In 2001, NCEES organized the Engineering Licensure Qualifications Task Force (ELQTF), which included representatives from several engineering organizations, to study the current engineering licensure system and develop recommendations for change. That Task Force issued its report in March 2003 which recommended several changes to improve the existing licensure system with the goals of (1) improving the quality of the nation's engineering force and (2) substantially increasing the number of engineers falling within the jurisdiction of the licensing system and who would be licensed. The Task Force envisioned achieving these goals by making certain modifications to the current licensing requirements and procedures, the principal ones being:

- Legally entitling persons graduating from an Accreditation Board for Engineering and Technology/Engineering Accreditation Commission (ABET/EAC)-accredited engineering program to use the title "Graduate Engineer" or one embracing a specific engineering discipline, e.g., "Mechanical Engineer."
- Changing the title "Engineer Intern" to "Associate Engineer" to encourage those entering the profession to embark upon the licensure path. Engineer Intern is perceived by some to be a denigrating term. To obtain the title of Associate Engineer an individual must be a graduate of an ABET/EAC-accredited engineering program and have successfully completed the Fundamentals of Engineering examination.
- Creating a new license with restricted authority entitled, "Registered Engineer." Such an engineer must be a graduate of an ABET/EAC-accredited engineering program, have successfully completed the Fundamentals of Engineering examination, and obtained at least four years of acceptable professional experience after graduation. This new category was intended to specifically provide a credential for those working in industry and government positions exempted from the need to possess a "Professional Engineer" license.
- Expanding the requirements to obtain a Professional Engineer (P.E.) license by requiring each applicant to complete a Nontechnical Professional Practice examination in addition to passing the Fundamentals of Engineering and Principals and Practice examinations and obtaining 4 years of acceptable professional practice after graduation.
- Recommending that Registered and Professional Engineers regularly obtain a prescribed amount of continuing professional development as a condition of continued licensure.
- Using specialty certification administered by professional and technical engineering societies to credential licensed engineers in specialties of the disciplines licensed.

The NCEES Board of Directors accepted the Task Force report and referred its recommendations to a new task force entitled, "Licensure Qualifications Oversight Group (LQOG)." This Group has studied the recommendations since late 2003 and has brought some forward for NCEES Board action.

CERTIFICATION

Certification grew out of a desire by ophthalmologists (already licensed as physicians) to distinguish themselves as possessing unique and special training in the care of eyes in 1911. The success of the ophthalmologists led to the creation of other certification boards for other medical specialties practiced by physicians in the ensuing decades. By the early 1950s, specialty certification of physicians was an established, accepted practice in medicine. However, professionals in fields allied with physicians generally eschewed certification.

Before the U.S. Environmental Protection Agency (USEPA) was created in 1970, environmental laws and regulations were administered by the U.S.

Public Health Service and State Health Departments. This organizational arrangement fostered close working relations between the sanitary engineers and physicians employed by these agencies. Sanitary engineers, specialists generally trained as civil engineers, believed that certification modeled on the practices of their physician colleagues would be beneficial to them. The ensuing discussions led to the formation of the American Academy of Sanitary Engineers in 1955, the predecessor of today's American Academy of Environmental Engineers. This embrace of certification by engineers was unique to sanitary engineers and avoided by other specialties of civil engineering and other engineering disciplines.

A major change in credentials for health professionals, other than physicians, occurred in the early 1970s. This change was imposed by the requirements of the newly formed Medicare program, affected insurance companies, and the Federal Department of Health, Education, and Welfare. At that time, the allied health professions who had been seeking licensure protection converted those efforts to national certification programs which embraced a focus on minimum competency and the use of written examinations to measure qualifications.

Certification in many other occupations followed the lead of the allied health professions with varying degrees of success. Some certification programs became "the" credential to have in their occupations and enjoy substantial support. Others were accepted by only a few. Overall, there are more than 1000 occupational certification programs available today.

THE CIVIL RIGHTS ACT OF 1964

The Civil Rights Act of 1964 and similar state civil rights legislation that it spawned created a dramatic change in credentialing. This change occurred because these laws made illegal the discrimination against individuals based on race, gender, etc. The laws did, however, permit discrimination based on qualifications.

For those issuing credentials it became necessary to ensure that the procedures they employed *objectively* measured an individual's qualifications. This gave rise to a new specialist, the psychometrician, and psychometric techniques for measuring an individual's capability to perform. The preferred measurement technique became the written examination.

In the years since this paradigm change, psychometrics became increasingly sophisticated in the techniques employed. These changes were not only the result of the normal evolution of a field of practice, but a response to litigation, primarily in medicine, that challenged both licensing and certification boards to demonstrate their objectivity.

ACCREDITATION OF CERTIFICATION

In 1974, the Institute of Public Administration completed the Feasibility Study of a Voluntary National Certification System for Allied Health Personnel. The study concluded that a system of voluntary certification could credential allied health professionals and that government involvement, other than providing policies recognizing the value of such certifications, was not required. This conclusion led the allied health organizations to found the National Commission for Health Certifying Agencies (NCHCA) in 1977 to develop certification standards. The intent was to evaluate certification programs against those standards and identify those programs which satisfied them. Financial support for the creation of NCHCA was provided by the federal government.

In 1987, NCHCA was renamed as the National Organization of Competency Assurance (NOCA) and its mission expanded to be a membership and resource organization for all interested in certification. To address the accrediting function, the original purpose of NCHCA, NOCA created the

National Commission for Certifying Agencies (NCCA) in 1989.

Equally dramatic changes were occurring during this same period, the 1970s and 1980s, in sanitary engineering or environmental engineering as it had come to be named. The proliferation of environmental legislation that occurred in the early 1970s caused many engineers to pursue careers in environmental engineering, which overnight had become much in demand. From a relatively small specialty of primarily civil engineers, environmental engineering grew by leaps and bounds. These new environmental engineers came from many disciplines; often they were scientists or others who sometimes obtained graduate environmental engineering degrees and sometimes did not. By the mid-1980s, several organizations and diploma mills were offering "environmental" certifications to these newcomers to the field. Much was at stake because substantial federal and state financial support included in the environmental legislation assured a well-funded market. As is often the case, the combination of substantial government pressure to produce coupled with financial aid led to abuse and outright fraud in issuing certifications.

The engineering profession, as a whole, became concerned, believing that all engineers would be tarnished by what was happening in the environmental arena. As a result, NSPE organized a conference in 1988 to address the proliferation of certifications that was attended by representatives of most engineering organizations. From this meeting and others that followed, it became clear to many that an accrediting body was needed to regulate certification in an attempt to thwart the diploma mills.

As a result of these discussions, the Council of Engineering Specialty Boards (later renamed as the Council of Engineering and Scientific Specialty Boards) (CESB) was formed in 1990. Unlike NCHCA, NOCA, and NCCA, it did not enjoy broad support by the engineering profession, nor was any government financial aid or financial support from the engineering profession as a whole provided. Six certification organizations and four engineering-wide organizations were the founding members of CESB. Like NCCA, the mission of CESB is to set standards for certification programs in engineering and related fields and to accredit those programs found to be conforming to those standards.

