

EVALUATING A SAFETY DEGREE CURRICULUM USING JOB ANALYSIS FOR PROFESSIONAL SAFETY PRACTICE

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Background

One of the accreditation requirements for certification boards is to ensure content validity for the examination(s) leading to the certification awarded. The certifying organization must demonstrate through recognized methodologies that the examination contents cover what people actually do in practice and the knowledge and skills required to be able to perform their work. In achieving accreditation through the standards of ANSI/ISO/IEC 17024 relating to certification of persons and the standards of the National Commission for Certifying Agencies, the Board of Certified Safety Professionals demonstrated that the contents of the examinations leading to the Certified Safety Professional® (CSP®) designation cover what safety professionals do in practice.

The approach used to demonstrate content validity for certification examinations is virtually identical to studies used to establish the contents of training and education programs for trades and professions. The approach is called job analysis or role delineation. The methodology outlines what people do (functions or domains and tasks or responsibilities) and the knowledge and skills required to perform each task. Completion of such studies is expensive, in part driven by the number of participants in the study. As a result, unless practice for a trade or profession changes rapidly, organizations perform such studies every few years only.

The purpose of this article is to summarize the most recent job analysis study conducted for the Certified Safety Professional and to demonstrate how to use the results to evaluate an academic curriculum that prepares people for professional safety practice.

Job Analysis Methodology

In 1999, the Board of Certified Safety Professionals completed its most recent study of professional safety practice. The study¹ was conducted in three stages, following the currently recognized procedures used by certification and licensure boards.

¹ *Job Analysis Study for Certified Safety Professional Examinations*, BCSP Technical Report 2001-1, Board of Certified Safety Professionals, Savoy, IL, February 2001.

The first stage involved a panel of 16 people, each from a different job setting in professional safety. The study report provides details on panel members. A facilitator led the three-day procedure. The process began by defining the major functions (also called domains) of professional safety practice. The group then defined the tasks (also called responsibilities) that make up each job function. In each step, the group reached consensus on the wording of each function and task. In the final task, the panel defined the knowledge and skills essential for each task. This resulted in 192 knowledge and 147 skill statements that define professional safety practice. Among the knowledge and skill statements, there are approximately 130 unique knowledge statements and 123 unique skill statements.

The second stage involved drafting a mail-out survey and pilot testing it. The purpose of the survey was to validate the work of the panel and to acquire ratings of each function and task on three rating scales. The purpose of the pilot study was to gain feedback on the survey content and format in order to refine the instrument and to identify any gaps in the definitions of practice. The pilot survey went to approximately 300 safety professionals in practice.

In the third stage of the job analysis study, about 3000 safety professionals received the survey instrument. About 1500 completed and returned the survey. All survey recipients held the Certified Safety Professional designation.

The survey asked respondents to rate the safety professional job functions and tasks on three scales. One rating was the importance of each function and task in the respondent's own practice. The second rating was the time spent in individual practice on each function and task. The third rating involved criticality in terms of protecting the public should someone fail to perform the function or task effectively.

Job Analysis Results

The survey results were compiled and analyzed. One result was the verification of the description of functions and tasks of practice.

Another result was estimating the portion of the examination that should be devoted to each function and task. The estimates are derived from the combination of the three ratings provided by each respondent. The study report details the computational procedure. The procedure establishes the recommended weighting for each function. The complete outline of functions, tasks, knowledge and skills with the final weighting (in percent of the examination contents) for each function is called the examination blueprint (see Appendix A).

Converting Job Analysis Results to Knowledge and Skill Outlines

When considering what knowledge one needs for practice, it is useful to organize the information into subject groups, rather than organizing the information around the functions and tasks of practice. After reviewing knowledge and skill statements, the author created a subject classification scheme to complete this stage of analysis. There is not likely to be full agreement on subject group titles or on which knowledge and skill statements should be assigned to a group. The overall goal was to create a reasonable scheme for the purposes of this paper.

There are two major groups of subjects for classifying knowledge statements. The first involves general subjects and the second involves more specific knowledge of particular safety subjects. Within each major group, knowledge statements are assigned to specific subjects. Appendix B is a complete listing of knowledge statements organized by group and subject.

The skills from the job analysis study of professional safety practice were analyzed in a similar manner and classified into major skill groups. Appendix C lists the skills by skill group.

Results of the Conversion Activity

One can estimate the importance and relevance of a subject in professional safety practice from the number of knowledge statements falling under a specific subject. The original study identified 192 knowledge statements. Some knowledge statements occur more than once. The weighting for each subject assumes that each knowledge statement represents approximately $\frac{1}{2}$ percent ($100\%/192$ statements = 0.52) of all of the knowledge covered by practice in general. The number of knowledge statements occurring within a subject is then an estimate of the importance and relevance of the subject across all of practice. For example, if a subject contained 20 knowledge statements, including repeated knowledge statements, then 10 percent of the training for professional safety practice might be devoted to the subject. This provides a general indication of the importance of the subject for professional safety practice. Some subjects may also be important in specific areas of practice and be under-estimated or over-estimated by this approach. Table 1 is a list of the group names, subjects and percent of practice weightings.

