The Comparative Study on the Certification Standards of U.S. Security Engineering Professional Education and the Qualification of Registered Safety Engineer

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Abstract: At present, The Accreditation Board for Engineering and Technology (ABET) in the US enjoys high recognition in the world and their experience is of great value to the development of our accreditation mechanism on engineering. Qualitative and quantitative research methods are adopted while combining questionnaire method, interview study, literature analysis and comparative research method. The article conducts an in-depth contrastive analysis on the accreditation mechanism in China and the US. The research findings show that there are some deficiencies in the security engineering education. Under the circumstances, the research analyses the disadvantages puts forward the corresponding countermeasures and relevant suggestions.

Keywords: AEBT, Comparative Study, Certification Standards, Registered Safety Engineer

1 Instruction

China has carried out the system of registration safety engineer operation qualification from 2002; develop the safety engineering professional certification system in the senior engineering course of undergraduate education. And international safety personnel interchange becomes more and more frequently as the global integration. The subject is to be solve, that is how to educate the qualified person who is suitable for safe requirement of all kinds business, special for the safety person who can obtain the certification from the range of international. The purpose of developing safety engineering subject in China is that the person has been training in senior university will be used to the requirement of society. The safety engineering certification subject has already acquired some achievements in Chinese senior university, but still has long way to go. Therefore, it is very important to reference the experience from abroad, especial from the American ABET engineering certification system, which has great significance for Chinese safety engineering education to train the safety engineer who can meet the social requirement.

2 The summarization of safety engineering education subject certification in USA

Safety engineering education subject is authenticated by Accreditation Board for Engineering and Technology (ABET).

2.1 The area of occupational safety and health in USA
The modern area of occupational safety and health in USA not only include the traditional four aspect-namely, occupational safety, industrial hygiene, occupational medicine, and occupational health nursing, but also other three new realm- employee assistance professionals, ergonomists, and occupational health psychologists.

2.2 The status of education about occupational safety and health
American Society of Safety Engineers (ASSE) confirm the worker for safety by four basic aspect: ① forecast, indentify and estimate the dangerous factor and operation; ② work for the control of design, method, process and plan about dangerous factor; ③ carry out the program on dangerous control; ④
measure, auditing, estimate the validity of control.
Presently, approximately half percent worker relate to safety have the Bachelor degree, about 30 percent professional person relate to safety own Bachelor of Science, several of them come from other subject realm (such as engineering, business, physics etc), then study the subject relate to safety.

2.3 Synopsis of education about occupational safety and health
With respect to the class on education, there are several classes as follows:
⑴associate degree or a certificate: a number of community and junior colleges duration 2 years, credit hour could transfer to phase of Bachelor degree.
⑵Bachelor of Science: about 32 schools have the Bachelor of Science program. About 24 schools(include university, independent colleges and universities, institute of technology, community college) can supply the program about occupational safety as the assistant bachelor degree, 2 years safety education relate to degree, associate degree or a certificate etc.
⑶master’s degree: about 31 colleges have the program relate to master’s degree, MA (master of arts), MS (master of science), MPH (master of public health degrees), refer to agriculture, mining, construction, and chemical processes etc.
⑷Doctoral programs: There is 9 colleges have the Doctoral programs.

2.4 Design for bachelor degree program
With regard to origin of student, the student of America subject about safety engineering who are the adult and a lot of them have several years work experiences and other realm education experience.
With regard to sort of the program, America college safety subject includes basic course, core course in specialty, compulsory occupational course, and optional subjects. With regard to consist of the program, includes methodology course, technology engineer course, behavior course, and medical science course.