In 1998, the American Society for Testing and Materials (ASTM) issued E1929-98, *Standard Practice for Assessment of Certification Programs for Environmental Professionals: Accreditation Criteria*. This standard describes the elements of a properly organized and administered certification program for environmental professionals. While ASTM does not provide accreditation of certification programs, the Standard specifies independent accreditation as a key criterion that must be obtained if a certification program is to satisfy the Standard. It expressly identifies CESB and NCCA as organizations capable of providing the required accreditation.

Recently, the International Standards Organization (ISO), an organization with international scope, promulgated ISO Standard 17024. This Standard defines quality standards for personnel credentials of all types; both licensing and certification are included. In the US, this Standard is being implemented by the American National Standards Institute (ANSI) as a result of an agreement between ISO and ANSI. Like NCCA and CESB, ANSI intends to accredit credentialing programs which voluntarily submit to its oversight and which comply with the ISO Standard.

CONCERNS, ISSUES, AND PROBLEMS WITH ENGINEERING CREDENTIALING

The Engineering Certification Task Force assessed the current state of credentialing in engineering, including both licensing administered by state licensing boards and certification provided by a many technical and professional not-for-profit organizations. Importantly, it noted that in many areas licensing and certification are complementary and pursue the same objectives. In other instances, licensing and certification programs unnecessarily compete with one another.

AREAS OF COMPATIBILITY

Accredited certification programs and licensing entities use similar methods and processes to evaluate and qualify those individuals to whom credentials are granted. These processes are nondiscriminatory, except as to qualifications, and objectively assess an individual's capabilities versus a defined body of knowledge and set of professional practice skills. They also provide procedures for disciplining credential holders who engage in illegal and/or unprofessional practices. However, certification programs that are not accredited may not use credentialing methods consistent with recognized standards.

Licensing and certification intend to protect the public from the incompetent and/or unethical practice and to enhance the professional stature of those credentialed. However, both professionals and the employers of professionals question if these intentions are fulfilled, i.e., does the possession of a properly issued credential actually assure a minimum level of competency.

For engineering disciplines and engineering-related scientific and technical practice specialties not covered by licensing (there are many more disciplines and specialties where licenses are not available than where they are available), certification provides a mechanism for identifying those possessing the education and experience necessary to be minimally competent practitioners.

NCEES and other engineering societies have consciously embraced certification. However, where supportive policies exist, they generally limit the use of certification to only licensed engineers. This is understandable given their missions. However, much of the work in technology is performed by teams of professionals including non-licensed engineers, scientists, and technicians in addition to licensed engineers. These professionals need recognized credentials.

AREAS OF COMPETITION

Licensing laws clearly define areas of practice limited to those who are licensed. However, this does not prevent the market (employers of practitioners) and practitioners themselves from using various ways to circumvent these laws. Sometimes, in these instances certification is used as an alternative credential. This practice creates competition between licensing and certification where it might not otherwise exist.

Licensing bodies and those organizations composed of licensed engineers have, historically, been aggressive in their efforts to prevent infringement upon the domain of the licensed professionals. Such efforts create an atmosphere of exclusion and, as a result, competition with accredited certification programs for tasks that do not require a licensed engineer or engineering expertise.

Certification programs enjoy no statutory preference and depend upon the advantages they can confer to justify their existence. This condition leads many certification programs to try to obtain exclusive rights to practice for those they certify via regulations or market requirements. These efforts, particularly if they infringe or are perceived to infringe upon the domain of licensed engineers, create competition with licensed engineers. This results in conflict between certifying organizations and the professional organizations which sponsor them versus the licensing bodies and the allied organizations of licensed engineers.

The ECTF concluded that the existing competition between licensing and certification is unnecessary and counterproductive because both have the same goals and, when both types of credentials are properly used, do not infringe upon each other's market, particularly where the expertise of engineers, scientific specialists, and technicians are necessary for accomplishment of a scope of work.

CREDENTIALING CONCERNS AND PROBLEMS

Several problems exist with the current credentialing regime for engineers and engineering-related specialists. A striking observation of the ECTF was that these problems are viewed commonly by practicing professionals, those who employ them, and the public.

Limited Understanding of Credentials — Credentialing, both licensing and certification, employs complex, little-understood processes. Key terms in the lexicon of credentialing are poorly defined or lacking in universality of use, e.g., there is no universally accepted definition of “discipline” or “specialty,” and where clear definitions of terms exist they are often misapplied. For example, accreditation is used where certification should be used and vice-versa. Similarly, what each credential implies and what it does not are not clear. The lack of clarity in terminology and understanding coupled with the wide array of credentials is confusing to the public, professionals, and those who employ them. Often, erroneous or confusing information is disseminated by the licensing and certification organizations themselves.

Accordingly, substantial incorrect information and perceptions about credentials abounds. Some of the errors are accidental, ranging from dissemination of incorrect information to the unintentional misuse of credentials. Examples of the later include incorrect use of a credential(s) in government regulations and the attribution of unintended benefits (by the credential issuer) of a credential(s) by its holders and users. Other errors appear to be intentional as both practicing professionals and credentialing organizations seek to obtain competitive advantage.

Limited Acceptance of Credentials — Generally, engineers and employers of engineers seek to avoid licensing except where required by law. Proof of this observation is the fact that only 20 percent of all degreed engineers are licensed. This condition is exacerbated by several factors:

- Licenses are not available for all engineering disciplines and specialties;
- The 18 different licenses potentially available to engineers are not available in all jurisdictions (states and territories). Not all states and territories issue discipline-specific licenses, although all employ discipline specific examinations;
- Many engineers perceive few, if any, rewards to being licensed;
- An innate human fear of examinations and peer scrutiny causes engineers who could be licensed to eschew obtaining a license unless essential to be employed and/or advance in their profession; and
- Many, including engineers, their employers, and the public, do not believe that licenses can adequately measure competence

Certification is also poorly accepted for most of the same reasons as licensing. However, there are a few exceptions, e.g., industrial hygiene, industrial safety, and quality control. Certification is further compromised by its voluntary nature; i.e., certification is not required by law and is seldom required by government regulation. Further, most certification programs in engineering and engineering-related occupations are not accredited. Lacking the independent assessment of certification practices that accreditation provides, there is no assurance for employers and the public that the certifications possessed by individuals have been legitimately conferred.

Technology Complexity — The very nature of engineering practice complicates engineering credentials. It was more than 150 years ago that engineering was a unified profession. As technology evolved, its increasing complexity spawned more and more specialties. There is no sign that this "splintering" will abate. Along with the splintering of engineering, a wide array of scientists, technicians, and others became part of the "engineering team." Often, the roles of different engineering disciplines overlap as do the roles of engineers with others on the engineering team.

Credentials, both licenses and certifications, must define a body of knowledge against which an individual is measured. The common practice has been to narrow this body of knowledge to ease measurement. Consequently, this practice has served to further splintering. Unlike medicine, there is no generic engineering license. As certifications have expanded they, too, have splintered. For example, the oldest engineering certification, environmental engineering, was divided 20 years after its creation into seven different certifications to mirror the specialization in this discipline.