Table 1. Safety Knowledge Statement Groups and Subjects

Group/Subject	Number of Statements	Number of Different Statements	Percent of Practice
GENERAL	100	69	52
A. Laws, Regulations, Standards, & Government	9	3	4.7
B. Mathematics, Statistics, Physical & Chemical Sciences	11	5	5.7
C. Technology (Engineering, Facilities, Equipment, Processes, Computers & Systems)	16	14	8.3
D. Behavioral and Organizational Science	17	10	8.8
E. Business and Management	15	13	7.8
F. Training and Education	19	11	9.9
G. Communication	14	12	7.3
H. Security	1	1	0.5
SAFETY, HEALTH, ENVIRONMENT AND ERGONOMICS	92	61	48
A. General	3	2	1.6
B. SHE in Design, Controls, Technology	7	6	3.6
C. Risk Management and Insurance	9	4	4.7
D. Safety Management	9	9	4.7
E. Inspections, Investigations, Audits	5	5	2.6
F. Fire Protection	4	1	2.1
G. Industrial Hygiene	5	4	2.6
H. Ergonomics	3	2	1.6
I. Environmental	4	2	2.1
J. Emergencies & Emergency Response	5	5	2.6
K. Professional Development and Ethics	20	15	10.4
L. Applied SHE - Construction	4	2	2.1
M. Applied SHE - Transportation	1	1	0.5
N. Applied SHE - Product Safety	2	1	1.0
O. Applied SHE - Process/Petro-Chemical	3	2	1.6
P. Applied SHE - Systems	3	2	1.6

Figure 1 shows the distribution of knowledge statements based on weighting among subjects within the first group, General Subjects. Figure 2 shows the distribution among the specific Safety, Health and Environmental Subjects.

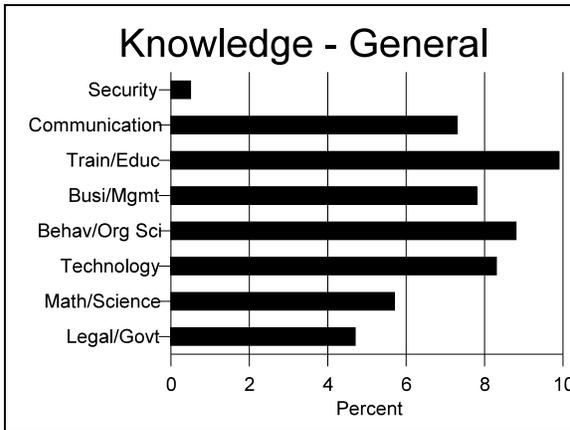


Figure 1. Distributuion of General Knowledge Statements

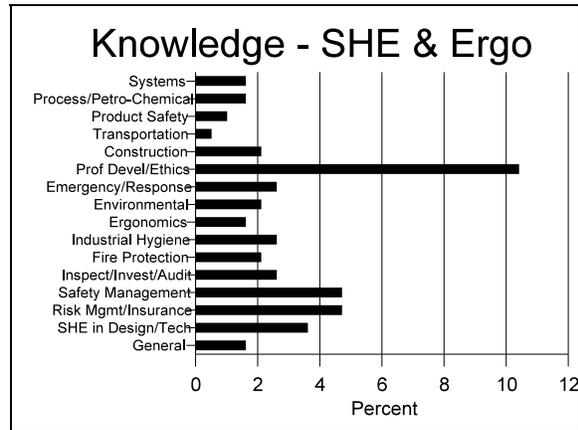


Figure 2. Distribution of Specific SH&E Knowledge Statements

The importance of each skill group was estimated in a manner similar to that used for knowledge statements. Since the job study identified 147 skill statements, including repeated skills across functions and tasks, one can estimate the value of each skill statement at approximately 0.68 percent ($100\%/147 = 0.68$). The total value for a skills grouping is the number of skills times 0.68 percent. Table 2 identifies the skill groups and the weighting for each group. Figure 3 shows the distribution of skill statements among the skill groups based on group weighting.

Table 2. Safety Skills

Group/Subject	Number of Statements	Number of Different Statements	Percent of Practice
A. General and Applied Interpreting Skills	15	8	10.2
B. Ethics Application Skills	7	1	4.8
C. General and Applied Mathematical, Analytical and Scientific Skills	11	6	7.5
D. Creative Skills	2	2	1.4
E. General and Applied Verbal Communication Skills	27	19	18.4
F. General and Applied Written Communication Skills	13	13	8.8
G. General and Applied Training Skills	16	16	10.9
H. General and Applied Computer and System Skills	16	15	10.9
I. Applied Safety and Health Skills	13	13	8.8
J. Inspection and Investigative Skills	7	6	4.8
K. General and Applied Human Behavior Skills	13	10	8.8
L. General and Applied Business, Organization and Leadership Skills	17	14	11.6

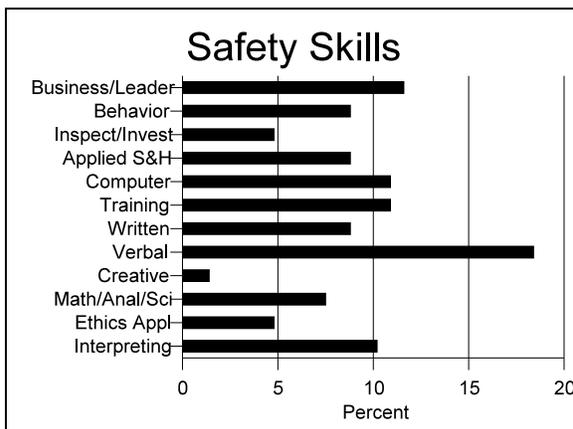


Figure 3. Distribution of Skill Statements

Evaluating a Curriculum

Most certification and licensure examinations test knowledge and not skills. However, academic programs help students acquire both knowledge and skills.

One can use the job analysis data to identify whether particular courses cover various knowledge and skills. The evaluation may cover only the courses in a safety degree major or all courses included in a degree program.

One approach for applying the job analysis data to evaluate a curriculum is to determine whether the curriculum covers the breadth of knowledge identified in the study. The procedure begins by creating one or more matrices. The vertical axis of a matrix is a list of courses by title and number. The list may include only the courses in the major or all courses in the degree program. The horizontal axis includes

a column for each knowledge group or subject. Because the matrix becomes large if there is a column for all subjects in both knowledge group, it may be easier to handle the evaluation in parts with a separate matrix for each group.

Once the matrix is established, someone with knowledge of the contents of each course can mark each cell in the matrix to indicate whether a course covers a knowledge group/subject at all. One may want to refer to the course syllabus in deciding how to mark the cell. Gaps in the matrix suggest where knowledge needed for practice is not covered.