<table>
<thead>
<tr>
<th>Sort of program</th>
<th>Name of course</th>
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<tbody>
<tr>
<td>basic course</td>
<td>mathematics, computer, physics, chemistry, anatomy, biostatistics, epidemiology, medicine etc.</td>
</tr>
<tr>
<td>core course in specialty</td>
<td>engineering control of risk factors, security of health and economic , safety philosophy, management and organization science, information exchange and language arts, introduction to system safety, accident prevention and control etc.</td>
</tr>
<tr>
<td>compulsory occupational course</td>
<td>Safety assessment, accident investigation, safety behavior, safety education and training methods etc.</td>
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<tr>
<td>optional subjects</td>
<td>According to the feature of schools, set up plan of program independently, such as special industrial sector (oil and gas industry safety, etc.), the ordinary concept of security (public safety policy, safety and security of simulation models etc.</td>
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2.5 The employment situation of graduates on occupational safety and health
The students of occupational safety and health after graduation is mainly engaged in manufacturing, mining, transportation, agriculture, chemical, oil refining, construction industry, or in the service industry. In the earlier, some students work in basic safety job-site, the last has been rose to the safety head of large companies. Many security managers are enhanced to the head of other department that special emphasis on security.
2.6 The graduates of occupational safety engage the work relate to the security situation
American Society of Safety Engineers (ASSE) statistics the status of occupational safety graduate students, in the 1995-1999 periods:
Bachelor degree: stable at 45-55%
   Master degree: from 75% to 94%
   Doctor of Philosophy: 100%

2.7 Certified Safety Professional (CSP)
The Board of Certified Safety Professionals (BCSP) assesses the applications, which meets the requirements for the Certified Security Professional certification, and issue the Certified Safety Professional (CSP).
The priority conditions that obtain Certified Safety Professional (CSP) are: get the Bachelor of Science degree accredited by ABET, 4 years work experience in security, through the examination organized by the BCSP.
Since many people engaged in security professional with non-security education background, such persons must be send in the verification that have occupational safety work experience and diploma instead of safety science degree.

3 Safety engineering education in China

3.1 The current situation of safety engineering education in China
As of 2007, China colleges which offered safety engineering subject (including the Independent Institute) total to 103 (only filed in the Ministry of Education) schools, in which 98 schools are college or university, 90 schools with safety engineering undergraduate.
At present China has 20 colleges or universities can confer the Doctor degree of "safety technology and engineering ", 44 colleges or universities have the right to grant master's degree on "safety technology and engineering," (not including research institutes); there is a lot of colleges offer safety engineering in different types, involving military, aviation, chemical, petroleum, mining, civil engineering, transportation, energy, environment, economy and so on several areas, demonstrated safety discipline is a integrated science that involved very wide application areas.

3.2 The analysis on undergraduate education curriculum of safety engineering
Safety engineering discipline of the basic curriculum of undergraduate education can be divided into basic courses, specialized basic courses and specialized courses and elective four parts.

4 Overview of safety engineering certification in China
Compared with developed countries, engineering education in China started relatively late. The main objectives to carry out engineering education are: Construction of Chinese engineering education quality monitoring system; promote the reform of engineering education; enhance education in engineering practice, further improve the quality of engineering education; establish the coherent education system of registered engineers and professional accreditation system, build the links between the business community and engineering education system, enhance the industry development adaptability by engineering education, facilitating the employment of personnel; promote Chinese engineering education participate in international exchanges, achieve international mutual recognition and enhance international competitiveness.
In 2008, China Engineering Education Accreditation based on mechanical engineering, chemical engineering, computer science, electrical and automation, and adds the security engineering education.
Safety engineering certification process includes six basic stages: ① certification for application; ②
school self-evaluation; ③ Review "self-assessment report"; ④ field test: ⑤ consideration and make a
certification results; ⑥ maintain certification status.

Safety Engineering Education Accreditation standards include two parts: common standards and
additional safety standards, general standards covers seven key aspects, namely professional goals,
quality assessment, curriculum, teaching staff, support conditions, student development and
Management system.

Complementary standards of Safety Engineering Education Accreditation, further defined the
professional requirements and curriculum system. The objectives of safety training for undergraduate
education are: promote scientific development by security technology, train for adapt to the needs of
socialist market economy, master the basic theory of safety management, safety engineering technology,
knowledge and basic skills, have the basic ability and quality of engaging in safety engineering
Research, design, testing, evaluation, monitoring and management, and have moral, intellectual and
physical development of advanced security professionals. Focus on the training of basic knowledge and
application ability on safety science, safety technology. So that the trained people meet require of
certified safety engineer and can engage in work on safety.