Restraints on Practice — Because engineering licenses are issued by states they hinder the freedom of licensed engineers to practice in modern business that regularly transcends state boundaries. Certifications, on the other hand, are typically national and international in scope and are not constrained by political boundaries.

The scope of each discipline or specialty-specific credential identifies the scope of an individual's competence. While this helps employers and the public identify the minimally competent in each discipline or specialty, the defined scope of each credential also operates to constrain the practicing professional and/or compel the professional to obtain multiple credentials. These practical considerations reportedly are reasons practitioners often eschew credentials.

Variable Requirements — Although the NCEES Model Law prescribes a uniform set of prerequisites and procedures for obtaining an engineering license, each state applies them differently. There is uniformity in the examinations employed, but the evaluation criteria for education and experience vary widely. Further, about one-half the licensing jurisdictions require continuing professional development, while the other half does not. Additionally, in those licensing jurisdictions which require continuing professional development, the requirements vary.

Variability is an even greater problem in certification, in part because of the various categories of certification available, i.e., certifications for licensed engineers, certifications for graduate engineers without licenses, certifications for engineering-related scientists and other professionals, and certifications for engineering technicians. CESB accreditation guidelines establish minimum standards appropriate to each category. However, the majority of certifications available to engineers, related professionals, and technicians are not accredited by CESB or any other certification accrediting body.

Without independent accreditation, there is no assurance for candidates, employers of those certified, and the public that a certifying body employs minimally-acceptable credentialing procedures appropriate to each category.

SUMMARY

Engineering licensing and certification of engineers and related specialists have many of the same problems and concerns. Both forms of credentials have the same objectives. Competition between the two, particularly exclusionary efforts where none are warranted, is detrimental to the profession and exists primarily because of incorrect understanding of each type of credential by the organizations granting them, those credentialed, those employing them, and the public.

RECOMMENDATIONS

Many of the problems with credentials for engineers and engineering-related specialists identified by the ECTF are indigenous to the specific credential and, therefore, are not addressed in these recommendations. However, it is noted that NCEES and various certification programs are working to address these problems. In fact, NCEES has already approved some changes to its Model Law for licensing in response to the work of the ELQTF and is considering others.

Licensing will not become universal for all engineers at anytime in the foreseeable future, if ever. Certification is a dynamic enterprise governed principally by market forces — if there is sufficient demand or perceived need for a certification, some organization will likely try to address that need. These two forms of credentialing for engineers and related specialists will exist for years to come. Therefore, devising mechanisms by which they can co-exist so as to benefit the engineering profession and related specialists is desired.

The public and employers are generally aware that licenses exist to identify those competent to practice a profession or vocation even if they do not understand the intricacies of licensing laws and regulations. In some professions, notably medicine, certification is similarly regarded. There is also a perception that licenses and certifications are efforts of those credentialed to protect their interests. However, on balance, such credentials are viewed as a positive benefit for society offering the public some protection from the incompetent.

Licensing requirements and practices vary between states, which are responsible for their implementation, and between the professions and vocations affected. Certification requirements and practices vary between the occupations and specialties certified. These varying requirements and practices are confusing to all affected — practitioners, employers, and the public. Where the available credentials within a particular profession are accepted by the profession's legitimizers, e.g., professional societies, the credentials fulfill their intended function. Physician credentials are an example. So, too, are the certifications for industrial hygienists and safety professionals.

However, if there is no general consensus by legitimizers on the appropriate and/or essential credentials for a profession, acceptance and use by practitioners and their employers is limited. The consequence of this lack of use of credentials deprives the public of some measure of accountability regarding the qualifications of practitioners necessary for the functioning of a complex society. Further, practitioners are deprived of benchmarks which can be used to stimulate and measure their career development. Such is the case in engineering and engineering-related specialties.

The ECTF identified four basic problems affecting the integration of licensing and certification and offered recommendations to address each. These are, in priority order:

1. Lack of understanding within the engineering profession and its leading professional societies regarding the role of certification vis-à-vis licensing
2. Lack of acceptance within the engineering profession and its leading professional societies regarding the role of certification of engineers and engineering-related specialists
3. Lack of understanding of the concept of accreditation and acceptance that accreditation of certification programs assures their integrity

4. Lack of widespread recognition by the profession and those who employ engineers and engineering-related specialists that valid credentials can measure competence

LICENSING VIS-À-VIS CERTIFICATION

As long as disputes exist within engineering and the community of engineering-related specialists regarding the juxtaposition of licensing and certification, both licenses and certifications will be compromised and the profession as a whole will be encumbered by unnecessary and counterproductive competition. The profession's many societies and organizations need to agree upon a universally acceptable policy regarding these two credential types. To that end, the following statement is proposed.

> "Licenses are the primary credential for engineers where required by law.
>
> Licenses are the preferred credential for engineers where examinations and requirements relevant to the individual's discipline exist.
>
> Certifications granted by independently accredited certification programs do not provide legal authority to practice, but do provide testimony to an individual's qualifications and expertise for engineering-related specialties, professions, or vocations and for engineers."

To establish a policy on this matter that is mutually acceptable, it is recommended that representatives of NCEES, NSPE, and CESB refine the proposed policy statement so that it can be officially endorsed by each organization as its policy on the matter of licensing vis-à-vis certification. Once this milestone is achieved, then the three organizations should work together to effect the adoption of such policy by all engineering societies and organizations of engineering-related specialists.

ACCEPTANCE OF CERTIFICATION

Properly performed, certification can effectively measure an individual's capability to perform a specific task(s). It has the ability to transcend the problems posed by the legislative and regulatory hurdles required of licensing and can be implemented by national or international organizations in response to market needs. It also has the ability to focus on narrow specialties that do not involve large segments of the profession as is commonly required of licensing.

The availability of certifications complementary to engineering licensing will increase the quality of practice within the engineering profession by providing objective measures which practitioners can use to demonstrate their unique capabilities and which employers can use to determine that they are hiring competent practitioners for their particular needs. Like licensing, certification by accredited programs demonstrate a personal commitment to high professional standards with an ethical obligation to hold paramount the health, safety, and welfare of the public.

Once the current counterproductive competition between licensing and certification is ended, each organization within the profession should consider and establish, where and when appropriate, certification programs which address particular market needs. Existing accredited certification programs should continue to serve their market.

REQUIRE ACCREDITATION

The quality and integrity of certification programs can only be assured by accreditation, i.e., an independent, third-party evaluation of a certification program's operations. This position was endorsed by the engineering profession when it was convened in 1988-1989 by NSPE. This endorsement led to the establishment of CESB to serve the profession's accreditation needs.

The value and utility of accreditation was recognized by the ASTM when it created its E1929-98, *Standard Practice for Assessment of Certification Programs for Environmental Professionals: Accreditation Criteria*, in 1998. To conform to this standard, any environmental certification program must be accredited by an independent, nationally-recognized third party experienced in conducting accreditation.