A more detailed analysis may mark each matrix cell in terms of the amount of time a course devotes to a subject. In addition, a rating scheme might establish basic quantitative estimates of coverage. A rating scale might include ratings of “not at all,” “a little,” “moderately”, or “a great deal.” A rating scheme might also be based on level of difficulty, such as “not at all,” “elementary,” “intermediate,” or “advanced.” Gaps or marks indicating limited coverage may identify opportunities for improvement.

A third approach is to evaluate specific courses in depth. In this case, the evaluation issue is whether a course covers specific knowledge statements. One can estimate whether a course covers each individual knowledge statement relevant and important for the course. Table 3 provides an outline for this type of evaluation.

Table 3. Analysis of a Specific Course for Coverage of Knowledge Statements

Course ID and Title		
Covered?		KNOWLEDGE GROUP/SUBJECT and Knowledge Statements
Yes	No	COMMUNICATION
		D1R6K1 Communication and presentation techniques
		D2R4K4 Documentation protocol
		D2R4K6 Appropriate entities to contact for forms, approval and certifications
		D3R4K1 Graphic Design
		D3R4K3 English and grammar
		D3R4K4 Format for various types of media
		D3R4K5 Protocols for public announcements
		D3R4K7 Legal aspects of communication
		D3R6K4 Standards development
		D3R7K8 Data analysis and presentation
		D4R1K4 Formal and informal presentation techniques

Suppose there is a course that include the subject: “Inspections, Investigations and Audits.” One could review each knowledge statement in this subject (see Appendix B) to see if the five knowledge statements are adequately covered. If not, the analysis will suggest content improvements for the course.

In another example, a course may cover communication in the General knowledge group. One could rate the course by indicating that it covers communication knowledge a lot, but only at an elementary level. Further study of results might indicate that this course should be covering more advanced communication knowledge to complement the elementary level already covered in other courses.

One can also use the job analysis data to identify whether skills are developed in the entire program of study. Again, a general analysis or a precise analysis can reveal opportunities for improvement. The general analysis will identify whether skill groups are developed in particular courses. The precise analysis will identify whether specific skills are covered in a logical order during the entire educational program or within specific courses.

One might rate a course on both knowledge and skills. The example above relating to communication knowledge could be extended to communication skills. The analysis for skills may indicate that the course provides a limited opportunity to develop writing skills, but the skill development activities occur at an advanced level and nicely complement other courses that provide greater opportunity for writing skills at an elementary or intermediate level.

Whether one completes an evaluation at a general or detailed level, the results of the evaluation can identify potential improvements in specific courses or across the program of study for students entering or advancing in professional safety practice.

Summary

The job analysis studies conducted by BCSP to establish the examination blueprints for the Safety Fundamentals and Comprehensive Practice examinations that lead to the Certified Safety Professional designation are valuable resources for safety degree programs. The knowledge and skills defined in the job analysis studies are essential for effective professional safety practice. Schools offering a degree or courses in safety practice can compare the course contents to the knowledge and skills and identify whether the course and the entire program prepare students for effective professional safety practice.

Appendix A. The CSP Examination Blueprints

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Domain 1. Safety, Health and Environmental Management
(SAFETY FUNDAMENTALS - 37% • COMPREHENSIVE PRACTICE - 34%)

Responsibility 1. Design comprehensive management systems by defining requirements and developing policies, procedures and programs to protect people, property and the environment.

Knowledge	Skills
D1R1K1 Statutory and case law regulating safety, health and the environment	D1R1S1 Interpreting and applying regulations
D1R1K2 Operational process to design/develop safe work practices	D1R1S2 Applying inspection and control methods for potentially hazardous exposure
D1R1K3 Material process flow	D1R1S3 Mathematical and statistical analysis
D1R1K4 Safety, health and environmental sciences	D1R1S4 Analyzing production process hazards
D1R1K5 Design of hazard control systems (i.e. fall protection, scaffolding)	D1R1S5 Designing safe work practices for systems, facilities and equipment
D1R1K6 Design of record keeping systems that allow for collection, storage, interpretation and dissemination	D1R1S6 Interpreting and applying safety, health and environmental science data for process improvement
D1R1K7 Mathematics and statistics	D1R1S7 Interpersonal communication
D1R1K8 Methods and techniques for achieving safety through design	D1R1S8 Problem solving in incident investigation
D1R1K9 Methods and techniques for accident investigation	D1R1S9 Integrating safety system into the organizational culture
D1R1K10 Property protection (physical and intellectual) and security	D1R1S10 Designing effective training programs with emphasis on employee behavior
D1R1K11 Organizational theory and behavioral science	

Responsibility 2. Implement policies, procedures and programs through management systems to protect people, property and the environment.

Knowledge	Skills
D1R2K1 Organization theory and behavioral science	D1R2S1 Interpersonal communication
D1R2K2 Education and training methods	D1R2S2 Teaching and training in safety, health and environmental science areas and how they apply to the management system
D1R2K3 Basic sciences: chemistry, biology, physics, physiology and anatomy	D1R2S3 Utilizing basic science to explain safety, health and environmental D1R2S issues
D1R2K4 Safety, health and environmental sciences	D1R2S4 Developing systems to track implementation
	D1R2S5 Ensuring that delegation of authority and responsibility are in compliance with the management system design

Responsibility 3. Determine the effectiveness of management systems by measuring and evaluating protection of people, property and the environment.

Knowledge	Skills
D1R3K1 Quantitative and qualitative performance indicators	D1R3S1 Applying safety, health and environmental knowledge to determine system effectiveness
D1R3K2 Mathematics and statistics	D1R3S2 Mathematical and statistical analysis
D1R3K3 Basic sciences: chemistry, biology, physics, physiology and anatomy	D1R3S3 Applying management and behavioral science to determine system effectiveness
D1R3K4 Safety, health and environmental issues	D1R3S4 Interpreting regulations to ensure a compliant and effective system
D1R3K5 Management and behavioral sciences	D1R3S5 Using interpersonal communication
D1R3K6 Laws, standards and regulations	D1R3S6 Utilizing accepted system safety techniques to compare system to industry/consensus systems
D1R3K7 Safety management systems	D1R3S7 Sampling and making observations
D1R3K8 Education and training methods	D1R3S8 Improving policies and procedures
D1R3K9 Auditing techniques and management systems reviews	

Responsibility 4. Implement risk management strategies by using the results of hazard identification and risk analyses to eliminate and/or reduce harmful exposure to people, property and the environment.