Regard to the training requirements of safety engineering undergraduate, need the following capabilities:
① comprehensive master the basic knowledge, engineering knowledge, evaluation of safety
management and safety knowledge; ② master basic computer knowledge, at least a computer
Programming language, with strong computer skills; ③ master a foreign language, with listening,
speaking, reading and writing skills and the ability of the skilled application of professional learning; ④
with independent access to knowledge, proposed, analyzed, and problem-solving ability, initial grasp of
scientific research, technology development and organization Management capacity; ⑤ have the special
knowledge and know the forefront trends with a strong practical ability, adaptability and innovation.

In the curriculum, the safety program for undergraduate teaching must include basic curriculum, basic
professional curriculum, professional course system and system of optional subjects.

Test requirements in the professional, school can choose from the following experiment at least 1 / 3
base on The actual situation of their own: security management experiment, measurement of
environmental parameters, ergonomics experiments, equipment safety inspection, gas detection and
analysis of experiments, fire prevention explosion test, comprehensive test of security information
collection, remote monitoring security experiment, fire monitoring experiments, component defect
detection, electrical equipment safety testing laboratory, dust detection and analysis of experimental,
industrial equipment secure on-line monitoring experiment, disaster prevention simulation, requires at
least 10 credits on experiment.

Regard to the professional practice and academic practice, require to set at least 30 credits, mainly basis
on academic basic practice and professional practice. The academic basic practice includes
metalworking, security awareness training, engineering training and production practice. Professional
practice which include the course design of safety management and safety evaluation, practical training
courses and other accessories. In addition to the conventional practiced and participating in production
practice, it should establish a relatively stable practice base and close connection of research and
production, some of them computer simulation can be practical, to train students skill on changing
circumstances of production operating conditions, to make them regulate, control and decision-making
with the changing, to supplement the training of general practice that difficult to achieve, to deepening
understand the actual production process.

For the thesis, the requirements focus on training students in the spirit of independent research capacity
and collaboration, in particular, to foster the ability of innovation and encourage new ideas, new
improvements, and new discoveries. Topic should have learned, combined with the engineering practice,
considering various constraints, including topics argument paper, a literature survey, technical survey,
design or experiment, the results of drawing.

Released by the Ministry of Education-National College and Career information Center from 226
subjects in colleges in 2007 on employment can be seen, safety engineering ranked No. 42, over the international business and other popular professional, relatively good employment situation. Such as the China University of Mining (Beijing), safety engineering as major disciplines university, the rate of employment reach to 100%.

The statistical results from the "safety engineering discipline professional development strategy research report” 66% of graduates on safety engineering into the business enterprise, 23% into the government and business sectors such as security monitoring, 11% into other areas (Include joining examination for graduate studies, study abroad, own businesses, etc.). Data on safety engineering undergraduate course about the employment situation is very satisfactory.

5 The analysis on differences between China and America in engineering undergraduate education

5.1 Differences in subject classification
U.S. Occupational Safety and Health is a part of public health disciplines, which studies the problem of safety, health, property damage, efficiency, impact and other issues in organization and its members in professional activities, mainly to solve the personal health and property safety and loss in the enterprises and institutions and other issues.
China’s safety engineering comes from the mine safety, the main object of study for the accident, the main research is to prevent and control accidents loss caused by the accident. Mainly solve, such as coal, petroleum, construction industries, other special security and control issues.

5.2 Differences in school education
U.S. schools offer undergraduate security around 40. The background of security with a diversity of disciplines, all types of universities is widely distributed.
As China's economic development, national increase the degree of attention on security engineering, more and more colleges and universities offer undergraduate security projects. From the number of the schools which start to offer safety engineering subject, 2000 to 2007 over 60 colleges and universities offer undergraduate security engineering, achieved twice the total number of schools in 2000(There are 30 colleges and universities that offer undergraduate safety engineering). Up to now, China’s number of colleges and universities that offer the safety engineering subject has the United States.