It is recommended that all engineering organizations recognize and recommend recognition by others of only accredited certification programs. CESB exists to serve the engineering profession in this need much as ABET serves the profession's needs for accrediting university education programs. It is noted that two other nationally-recognized accrediting bodies exist which can provide the same service.

Existing certification programs serving the profession which are not accredited should apply for and obtain accreditation as soon as they can meet the applicable standards.

CREDENTIALS — A MEASURE OF COMPETENCE

Whether written examinations and other accepted testing methods can measure an individual's competence or not can easily dissolve into a philosophical discussion requiring complex and indirect reasoning. This is particularly true if a profession does not universally embrace their use.

However, there is a large body of scientific work underpinning the methods used to evaluate the capabilities of individuals. All licensing laws and regulations are based on the premise that properly developed examinations can validly and reliably measure an individual's capability to perform a specific function or series of tasks.

Each organization involved in engineering and related fields should have a policy supporting the use of appropriate credentials regardless of whether they are licenses, certifications, or both. By creating a climate of uniformity across the profession regarding credentials, an important instrument will be established for advancing the quality of practice in the profession.

EDUCATION ABOUT CREDENTIALS

There exists widespread misunderstanding about credentials for engineers and engineering-related specialties. It is recommended that NCEES, NSPE, and CESB collaborate on preparing a comprehensive tutorial which explains credentials for the profession, including the role of licenses, the role of certifications, the relationship between licenses and certifications, the appropriate uses of credentials, the limitations of credentials, the benefits of credentials to practitioners, employers, and consumers, and a comprehensive glossary of credentialing terms.

Once developed, this generic document should be published by all three organizations in print and electronically and widely disseminated on a continuum. Additionally, this information should be made available to other engineering and engineering-related organizations with encouragement to supplement the document with information pertinent to their members and distribute it in their area of influence.

APPENDIX A
GUIDELINES FOR ENGINEERING AND RELATED SPECIALTY CERTIFICATION PROGRAMS

PREAMBLE: In order to be approved by the Council of Engineering and Scientific Specialty Boards (CESB), a specialty certification program must be consistent with the certification objectives prescribed by CESB. To that end, certification programs will be considered against the following General Guidelines as well as Specific Supplemental Guidelines for the CESB category into which they fall.

GENERAL GUIDELINES — APPLICABLE TO ALL PROGRAMS

1. PURPOSE OF SPECIALTY CERTIFICATION PROGRAM

a Have as a primary purpose the evaluation of individuals who practice in specialized areas within the field of engineering and the issuance of credentials to those individuals who meet the required level of knowledge and competence.

2. STRUCTURE OF CERTIFYING BODY

a. Be non-governmental;

b. Conduct certification activities which are national or international in scope;

c. Be administratively independent in matters pertaining to certification. However, appointment of members of the certifying body may be by the sponsoring organization;

d. Have a certifying body which consists of a majority of certified individuals; and

e. Have formal procedures for the selection of members of the certifying body which shall prohibit the certifying body from selecting more than one-third of its members.

3. RESOURCES OF CERTIFYING BODY

a. Have the financial resources to properly conduct the certification activities; and

b. Possess the knowledge and skill necessary to conduct the certification program.

4. CERTIFICATION PROGRAM OPERATION

a. Have a mechanism to evaluate individual competence that is objective, fair, and based on the knowledge, skills, and abilities needed to function in the specialty area;

b. Provide the public, consumers, and sponsoring organizations with an opportunity for input into the policies and decisions of the certifying body;

c. Have formal evaluation mechanisms that insure relevance of the knowledge, skills, and abilities used to define the specialty area;

d. Assure that any examinations used are designed to test the body of knowledge relevant to the specialty area;

e. Utilize appropriate measures to protect the security of all examinations;

f. Utilize pass/fail levels that are generally accepted in the psychometric community as being fair and reasonable; and

g. Utilize evaluation mechanisms that attempt to establish both reliability and validity for each form of an examination.

5. PUBLIC DISCLOSURE OF CERTIFICATION

a. Publish a document which clearly defines the certification responsibilities of the certifying body and outlines any other activities of the certifying body which are not related to certification;

b. Make available general descriptions of the procedures used in test construction and validation, test administration, and reporting of test results;

c. Publish a comprehensive summary or outline of the information, knowledge, or functions covered by any examination which may be required; and

d. Publish at least annually, a summary of certification activities, including number of applicants, number certified and number recertified.

6. RESPONSIBILITIES TO APPLICANTS

a. Shall not discriminate among applicants as to age, sex, race, religion, national origin, disability, or marital status;

b. Provide all applicants with copies of formalized procedures for application for, and attainment of, certification;

c. Have a formal policy for the periodic review of application and testing procedures to insure that they are fair and equitable;

d. Have competently proctored testing sites that are readily accessible in all areas of the nation at least once annually;

e. Have prompt reporting of test results to applicants;

f. Make available to applicants failing an examination information on general areas of deficiency;

g. Maintain confidentiality of each applicant's examination results; and

h. Have a formal published policy on appeal procedures.

7. RESPONSIBILITIES TO THE PUBLIC AND CONSUMERS

a. Strive to insure that any examination adequately measures the knowledge, skill, and abilities required for practice in the specialty area;

b. Award certification only after the knowledge, skills, and abilities of the individual have been evaluated and determined to be acceptable;

c. Maintain a publicly accessible roster of those persons certified by the certifying body;

d. Have formal due process policies and procedures for discipline of certificants, including revocation of the certificate; and

e. Insure that any title or credential awarded by the credentialing body accurately reflects the specialty area.

8. RECERTIFICATION

a. Have a process that has as its goal maintenance and enhancement of professional qualifications.

9. TITLES

a. The use of the title engineer, or any variation, is limited to those individuals certified by Professional Engineer Specialty Certification Boards or Graduate Engineer Specialty Certification Boards. It should be made clear that the title engineer in a specialty certification program does not convey any legal right to practice engineering, which is controlled by state laws.

b. The use of the title “Diplomate” or any variation is limited to those individuals certified by Professional Engineer Specialty Certification Boards.

c. The use of the phrase “in engineering” on certificates shall be considered equivalent to use of the title “engineer.” The modifications “engineering technology,” “engineering technologist,” “engineering technician,” and “engineering aspects” are acceptable terms which may be used by Engineering Related Specialty Certification

Boards and Engineering Technician Specialty Certification Boards respectively.