Knowledge	Skills
<p>D1R4K1 Laws, standards and regulations D1R4K2 Processing operations (e.g., critical inputs, assessment and inventory) D1R4K3 Mathematics and statistics D1R4K4 Insurance practices (types and premium calculations) D1R4K5 Industrial hygiene including chemical, physical and biological agents D1R4K6 Safety engineering D1R4K7 Safety management D1R4K8 Fire prevention and protection including life safety D1R4K9 Construction safety D1R4K10 Education and training methods D1R4K11 Ergonomics program management D1R4K12 Transportation/fleet safety management D1R4K13 Workers' compensation and case management D1R4K14 Risk management concepts D1R4K15 Crisis management D1R4K16 Post incident and loss mitigation D1R4K17 Behavior modification D1R4K18 Safety through design process</p>	<p>D1R4S1 Interpreting laws, standards and regulations D1R4S2 Mathematical and statistical analysis D1R4S3 Analyzing process flow, management of critical D1R4Spaths/systems D1R4S4 Quantifying loss data and trends D1R4S5 Analyzing sampling results and other data to support decision making and prioritizing control recommendations D1R4S6 Organizing the results and recommendations into an effective training program D1R4S7 Managing safety through the design processes</p>

Responsibility 5. Apply sound business practices and economic principles for efficient use of resources to increase the value of the safety processes.

Knowledge	Skills
<p>D1R5K1 Business regulations and laws D1R5K2 Economics, accounting and statistics D1R5K3 Process management, material flow and procurement D1R5K4 Personnel development techniques D1R5K5 Insurance practices (types and premium calculations) D1R5K6 Drug/alcohol programs including Employee Assistance Programs D1R5K7 Capital budgeting and long range planning</p>	<p>D1R5S1 Writing job descriptions which include safety accountability as a line item D1R5S2 Quantifying the economic value of the safety process D1R5S3 Determining the most appropriate drug and alcohol testing programs D1R5S4 Acquiring, allocating and controlling human and material resources D1R5S5 Using performance evaluations to quantify the effectiveness of employee programs D1R5S6 Applying project controls (budgeting, scheduling, estimating) to maximize system efficiency D1R5S7 Using capital budgeting techniques, activity-based cost accounting and cost-benefit analysis</p>

Responsibility 6. Encourage participation through communication and other methods to ensure that all stakeholders (e.g., employees, managers, vendors, contractors) have an understanding and an active role in the formulation and implementation of safety processes.

Knowledge	Skills
<p>D1R6K1 Communication and presentation techniques D1R6K2 Organizational theory and behavioral science D1R6K3 Laws, standards and regulations which require employee participation D1R6K4 Economics and budgeting D1R6K5 Management principles D1R6K6 Employee participation committees D1R6K7 Labor relations, including union/management committees</p>	<p>D1R6S1 Communication and presentation D1R6S2 Organizational development D1R6S3 Interpreting and applying laws, standards and regulations D1R6S4 Problem solving D1R6S5 Behavior modification techniques D1R6S6 Using capital budgeting techniques, activity-based cost accounting and cost-benefit analysis D1R6S7 Implementing employee participation committees D1R6S8 Working with unions and management</p>

Domain 2. Safety, Health and Environmental Engineering
(SAFETY FUNDAMENTALS - 25% • COMPREHENSIVE PRACTICE - 31%)

Responsibility 1. Evaluate facilities, products, systems, equipment, workstations and processes by applying qualitative and quantitative techniques to identify the hazards and assess the associated risks.

Knowledge	Skills
D2R1K1 Methods and techniques for evaluation of facilities, products, systems, equipment, workstations and processes	D2R1S1 Applying methods and techniques for hazard identification, hazard evaluation, risk assessment and control
D2R1K2 Methods and techniques for measurement, sampling and analysis	D2R1S2 Using analytical equipment: monitoring and sampling equipment
D2R1K3 Specifications and drawings	D2R1S3 Interpreting plans, specifications and drawings
D2R1K4 Laws, standards and regulations	D2R1S4 Interpreting laws, standards and regulations
D2R1K5 Risk assessment techniques	D2R1S5 Consulting with subject-matter experts
D2R1K6 Characteristics and hazards of materials	D2R1S6 Consulting with equipment manufacturers/suppliers and construction contractors to assure safety control compliance
D2R1K7 Basic sciences: chemistry, biology, physics, physiology and anatomy	D2R1S7 Benchmarking with other companies in same industry for safety equipment/facility design, engineering and controls
D2R1K8 Applied engineering sciences: electronics, mechanics, thermodynamics, materials, structures, plant layout, etc.	
D2R1K9 Industrial hygiene, including chemical physical and biological agents	
D2R1K10 Fire protection and prevention, including life safety	
D2R1K11 Environmental protection and pollution prevention	
D2R1K12 Construction safety	
D2R1K13 System safety	
D2R1K14 Product safety	
D2R1K15 Behavioral sciences	
D2R1K16 Education and training methods	
D2R1K17 Ergonomics and human factors	
D2R1K18 Process safety	
D2R1K19 Physical and chemical characteristics of hazardous materials	
D2R1K20 Equipment and facility safety requirements	

Responsibility 2. Recommend controls through design, engineering and specification to eliminate or reduce the risks posed by safety, health and environmental hazards.