5.3 Difference in training objectives
U.S. colleges and universities which offer the safety engineering specialty focus on the field of public health, subjects can be roughly summarized as the safety of human activities, health-related factors and loss of control. The training of security personnel requirements applies to most of the public domain.
In China, disciplines of safety engineering focused on the areas of operation safety and security technologies, subjects for the accident, purpose of the study for the prevention of damage caused by accident. The security personnel are required to have a strong industry background can be applied to solve practical problems arising in the work by the way of safety engineering.

5.4 Curriculum differences
In the categories of course, the two countries is basically the same safety engineering, are the basic courses, specialized courses and elective courses.
China and the U.S. in safety engineering curriculum on the fundamental difference is not much, but in the professional setup of the course were quite different. More emphasis on methodology in Chinese universities and technology-related safety courses, and aspects for psychological and medical were less concerned. American college curriculum is relatively balanced, although the focus is also the course methodology and security technologies, but also offers a number of the curriculum of medical and psychological aspects. In the United States pay more attention to industrial health and physical health
problems, China’s security engineering education is more emphasis on the using the engineering methods to solve practical production arising.

5.5 Differential in role of professional certification
In the U.S., professional certification carried out earlier, the ABET accredited engineering school graduates, either to work or participate in Certified Security Professional (CSP), be given a degree of priority qualification. Carrying out the work of the professional certification later, social awareness is not high; safety engineering education and exam of the certified safety engineer have been not connected.

6 Conclusion: Development proposals of security engineering education

6.1 Enhance safety engineering disciplines, science curriculum construction
Safety engineering discipline is interdisciplinary, that establish based on science and technology. Recent years in China, safety engineering undergraduate education, scientific research ability in general heavy attention and light engineering practice ability, students of engineering design and practical ability have generally fallen. Implementation of the registered engineer, we must improve this situation. Therefore, colleges and universities should take the professional certification as an opportunity to further strengthen the teaching reform, strengthen the practice teaching, and strengthen co-operation with industrial enterprises, focus on students of engineering design and practical abilities. Education authorities and safety engineering department should increase multi-faceted supporting on the cross-disciplinary, further research the concept and system of disciplines, actively explore and expand research and innovative teaching, and promote the development of our country's security and enhance the engineering disciplines.

On the structure of undergraduate education in safety engineering knowledge, through years of study, has gradually formed its own professional science and technology system, based on the lateral for the arts and (arts and sciences combined), security infrastructure theory (basic principles), safety engineering theory (basic Knowledge), safety engineering (basic skills), 4 knowledge platform; its vertical expertise in the safety category, based on established safety equipment engineering, security "equipment, " Health, safety social engineering, security systems engineering, safety testing, 5 subjects testing technology, professional branch direction.

Universities should be funded under the required for the safe production and independently design safety courses, “tailored” to train people, meet the industry needs, business needs.

6.2 Speed up the security of professional certification; promote connection between safety professional accreditation and Registration
Safety of Engineers standards, security professional certification focuses on the establishment of long-term mechanism on teaching quality guarantee, through professional certification, safety engineering undergraduate education can contribute to more targeted training, employment channels more smooth; registered safety engineer disciplines clearer, more office based solid; promote safety engineering education and registration of safety engineers the social reputation, play a greater role in the national economy.

China can learn the accreditation way from ABET- through authentication of the school which offer safety engineering education, timely manner the results to the public, educational institutions only through the authentication, the security engineering graduates can be recognized by society. Make the professional certification and further assessment courses which will be carried out to match, support the mach about system safety engineer and the registration, so that lay a solid knowledge base for the growing of safety engineers. In-depth assessment, the implementation security standards for safety engineer certification and registration of convergence, qualified school graduates apply for registration as a safety engineer priority conditions. Safety Engineering Undergraduate Education certification in
China has just started, for the security engineering certification for positive and healthy development continues, standards need to be further improved, further work is required, the channels of international cooperation need to be further expanded. I believe that insist on the general direction of safety engineering education in training, social services, scientific research, a closely integrated with economic development, college safety education system base on registered safety engineer will further develop.

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