SUPPLEMENTAL GUIDELINES FOR CESB RECOGNITION OF PROFESSIONAL ENGINEER SPECIALTY CERTIFICATION PROGRAMS

To achieve CESB recognition, Professional Engineer Specialty Certification programs will be measured against the following guidelines:

1. The certifying body should have a detailed document specifying the "body of knowledge" or "minimum level of skills and knowledge" required by a practitioner in the specialty area.
2. Candidates for certification must be licensed or registered as a Professional Engineer by the lawfully constituted licensure board of any state or jurisdiction of the United States or the equivalent licensure from another country as determined by a State Board, and have at least six (6) years of acceptable experience in engineering following the baccalaureate degree, or have at least two (2) years of acceptable experience in engineering following licensure.
3. Certification shall be granted upon demonstration and documentation of comprehensive knowledge and experience covering the topics enumerated in the "body of knowledge" or "minimum level of skills and knowledge" document(s) for the specialty.
4. Because certification is to recognize continuing professional qualifications in current technology, the period of certification shall not exceed five years without recertification. When extenuating circumstances prevent an individual from recertifying within the prescribed time interval, the certifying body may grant a limited extension.
5. Recertification may be achieved either by examination or by presenting satisfactory evidence of some combination of professional experience, continuing professional development, and professional society activity in the specialty area. In the latter case, while professional experience should receive primary weighting in granting recertification, the requirements must include cumulative continuing professional development in the specialty area at the rate of at least twenty hours per year. Professional society volunteer activity, related professional community volunteer service, authoring of technical papers, and similar activities may be considered by the certifying body in lieu of a portion of the continuing professional development or professional experience requirements. All activities for which recertification credit is granted must have been conducted during the immediately preceding period of certification. No credit may be granted for activities occurring at any prior time.
6. The certifying body may grant the title of "emeritus" or "retired" to persons who are retired from practice in this specialty but were currently certified at the time of retirement and who no longer engage in professional practice in the specialty area. Retirees who subsequently reenter the profession as consultants or through reemployment must renew their certification in the manner specified in Item 5 above.

SUPPLEMENTAL GUIDELINES FOR CESB RECOGNITION OF GRADUATE ENGINEER SPECIALTY CERTIFICATION PROGRAMS

To achieve CESB recognition, Graduate Engineer Specialty Certification programs will be measured against the following guidelines:

1. The certifying body must have developed a detailed document specifying the "body of knowledge" or "minimum level of skills and knowledge" required by a practitioner in the specialty area. Evidence must be presented that the body of knowledge document has been developed and subjected to critique by practicing professionals in the field. The document must be reviewed and updated as necessary to maintain currency with the state-of-the-art no less frequently than once every five years.
2. Candidates for certification must hold an EAC/ABET accredited degree (or equivalent) and possess a minimum of four years of practical

experience in responsible charge of work in the specialty area.

3. Certification shall be granted upon successful completion of a comprehensive examination covering the topics enumerated in the "body of knowledge" or "minimum level of skills and knowledge" document(s) for the specialty.

   NOTE: For a period not to exceed twelve months after the date of recognition of the program, newly recognized certification programs may grant certification to individuals on the basis of eminence or extensive education and/or experience without examination (i.e., by grandfathering). After that time, no individual shall be certified other than by examination.

4. Because certification is to recognize continuing professional qualifications in current technology, the period of certification shall not exceed five years without recertification. It is further recommended that the period of certification be limited to three years if feasible in the opinion of the cognizant certifying body.

5. Recertification may be achieved either by examination or by presenting satisfactory evidence of some combination of continuing professional experience, continuing professional development, and professional society activity in the specialty area. In the latter case, while continuing professional experience should receive primary weighting in granting recertification, the requirements must include an average of at least twenty hours of continuing professional development in the specialty area per year. Continuing professional development activities may include formal courses, technical meeting attendance, and related activities. Professional society volunteer activity, related professional community volunteer service, authoring of technical papers, and similar activities may be considered by the certifying body in lieu of a portion of the continuing professional development or professional experience requirements. All activities for which recertification credit is granted must have been conducted during the immediately preceding period of certification. No credit may be granted for activities occurring at any prior time.

6. Certification may not be granted for a period exceeding five years. If recertification requirements are not met on or before the expiration date of current certification, recertification may be achieved by examination. When extenuating circumstances prevent an individual from recertifying within the prescribed time interval, the certifying body may grant a limited extension. The certifying body, however, may grant the title of "emeritus" or "retired" to fully retired persons who were currently certified at the time of retirement and who no longer engage in professional practice in the specialty area. Retirees who subsequently reenter the profession as consultants or through reemployment must renew their certification in the manner specified in Item 5 above.

SUPPLEMENTAL GUIDELINES FOR CESB RECOGNITION OF ENGINEERING RELATED SPECIALTY CERTIFICATION PROGRAMS

To achieve CESB recognition, Engineering Related Specialty Certification programs will be measured against the following guidelines:

1. The certifying body must have developed a detailed document specifying the "body of knowledge" or "minimum level of skills and knowledge" required by a practitioner in the specialty area. Evidence must be presented that the body of knowledge document has been developed and subjected to critique by practicing professionals in the field. The document must be reviewed and updated as necessary to maintain currency with the state-of-the-art no less frequently than once every five years.

2. Candidates for certification must hold a baccalaureate degree (accredited by an accrediting body recognized by the Council on Postsecondary Accreditation) in a field related to engineering (or equivalent) and possess a minimum of four years of practical experience in responsible charge of work in the specialty area. At the discretion of the certifying body, a supplementary

examination or four years of related education and/or experience beyond the four-year minimum requirement may be accepted in lieu of an accredited degree.

3. Certification shall be granted upon successful completion of a comprehensive examination covering the topics enumerated in the "body of knowledge" or "minimum level of skills and knowledge" document(s) for the specialty.

   NOTE: For a period not to exceed twelve months after the date of recognition of the program, newly recognized certification programs may grant certification to individuals on the basis of eminence or extensive education and/or experience without examination (i.e., by grandfathering). After that time, no individual shall be certified other than by examination.

4. Because certification is to recognize continuing professional qualifications in current technology, the period of certification shall not exceed five years without recertification. It is further recommended that the period of certification be limited to three years if feasible in the opinion of the cognizant certifying body.

5. Recertification may be achieved either by examination or by presenting satisfactory evidence of some combination of continuing professional experience, continuing professional development, and professional society activity in the specialty area. In the latter case, while continuing professional experience should receive primary weighting in granting recertification, the requirements must include an average of at least twenty hours of continuing professional development in the specialty area per year. Continuing professional development activities may include formal courses, technical meeting attendance, and related activities. Professional society volunteer activity, related professional community volunteer service, authoring of technical papers, and similar activities may be considered by the certifying body in lieu of a portion of the continuing professional development or professional experience requirements. All activities for which recertification credit is granted must have been conducted during the immediately preceding period of certification. No credit may be granted for previous activities.

6. Certification may not be granted for a period exceeding five years. If recertification requirements are not met on or before the expiration date of current certification, recertification may be achieved by examination. When extenuating circumstances prevent an individual from recertifying within the prescribed time interval, the certifying body may grant a limited extension. The certifying body, however, may grant the title of "emeritus" or "retired" to fully retired persons who were currently certified at the time of retirement and who no longer engage in professional practice in the specialty area. Retirees who subsequently reenter the profession as consultants or through reemployment must renew their certification in the manner specified in Item 5 above.

SUPPLEMENTAL GUIDELINES FOR CESB RECOGNITION OF ENGINEERING TECHNICIAN SPECIALTY CERTIFICATION PROGRAMS

To achieve CESB recognition, Engineering Technician Specialty Certification programs will be measured against the following guidelines;

1. The certifying body must have developed a detailed document specifying the "body of knowledge" or "minimum level of skills and knowledge" required by a practitioner in the specialty area. Evidence must be presented that the body of knowledge document has been developed and subjected to critique by practitioners in the specialty area. The document must be updated as necessary to maintain currency with the state-of-the-art.