Knowledge	Skills
D2R2K1 Laws, standards and regulations	D2R2S1 Interpreting laws, standards and regulations
D2R2K2 Risk management	D2R2S2 Applying methods and techniques for hazard identification, hazard evaluation, risk assessment and control
D2R2K3 Record keeping, data collection and retrieval systems	D2R2S3 Using data collection, retrieval and analysis systems
D2R2K4 Materials	D2R2S4 Eliminating or controlling exposure to identified hazards by substitution, engineering or using PPE
D2R2K5 Basic sciences: chemistry, biology, physics, physiology and anatomy	D2R2S5 Consulting with subject matter experts
D2R2K6 Applied engineering sciences: electronics, mechanics, thermodynamics, materials, structures, plant layout, etc.	D2R2S6 Communicating risks that are present and appropriate control measures to management
D2R2K7 Industrial hygiene, including chemical, physical and biological agents	
D2R2K8 Fire protection and prevention, including life safety	
D2R2K9 Environmental protection and pollution prevention	
D2R2K10 Construction safety	
D2R2K11 System safety	
D2R2K12 Product safety	
D2R2K13 Behavioral sciences	
D2R2K14 Education and training methods	
D2R2K15 Ergonomics and human factors	
D2R2K16 Process safety	
D2R2K17 Ventilation system	
D2R2K18 Procurement	

Responsibility 3. Evaluate controls by analyzing feasibility, effectiveness, reliability and cost to achieve the optimal solution.

Knowledge	Skills
D2R3K1 Laws, standards and regulations	D2R3S1 Interpreting laws, standards and regulations
D2R3K2 Methods and techniques for evaluating feasibility, effectiveness, reliability and cost-benefit	D2R3S2 Applying methods and techniques for evaluating feasibility effectiveness, reliability and cost-benefit
D2R3K3 Risk assessment	D2R3S3 Applying economics analysis
D2R3K4 Specifications and drawings	D2R3S4 Interpreting plans, specifications and drawings
D2R3K5 Data management	D2R3S5 Performing compliance and conformance inspections and audits
D2R3K6 Industrial hygiene, including chemical, physical and biological agents	D2R3S6 Consulting with subject matter experts
D2R3K7 Fire protection and protection, including life safety	D2R3S7 Using data collection and retrieval systems
D2R3K8 Environmental protection and pollution prevention	D2R3S8 Interpreting analytical results
D2R3K9 Construction technology	D2R3S9 Testing and maintaining fire detection and suppression systems
D2R3K10 Inspection and auditing techniques	
D2R3K11 System and occupational safety	

Responsibility 4. Obtain compliance certifications, listings, approvals or authorizations by identifying and meeting applicable national and international laws, regulations and standards in order to ensure product, process and facility safety.

Knowledge	Skills
D2R4K1 Laws, standards and regulations	D2R4S1 Interpreting data
D2R4K2 Data management	D2R4S2 Interpreting laws, standards and regulations
D2R4K3 Quality assurance and control	D2R4S3 Performing quality assurance audits and inspections
D2R4K4 Documentation protocol	D2R4S4 Using document processing protocols
D2R4K5 Certification requirements	D2R4S5 Managing the approval process
D2R4K6 Appropriate entities to contact for forms, approval and certifications	D2R4S6 Consulting with subject matter experts
	D2R4S7 Meeting with federal, state and local officials

Domain 3. Safety, Health and Environmental Information Management and Communications (SAFETY FUNDAMENTALS - 33% • COMPREHENSIVE PRACTICE - 30%)

Responsibility 1. Develop effective training programs by establishing learning objectives to impart knowledge and facilitate an understanding of hazards and controls.

Knowledge	Skills
D3R1K1 Adult learning D3R1K2 Group dynamics D3R1K3 Technical content D3R1K4 Needs analysis D3R1K5 Testing and measurement D3R1K6 Presentation media and technologies D3R1K7 Graphic design	D3R1S1 Applying appropriate lesson plans that include interactive learning (e.g., small exchange, case studies, experience sharing) D3R1S2 Item/question writing and test construction D3R1S3 Using presentation technology: hardware and software D3R1S4 Conducting audience needs assessments D3R1S5 Facilitating group interactions to maximize learning D3R1S6 Making effective graphics D3R1S7 Providing an effective learning environment (e.g., classroom layout, lighting, minimal distraction, etc.) D3R1S8 Organizing presentation

Responsibility 2. Deliver effective training programs by using media and methods appropriate to the audience to maximize understanding of the subject matter.

Knowledge	Skills
D3R2K1 Presentation media D3R2K2 Adult learning D3R2K3 Target audience background and informational needs D3R2K4 Group dynamics D3R2K5 Active learning techniques D3R2K6 Conflict resolution techniques	D3R2S1 Using presentation technology: hardware and software D3R2S2 Using lesson plans D3R2S3 Soliciting audience feedback D3R2S4 Resolving conflicts D3R2S5 Encouraging participation D3R2S6 Communicating effectively using verbal and nonverbal skills D3R2S7 Integrating critical thinking processing into presentations

Responsibility 3. Evaluate training programs through performance assessments and various forms of feedback in order to assure that training is effective.

Knowledge	Skills
D3R3K1 Testing and measurement D3R3K2 Sampling techniques D3R3K3 Statistical analysis D3R3K4 Item writing and test construction D3R3K5 Methods for obtaining feedback	D3R3S1 Item/question writing and test construction D3R3S2 Using sampling techniques to assess performance D3R3S3 Mathematical and statistical analysis D3R3S4 Gathering feedback

Responsibility 4. Present technical information, both verbally and in writing, to effectively communicate with employees, management, customers, contractors, public relations officials, vendors and the public.

Knowledge	Skills
D3R4K1 Graphic design D3R4K2 Group dynamics D3R4K3 English and grammar D3R4K4 Format for various types of media D3R4K5 Protocols for public announcements D3R4K6 Risk assessment techniques D3R4K7 Legal aspects of communication	D3R4S1 Using graphics, illustrations and other media D3R4S2 Audience dynamics D3R4S3 Communicating effectively using verbal and nonverbal skills D3R4S4 Formatting of technical papers and other media D3R4S5 Writing and delivering public announcements D3R4S6 Applying risk communication strategies D3R4S7 Writing procedures, policies, SOPs, etc.