2. Candidates for certification must have demonstrated a level of knowledge equivalent to that associated with an accredited engineering technology associate degree and possess a minimum of two years of relevant work experience. Related college level coursework or a related college degree may be substituted for part of the

minimum of two years of relevant work experience.

3. Certification shall be granted upon successful completion of a comprehensive examination covering the topics enumerated in the "body of knowledge" or "minimum level of skills and knowledge" document(s) for the specialty area.

   NOTE: For a period not to exceed twelve months after the date of recognition of the program, newly recognized certification programs may grant certification to individuals on the basis of eminence or extensive education and/or experience without examination (i.e., by grandfathering). After that time, no individual shall be certified other than by examination.

4. Because certification conveys knowledge of current technology, periodic recertification shall be a feature of the specialty certification program. The period of certification shall be established by the certifying body to reflect the rate of change of technology and common practices in the specialty area. It is suggested that this period not exceed five years.

5. Recertification shall be achieved either by an examination or by continued work experience in the specialty area and some combination of continued professional development and volunteer technical activity in the specialty area. Work experience should receive primary weighting in granting recertification. Continued professional development activities include formal courses, workshops, seminars, and attending technical meeting sessions. Volunteer technical activities include technical committee service, technical community service, and technical paper/presentation authorship. All activities for which recertification credit is granted must have been conducted during the immediately preceding period of certification. No credit may be granted for previous activities.

6. The certifying body shall have a procedure for reinstatement of certification when recertification is not accomplished within the prescribed time period and this procedure shall use current qualifications of the candidate.

7. Fully retired persons certified at the time of retirement and no longer practicing in the specialty area may be granted the title of "emeritus" or "retired". Retirees who subsequently reenter practice of the specialty area as consultants or through reemployment must reinstate their certification in the manner specified in No. 6 above.

APPENDIX B
HISTORY OF CREDENTIALS IN ENGINEERING

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October 1, 2004

INTRODUCTION

To chart a course for the future, it is generally helpful to understand the past. Credentialing of occupations and engineering in particular has an extensive history filled with many different efforts and innumerable discussions, many with substantial unresolved disagreements. From this rich history I have selected but a few events that I believe key to the work of the Engineering Certification Task Force. This selection is not exhaustive and I am sure that I have omitted some others believe to be important.

Most of the credentialing effort has been in the past 40 years. As either a volunteer in society work or as an association executive during this period I have been personally involved in many of the efforts I will describe.

THE EARLY YEARS

Credentialing in engineering is nearly 100 years old. In fact, credentialing in all professions is of a similar age. Before the beginning of the 20th century, regulation of all occupations was believed to be undemocratic in that it restricted how a person could earn a living. College training for vocational practice was the exception rather than the norm in this laissez-faire world.

In an atmosphere of individual freedom, the abuses of some gave rise to professional societies as an antidote to protect the public from the unskilled. The first engineering society in the U.S. was the American Society of Civil Engineers which was formed in 1852. But, the society's interest in limiting practice to the formally-trained was minimal. Engineering of the time, focused on public works such as railroads, bridges, and waterworks, remained open to anyone with the interest and capability to "engineer" public works.

In medicine, there was greater concern about those who lacked formal training from traditional institutions of higher learning because of the proliferation of "diploma mills" that granted papers (diplomas) to individuals with little or no training. As a consequence, the traditionally trained physicians attempted to set themselves apart by establishing local and state medical societies and standards for admission which effectively excluded those who had not been trained at recognized medical schools. These medical societies advised the public that it was in their best interest to seek care from only those who enjoyed medical society membership.

However, these medical societies could not prevent those lacking formal training from continuing to practice. Therefore, leaders of medical societies appealed to their legislators to regulate the practice of medicine because the untrained were a menace to society. Compliant legislatures invoked their police powers to justify licensure of physicians as the most practical way to safeguard the health, safety, and welfare of the citizens they represented.

Lacking the necessary expertise to set entry qualifications, practice standards and ethical guidelines specified in the licensing laws, the legislatures created licensing boards to implement the new laws. To populate these boards, they turned to the leaders of the medical societies who had advocated the licensing laws. Thus was born the concept of self regulation, a tradition that continues to the present day. While there is logic to self regulation it has also created problems. Licensing boards were intended to operate in the public interest. However, experience has proven that they are not necessarily effective in taking action against the incompetent and that they have operated to protect the economic interests of those they license.

LICENSURE IN ENGINEERING

The first licensing of engineers occurred in Wyoming in 1907 to address problems that had and were occurring in land surveying, water rights, and water diversion. Although these problems were caused by surveyors, since surveying was a branch of civil engineering at the time engineers were the ones subjected to state control. Wyoming was followed by Louisiana in 1908. The first all-inclusive engineering licensing law was adopted by Florida in 1917. Other states followed the lead of these pioneers. However, there was no rush to embrace licensing. By 1920 there were 10 licensing boards, seven of which acted to form the Council of State Boards of Engineering Examiners (CSBEE), the predecessor of today's NCEES (National Council of Examiners for Engineering and Surveying). These beginning licensure efforts emphasized experience as the primary qualification and varied from state to state reflecting the particular needs and political considerations of each state.

In 1929, ASCE proposed a model law for licensing of engineers in an attempt to establish some uniformity. It was debated at conferences including all engineering societies of the day over the next three years. Finally, in 1932 a revised draft was adopted by the NCSBEE. This was the same year that Engineers Council for Professional Development (ECPD), the predecessor of ABET (Accreditation Board for Engineering and Technology) was established to provide input of practicing engineers into the curricula of engineering schools.

It is important to recall that when the above events were unfolding the U.S was entering the Great Depression. The well being of engineers was a concern of the engineering societies and the American Association of Engineers, an organization founded in 1914. This concern was a key factor leading to the formation of the National Society of Professional Engineers in 1934 which limited its membership to licensed engineers. By this time there were 28 states which licensed engineers. NSPE, nationally, and state engineering societies continued to press the states for licensing of engineers stressing the public protection it provided. Opponents of licensing, and there were many, stressed that it was a Trojan horse for unionization of engineers — unionization was an anathema of industry in those times. However, by 1950 all states and Alaska, Hawaii, the District of Columbia and Puerto Rico had passed licensing or registration laws of some kind governing the practice of engineering. Generally, these early laws included exemptions for engineers working for industry, utilities, and in many governmental positions and focused on only those offering to perform engineering services for the public, establishing a pattern that continues to the present.

The format of the current licensing system began to take shape with the administration of the first NCSBEE Fundamentals of Engineering examination in 1965. The first Principals and Practice of Engineering (PE) examination was administered the following year. Although there were national examinations, not all states used them. It took another 20 years before uniform national examinations were employed to license engineers. During this period the NCEES Model Law was modified on several occasions to keep pace with changes in credentialing procedures and practices.