Responsibility 5. Communicate hazards, risks and control measures to employees, management, customers, contractors, vendors and the public by preparing and delivering appropriate information to educate an organization or the community.

Knowledge	Skills
D3R5K1 Legal aspects of communication	D3R5S1 Creating labels and warnings
D3R5K2 Labeling requirement for products, materials and equipment	D3R5S2 Applying international warnings and symbols
D3R5K3 International symbols	D3R5S3 Applying proper format: color, lighting, placement, etc.
D3R5K4 Symbology (colors, wording, format, presentation)	D3R5S4 Integrating cultural norms into communications
D3R5K5 Cultural norms and their relationship to communication	D3R5S5 Delivering the information in the language and media appropriate for the audience

Responsibility 6. Develop ongoing relationships with the community by interacting with outside organizations to foster a mutual understanding of the profession and community needs with regards to safety issues.

Knowledge	Skills
D3R6K1 Governmental entities and responsibilities	D3R6S1 Establishing and working within mutual aid agreements
D3R6K2 Mutual aid agreements	D3R6S2 Planning and implementing emergency response activities
D3R6K3 Emergency response planning and communication	D3R6S3 Providing input during standards development
D3R6K4 Standards development	D3R6S4 Negotiating with political entities
D3R6K5 Sphere of influence	

Responsibility 7. Maintain a record keeping and data capture and retrieval system by using appropriate data management systems to acquire, analyze and distribute accurate data.

Knowledge	Skills
D3R7K1 Record keeping and recording requirements (e.g., OSHA, EPA, workers' compensation, hazardous waste permitting and manifesting requirements, DOT)	D3R7S1 Managing record keeping (e.g., OSHA, EPA, workers' compensation, hazardous waste permitting and manifesting requirement requirements, DOT)
D3R7K2 Statistical analysis	D3R7S2 Mathematical and statistical analysis
D3R7K3 Computers, data transfer and storage hardware options	D3R7S3 Using computers, data transfer and storage hardware
D3R7K4 Data logging and monitoring equipment	D3R7S4 Using data loggers and monitoring equipment
D3R7K5 Business software (e.g., database software)	D3R7S5 Construction reports and data collection forms
D3R7K6 Report development (e.g., training records, accident report forms, inspection forms)	D3R7S6 Complying with confidentiality requirements
D3R7K7 Record retention requirements and management protocols (confidentiality, etc.)	D3R7S7 Complying with record retention protocols
D3R7K8 Data analysis and presentation	D3R7S8 Maintaining data integrity
D3R7K9 Chain of custody regard to incident investigation	D3R7S9 Preserving chain of custody for evidence in incident investigation
	D3R7S10 Calculating accident and incident rates

Responsibility 8. Develop and maintain proficiency in professional communication through continuing personal education in the use of business technology.

Knowledge	Skills
D3R8K1 Computer software concepts (databases, spreadsheets, word processing)	D3R8S1 Using standards business software
D3R8K2 Internet resources	D3R8S2 Exchanging information via the internet
D3R8K3 Information transfer and storage technologies	D3R8S3 Using information transfer and storage techniques
D3R8K4 Information acquisition (data logging) technologies	D3R8S4 Using data acquisition equipment
D3R8K5 Telecommunications technology	D3R8S5 Using teleconferencing, email and other electronic media

Domain 4. Professional Conduct and Ethics
(SAFETY FUNDAMENTALS - 5% • COMPREHENSIVE PRACTICE - 5%)

Responsibility 1. Hold paramount the protection of people, property and the environment by persistently working with management and governmental agencies until the identified hazard has been eliminated or minimized.

Knowledge	Skills
D4R1K1 BCSP Code of Professional Conduct	D4R1S1 Applying BCSP Code of Professional Conduct
D4R1K2 Organizational protocol	D4R1S2 Following organizational protocol
D4R1K3 Conflict resolution techniques	D4R1S3 Resolving conflict
D4R1K4 Formal and informal presentation techniques	D4R1S4 Communicating effectively using verbal and nonverbal skills
D4R1K5 Negotiation procedures	D4R1S5 Negotiating compliance issues with government and other entities or affected parties
D4R1K6 Laws, standards and regulations	D4R1S6 Using laws, standards and regulations as benchmarks

Responsibility 2. Adhere to standards of professional conduct by limiting practice to areas of competence and avoiding conflicts of interest to minimize the potential for harm.

Knowledge	Skills
D4R2K1 BCSP Code of Professional Conduct	D4R2S1 Applying BCSP Code of Professional Conduct
D4R2K2 General business ethics	D4R2S2 Applying team building and interpersonal techniques
D4R2K3 Conflict resolution techniques	D4R2S3 Resolving conflicts through negotiation
D4R2K4 Personal and professional limitations	D4R2S4 Selecting consultants and outside resources and providing adequate support
D4R2K5 Methods of facilitating teamwork	
D4R2K6 Competencies of other technical professionals with whom the safety professional interacts	
D4R2K7 Consequences of professional errors or omissions	
D4R2K8 Elements of a conflict of interest policy	
D4R2K9 Laws relating to conflict of interest	

Responsibility 3. Accept responsibility to promote safety by providing technical counsel and advice on issues related to the safety profession to protect people, property and the environment.

Knowledge	Skills
D4R3K1 BCSP Code of Professional Conduct	D4R3S1 Applying BCSP Code of Professional Conduct
D4R3K2 Sources safety, health and environmental literature and other information	D4R3S2 Avoiding errors and omissions
D4R3K3 Job authority, responsibility and accountability	D4R3S3 Resolve conflict
D4R3K4 Professional liability issues	
D4R3K5 Conflict resolution	

Responsibility 4. Conduct professional activities by following organizational protocol to assist in making positive, balanced and effective decisions.