CERTIFICATION

Certification grew out of a desire by ophthalmologists (already licensed as physicians) to distinguish themselves as possessing unique and special training in the care of eyes in 1911. The success of the ophthalmologists led to the creation of other certification boards for other medical specialties practiced by physicians in the ensuing decades. By the early 1950s, specialty certification was an established, accepted practice in medicine.

Before EPA was created in 1970, environmental laws and regulations were administered by the U.S. Public Health Service and State Health Departments. This organizational arrangement fostered close working relations between the sanitary engineers and physicians employed by these agencies. Sanitary engineers, specialists generally trained as civil engineers, believed that certification modeled on the practices of their physician colleagues would be beneficial to them. The ensuing discussions led to the formation of the Academy of Sanitary Engineers in 1955, the predecessor of today's American Academy of Environmental Engineers. This embrace of certification by engineers was unique to sanitary engineers and eschewed by other specialties of civil engineering and other engineering disciplines.

However, other professions allied or involved with the delivery of medical services did accept certification. They came to this position reluctantly, preferring licensure which before 1970 was recognized by insurance companies and the newly formed Medicare program as qualification for reimbursement. But the press for licensing by the allied health professions created such confusion in health care that the Federal Department of Health, Education, and Welfare called for a moratorium on these licensing efforts in the early 1970s. As a result, the allied health professions converted their licensing proposals to national certification programs which embraced the practices those proposals included — a focus on minimum competency and the use of written examinations to measure qualifications.

Certification in many other occupations followed the lead of the allied health professions with varying degrees if success. Some certification programs became “the” credential to have in their occupations and enjoy substantial support. Others were accepted by only a few. Overall, there are more than 1000 occupational certification programs available today.

THE CIVIL RIGHTS ACT OF 1964

The Civil Rights Act of 1964 and similar state civil rights legislation that it spawned created a dramatic change in credentialing. This change occurred because these laws made illegal discrimination against individuals based on race, sex, etc. The laws did, however, permit discrimination based on qualifications.

For those issuing credentials it became necessary to ensure that the procedures they employed objectively measured an individual's qualifications. This gave rise to a new specialist, the psychometrician, and psychometric techniques for measuring an individual's capability to perform. The preferred measurement technique became the written examination.

In the years since this paradigm change, psychometrics became increasingly sophisticated in the techniques employed. These changes were not only the result of the normal evolution of a field of practice, but a response to litigation, primarily in medicine, that challenged both licensing and certification boards to demonstrate their objectivity.

ACCREDITATION OF CERTIFICATION

In 1974, the Institute of Public Administration completed the Feasibility Study of a Voluntary National Certification System for Allied Health Personnel. The study concluded that a system of voluntary certification could credential allied health professionals and that government involvement, other than providing policies recognizing the value of such certifications, was not required. This conclusion led the allied health organizations to found the National Commission for Health Certifying Agencies (NCHCA) in 1977 to develop certification standards. The intent was to evaluate certification programs against those standards and identify those which satisfied them. Financial support for the creation of NCHCA was provided by the federal government.

In 1987, NCHCA was renamed as the National Organization of Competency Assurance (NOCA) and its mission expanded to be a membership and resource organization for all interested in certification. To address the accrediting function, the original purpose of NCHCA, NOCA created the National Commission for Certifying Agencies (NCCA) in 1989.

Equally dramatic changes were occurring during this same period, the 1970s and 1980s, in sanitary engineering or environmental engineering as it had come to be named. Following the proliferation of legislation that occurred in the early 1970s demonstrating the federal and related state governments' commitment to protecting the environment, many engineers rushed to become environmental engineers. From a relatively small specialty of primarily civil engineers, environmental engineering grew by leaps and bounds. These new environmental engineers came from many disciplines, often they were scientists or others who sometimes obtained graduate environmental engineering degrees and sometimes did not. By the mid-1980s several organizations and diploma mills were offering "environmental" certifications to these newcomers to the field. Much was at stake because the federal and state environmental legislation often included substantial financial support in the rush to clean up the environment. As is often the case, the combination of substantial government pressure to produce coupled with financial aid led to abuse, waste, and outright fraud.

The engineering profession, as a whole, became concerned believing that all engineers would be tarnished by what was happening in the environmental arena. As a result, NSPE organized a conference in 1988 to address the proliferation of certifications that was attended by representatives of most engineering organizations. From this meeting and others that followed, it became clear to many that an accrediting body was needed to regulate certification in an attempt to thwart the diploma mills.

As a result of these discussions, the Council of Engineering Specialty Boards (later renamed as the Council of Engineering and Scientific Specialty Boards) (CESB) was formed in 1990. Unlike NCHCA, NOCA, NCCA, it did not enjoy broad support by the engineering profession. Nor, was any government financial aid or financial support from engineering as whole provided. Six certification organizations and four engineering-wide organizations were the founding members of CESB. Like NCCA, the mission of CESB is to set standards for certification programs in engineering and related fields and accredit those programs found to be conforming to those standards.

In 1998, ASTM (American Society for Testing and Materials) issued Standard 1929-98. This standard described the elements of a properly organized and administered certification program for environmental professionals. While ASTM does not provide accreditation of certification programs, the Standard specifies independent accreditation as a key criterion that must be obtained if a certification program is to satisfy the Standard. It expressly identifies CESB and NCCA as organizations capable of providing the required accreditation.

Recently, the International Standards Organization, an organization with international scope, promulgated ISO Standard 17024. This standard defines quality standards for personnel credentials of all types; both licensing and certification are included. In the US, this Standard is being implemented by the American National Standards Institute (ANSI) as a result of an agreement between ISO and ANSI. Like NCCA and CESB, ANSI intends to accredit credentialing programs which voluntarily submit to its oversight and which comply with the ISO Standard.

CURRENT CONDITIONS

The credentialing of engineers and engineering related occupations in 2004 in the United States continues to be a work in progress. In summary:

- About 20% of the 2 million practicing engineers) are licensed
- About 70 organizations provide certification for engineering and engineering related specialties and for engineering technicians
- With a few exceptions, neither licensing nor certification enjoy support by all stakeholders — consumers, businesses, governments, and practitioners — in technology disciplines and specialties
- Accreditation of engineering and engineering certification programs has achieved modest acceptance, with most of the accredited programs operating in the environmental field
- Expansion of engineering continues with new specialties or disciplines, some with significant size potential such as software and biomedical engineering

THE FUTURE

Much remains to be done if credentialing of engineering and engineering related occupations is to enjoy the broad-based support of all stakeholders comparable to that enjoyed by those practicing in medicine. Most important is the need for consensus within the profession regarding the need for and form of credentials.

APPENDIX C
CERTIFICATION ACCOUNTABILITY

ABOUT CESB
(COUNCIL OF ENGINEERING & SCIENTIFIC SPECIALTY BOARDS)

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In the post-Watergate, post-Enron world today, neither public nor private organizations and institutions enjoy the public's trust and rightly so. The unethical and improper, if not illegal actions, of a few have compromised forever the trust that was once enjoyed without question.