Knowledge	Skills
D4R4K1 BCSP Code of Professional Conduct	D4R4S1 Applying BCSP Code of Professional Conduct
D4R4K2 General business ethics	D4R4S2 Following organizational protocol
D4R4K3 Organizational protocol	D4R4S3 Applying management principles of authority, responsibility and accountability
D4R4K4 Management principles of accountability and responsibility	

Responsibility 5. Improve technical competency through continuing professional and self-development in order to increase knowledge and skills.

Knowledge	Skills
<p>D4R5K1 BCSP Code of Professional Conduct</p> <p>D4R5K2 Recent technical issues and advances in the safety, health and environmental profession</p> <p>D4R5K3 Continuing education sources in the safety, health and environmental profession (e.g., conferences, professional seminars, networking, textbooks, magazines, professional journals)</p> <p>D4R5K4 Specialty certification opportunities</p>	<p>D4R5S1 Applying BCSP Code of Professional Conduct</p> <p>D4R5S2 Selecting appropriate professional development opportunities</p>

Responsibility 6. Foster accurate accountability for injuries/illnesses and other types of occurrences by identifying root and contributing causes in order to assure that proper controls are implemented.

Knowledge	Skills
<p>D4R6K1 BCSP Code of Professional Conduct</p> <p>D4R6K2 Conflict resolution techniques</p> <p>D4R6K3 Methods of identifying accident causation</p> <p>D4R6K4 Management principles of authority, responsibility and accountability</p>	<p>D4R6S1 Applying BCSP Code of Professional Conduct</p> <p>D4R6S2 Performing incident investigations, including root cause analysis</p> <p>D4R6S3 Interviewing people</p> <p>D4R6S4 Negotiating acceptance and/or ultimately assigning responsibility</p> <p>D4R6S5 Applying management principles of authority, responsibility and accountability</p>

Appendix B. Outline of Knowledge Required for Professional Safety Practice

([xx] is number of times a knowledge statements appears in the blueprints.)

GENERAL

Laws, Regulations, Standards, Government

Statutory and case law regulating safety, health and the environment
Laws, standards and regulations [7]
Laws, standards and regulations which require employee participation

Mathematics, Statistics, Physical & Chemical Sciences

Mathematics and statistics [3]
Basic sciences: chemistry, biology, physics, physiology and anatomy [4]
Methods and techniques for measurement, sampling and analysis
Sampling techniques
Statistical analysis [2]

Technology (Engineering, Facilities, Equipment, Processes, Computers & Systems)

Operational process to design/develop safe work practices
Material process flow
Methods and techniques for evaluation of facilities, products, systems, equipment, workstations and processes
Specifications and drawings [2]
Materials
Data management [2]
Computers, data transfer and storage hardware options
Data logging and monitoring equipment
Business software (e.g., database software)
Computer software concepts (databases, spreadsheets, word processing)
Internet resources
Information transfer and storage technologies
Information acquisition (data logging) technologies
Telecommunications technology

Behavioral and Organizational Science

Organizational theory and behavioral science [2]
Organizational theory and behavioral science
Behavior modification
Personnel development techniques
Drug/alcohol programs including Employee Assistance Programs
Organizational theory and behavioral science
Labor relations, including union/management committees
Behavioral sciences [2]
Conflict resolution techniques [5]
Negotiation procedures [2]
Methods of facilitating teamwork

Business and Management

Quantitative and qualitative performance indicators
Management and behavioral sciences
Processing operations (e.g., critical inputs, assessment and inventory)
Business regulations and laws
Economics, accounting and statistics
Capital budgeting and long range planning
Economics and budgeting
Management principles
Procurement
Quality assurance and control
Organizational protocol [3]
Management principles of accountability and responsibility

Training/Education

Education and training methods [5]
Adult learning
Group dynamics [4]
Technical content
Needs analysis
Testing and measurement [2]
Adult learning
Target audience background and informational needs
Active learning techniques
Item writing and test construction
Methods for obtaining feedback

Communication

Communication and presentation techniques
Documentation protocol
Appropriate entities to contact for forms, approval and certifications
Graphic design [2]
English and grammar
Format for various types of media
Protocols for public announcements
Legal aspects of communication
Standards development
Data analysis and presentation
Formal and informal presentation techniques
Presentation media and technologies [2]

Security

Property protection (physical and intellectual) and security

SAFETY, HEALTH, ENVIRONMENT & ERGONOMICS

General

Safety, health and environmental sciences [2]
Safety, health and environmental issues
Sphere of influence

SHE in Design, Controls, Technology

Methods and techniques for achieving safety through design
Safety engineering
Safety through design process
Characteristics and hazards of materials
Applied engineering sciences: electronics, mechanics, thermodynamics, materials, structures, plant layout, etc. [2]
Equipment and facility safety requirements

Risk Management & Insurance

Insurance practices (types and premium calculations) [2]
Workers' compensation and case management
Risk management concepts [4]
Risk assessment techniques [4]

Safety Management

Design of record keeping systems that allow for collection, storage, interpretation and dissemination
Safety management systems
Safety management
Employee participation committees
Record keeping, data collection and retrieval systems
Methods and techniques for evaluating feasibility, effectiveness, reliability and cost-benefit
Record keeping and recording requirements (e.g., OSHA, EPA, workers' compensation, hazardous waste permitting and manifesting requirements, DOT)
Report development (e.g., training records, accident report forms, inspection forms)
Record retention requirements and management protocols (confidentiality, etc.)