Transparency and accountability have become essential attributes of responsible organizations. Open meetings, comprehensive reports, freedom of information and independent testing are among the several methods employed. Independent testing has been an accepted norm for products for decades — Underwriter's Laboratory, Good Housekeeping, Consumer Reports are a few of the more commonly known providers of such services on which the public has come to rely.

Testing as applied to products is not necessarily applicable to services performed by individuals. Here, credentials, such as licensing and certification, are employed to determine an individual's capability to perform a particular task or service. Today, there are more than 1000 professions and occupations ranging from appraisers to welders and every letter of the alphabet in between which are either licensed by the government or certified by some organization. While these institutions and organizations attest to an individual's qualifications, how does the public know that the persons so licensed or certified do indeed possess the represented qualifications? And, that is the question, albeit in more limited form, that has been presented to this panel.

BACKGROUND

A common problem in discussing credentials is that while there are just a few significant terms, these terms are universally abused. People say registration when the correct term is license; they say accreditation when the correct term is certification; and vice-versa. So I begin by providing the correct definitions of the relevant terms — credential, license, certification, and accreditation.

A *credential* is something that gives a title to credit or confidence; it is also a testimonial showing the person is entitled to credit or a right to exercise official power (Webster). Credentials can be university degrees, licenses, and/or certification.

A *license* is authorization granted by a government to perform a function or service, e.g., a driver's license, an engineering license, etc. Licensing is based on the police powers of government to protect the health, safety, and welfare of the public. It requires the demonstration of the minimum degree of competence needed to perform the authorized function.

Certification is a voluntary act that, according to some organized procedure, measures an individual's capability to perform a particular function. Because it is voluntary, it conveys no authority or privilege, i.e., one need not possess the certificate to legally perform a function or service, albeit custom or market forces may require it. Certification exists today in more than one thousand professions and trades.

Accreditation is like certification in that it is voluntary and measures capability to perform. It differs in that it applies to institutions and programs, not individuals. A familiar example is the accreditation of education programs. Another is accreditation of certification programs.

ABOUT CREDENTIALING

All credentials are founded on the body of knowledge they embrace. Or, said another way, the name of the credential describes, in a general, summary way the knowledge the credential holder possesses.

Secondly, there must be a systematic method by which an individual's capability is objectively assessed. Typically, this is a written examination or examinations using objective type (multiple choice) test items or free response type (essay questions) test items. However, oral examinations, portfolio reviews, and real world performance can also be used.

The scoring system(s) employed must be free of bias — race, gender, etc. — and determine, by an appropriately set passing score, that the individual has the minimum amount of the body of knowledge to hold the credential. Therefore, the objective, written examination has become the preferred assessment method.

Credentialing has many functions, but its most important function, in all its many forms, is to protect the public from those lacking the requisite capability to properly practice a profession or perform a service. Any credential of human capability is an intangible quality. It cannot guarantee performance, but only offers an increased probability of a successful result.

Secondly, credentialing provides value to the credential holder by:

- being useful,
- providing differentiation,
- recognizing achievement,
- conferring economic benefit, and
- providing personal satisfaction.

A credential also provides leadership in the profession it serves, i.e., it defines an objective to which the profession's practitioners should aspire.

WHICH CREDENTIAL?

The need for and desirability of a credential is dependent upon laws, regulations, and market forces. If a credential is mandated by law, it is a license. Licenses are a well-established government function dating back to the beginning of the 20th century. Post-Watergate, a number of procedures and processes were adopted to ensure that the public can rely upon the government license-granting agencies to properly discharge their responsibilities and to regulate those that they have licensed. The effects of these changes are well known. Also, there are national organizations which act to ensure uniformity and compliance with recognized credentialing practices in licensing of different professions. In engineering for example, this role is filled by the National Council of Examiners for Engineering and Surveying (NCEES), an organization of all state engineer licensing boards.

Education degrees and certification are customarily desired or required by market forces and in some instances by regulation. For example, it is common to expect a person seeking an engineering job to have an engineering degree. But, which school offers an acceptable engineering degree? Accepted engineering education programs are those which have been accredited by the Accreditation Board for Engineering and Technology or ABET as it is commonly known. Most engineering degree programs are accredited, but not all. ABET accreditation has become universally accepted as is the measure of a proper engineering education. For other disciplines, there are other organizations which accredit college degrees. Accreditation has become the norm for measuring the quality of college degree programs.

Certifications are far less regulated than licenses and education degrees for two reasons:

- **They are a relatively new phenomenon.** Until the last two to three decades certification was not typical. Yet, within this time period, many occupations came to see the value of certification in an increasingly complex world of specialists.

- **They are not required by law.** Across all types of certifications, it is estimated that no more than 150 certification programs are accredited, most of which are in the health related professions.

As hundreds of not-for-profit and a few for-profit organizations embraced certification as a way to distinguish specialists for altruistic and economic reasons, it became apparent that not all certification programs were using proper credentialing practices. In some instances, this was the result of ignorance, in others it was because of economics or greed.

The leaders in certification established accreditation of certification programs to address this need. The first accreditation organization for certification programs was the American Board of Medical Specialists (ABMS). It focused on physician specialty certification. ABMS was followed in the 1970s by the National Council of Certifying Agencies (NCCA). It accredits those programs certifying health professionals allied with the practice of medicine; and, it will also accredit certification programs in non-health fields.

The proliferation of environmental certifications in the 1980s, a byproduct of the boom in hazardous waste cleanup work, raised concern in the engineering and technology communities regarding the legitimacy of many of these credentials. After a couple of years of discussion, these communities formed the Council of Engineering and Scientific Specialty Boards (CESB) in 1990 for the purpose of accrediting certification programs in engineering and related fields. Because of the culture in these fields, CESB accredits programs certifying licensed engineers, graduate engineers, professionals in engineering-related fields and engineering technicians. CESB accreditation is recognized by ASTM in its Standard E1929-98 (Standard Practice for Certification Programs for Environmental Professionals) and others as the measure of properly operated certification programs in engineering and technology.

The standards of each of these accreditation organizations are substantially the same with some minor variation to accommodate the differences in the professions. The CESB standards, Guidelines for Engineering and Related Specialty Certification Programs can be viewed in detail on CESB's website — www.cesb.org. Each examine a certification program in detail determine if it is in full or substantial compliance with these standards before awarding accreditation.

The organizations with certification programs accredited by CESB include:

- AACE International
- Academy of Board Certified Environmental Professionals
- American Academy of Environmental Engineers
- American Board of Health Physics
- American Board of Industrial Hygiene
- Board of Certified Safety Professionals
- Board of Environmental, Health & Safety Auditor Certifications
- Institute of Hazardous Materials Management
- Institute of Professional Environmental Practice
- National Academy of Forensic Engineers

SUMMARY

Certification, properly performed, can provide many benefits to the credential holder as well as help the public identify appropriately qualified specialists. It is incumbent upon the individual seeking certification to choose the certification(s) appropriate to the individual's profession and specialty. Accreditation of a certification program assures the individual that the program has been examined and determined to employ recognized credentialing practices in granting the certification it awards.

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