Inspections, Investigations, Audits

Methods and techniques for accident investigation
Auditing techniques and management systems reviews
Inspection and auditing techniques
Chain of custody regard to incident investigation
Methods of identifying accident causation

Fire Protection

Fire prevention and protection including life safety [4]

Industrial Hygiene

Industrial hygiene including chemical, physical and biological agents [4]
Ventilation system

Ergonomics

Ergonomics program management
Ergonomics and human factors [2]

Environmental

Environmental protection and pollution prevention
Physical and chemical characteristics of hazardous materials
Environmental protection and pollution prevention [2]

Emergencies

Crisis management
Post incident and loss mitigation
Governmental entities and responsibilities
Mutual aid agreements
Emergency response planning and communication

Professional Development and Ethics

Certification requirements
BCSP Code of Professional Conduct [6]
General business ethics
Personal and professional limitations
Competencies of other technical professionals with whom the safety professional interacts
Consequences of professional errors or omissions
Elements of a conflict of interest policy
Laws relating to conflict of interest
Sources safety, health and environmental literature and other information
Job authority, responsibility and accountability
Professional liability issues
General business ethics
Recent technical issues and advances in the safety, health and environmental profession
Continuing education sources in the safety, health and environmental profession (e.g., conferences, professional seminars, networking, textbooks, magazines, professional journals)
Specialty certification opportunities

Applied SHE - Construction

Construction safety [3]
Construction technology

Applied SHE - Transportation

Transportation/fleet safety management

Applied SHE - Product Safety

Product safety [2]

Applied SHE - Process/Petro-Chemical

Process management, material flow and procurement
Process safety [2]

Applied SHE - Systems

System safety [2]
System and occupational safety

Appendix C. Outline of Skills Required for Professional Safety Practice ([xx] is number of times a skill statements appears in the blueprints.)

General and Applied Interpreting Skills

Interpreting and applying regulations
Interpreting and applying safety, health and environmental science data for process improvement
Interpreting and applying laws, standards and regulations
Interpreting plans, specifications and drawings [2]
Interpreting laws, standards and regulations [6]
Interpreting analytical results
Interpreting data [2]
Interpreting regulations to ensure a compliant and effective system

Ethics Application Skills

Applying BCSP Code of Professional Conduct [7]

General and Applied Mathematical, Analytical and Scientific Skills

Mathematical and statistical analysis [5]
Sampling and making observations
Utilizing basic science to explain safety, health and environmental issues
Calculating accident and incident rates [2]
Analyzing sampling results and other data to support decision making and prioritizing control recommendations
Problem solving

Creative Skills

Designing safe work practices for systems, facilities and equipment
Managing safety through the design processes

General and Applied Verbal Communication Skills

Interpersonal communication [3]
Using interpersonal communication
Communication and presentation
Working with unions and management
Consulting with subject matter experts [4]
Consulting with equipment manufacturers/suppliers and construction contractors to assure safety control compliance
Consulting with subject matter experts
Meeting with federal, state and local officials
Providing input during standards development
Negotiating with political entities
Negotiating compliance issues with government and other entities or affected parties
Using presentation technology: hardware and software [2]
Making effective graphics
Communicating effectively using verbal and nonverbal skills [3]
Using graphics, illustrations and other media
Using teleconferencing, email and other electronic media
Interviewing people
Integrating cultural norms into communications
Communicating risks that are present and appropriate control measures to management.
Applying risk communication strategies
Delivering the information in the language and media appropriate for the audience

General and Applied Written Communication Skills

Improving policies and procedures
Writing job descriptions which include safety accountability as a line item
Exchanging information via the internet
Constructing reports and data collection forms
Writing procedures, policies, SOPs, etc
Creating labels and warnings
Item/question writing and test construction
Formatting of technical papers and other media
Writing and delivering public announcements
Applying international warnings and symbols
Applying proper format: color, lighting, placement, etc.
Establishing and working within mutual aid agreements
Constructing reports and data collection forms

General and Applied Training Skills

Designing effective training programs with emphasis on employee behavior
Teaching and training in safety, health and environmental science areas and how they apply to the management system
Organizing the results and recommendations into an effective training program
Applying appropriate lesson plans that include interactive learning (e.g., small exchange, case studies, experience sharing)
Item/question writing and test construction
Conducting audience needs assessments
Facilitating group interactions to maximize learning
Providing an effective learning environment (e.g., classroom layout, lighting, minimal distraction, etc.)
Organizing presentation
Using lesson plans
Soliciting audience feedback
Encouraging participation
Integrating critical thinking processing into presentations
Using sampling techniques to assess performance
Gathering feedback
Audience dynamics

General and Applied Computer and System Skills

Developing systems to track implementation
Using computers, data transfer and storage hardware
Using data loggers and monitoring equipment
Complying with confidentiality requirements
Complying with record retention protocols
Maintaining data integrity
Preserving chain of custody for evidence in incident investigation
Using standard business software
Using information transfer and storage techniques
Using data acquisition equipment
Using data collection, retrieval and analysis systems
Eliminating or controlling exposure to identified hazards by substitution, engineering or using PPE
Using data collection and retrieval systems
Using document processing protocols
Using computers, data transfer and storage hardware
Using data loggers and monitoring equipment

Applied Safety and Health Skills

Applying safety, health and environmental knowledge to determine system effectiveness
Utilizing accepted system safety techniques to compare system to industry/consensus systems
Quantifying loss data and trends
Analyzing production process hazards
Applying methods and techniques for hazard identification, hazard evaluation, risk assessment and control
Using analytical equipment: monitoring and sampling equipment
Benchmarking with other companies in same industry for safety equipment/facility design, engineering and controls
Applying methods and techniques for hazard identification, hazard evaluation, risk assessment and control
Testing and maintaining fire detection and suppression systems
Planning and implementing emergency response activities
Managing record keeping (e.g., OSHA, EPA, workers' compensation, hazardous waste permitting and manifesting requirements, DOT) [2]
Selecting appropriate professional development opportunities
Avoiding errors and omissions [2]

Inspection and Investigative Skills

Problem solving in incident investigation
Preserving chain of custody for evidence in incident investigation
Performing incident investigations, including root cause analysis
Applying inspection and control methods for potentially hazardous exposure
Performing compliance and conformance inspections and audits
Performing quality assurance audits and inspections

General and Applied Human Behavior Skills

Integrating safety system into the organizational culture
Behavior modification techniques
Resolving conflicts [4]
Resolving conflicts through negotiation
Applying team building and interpersonal techniques
Negotiating acceptance and/or ultimately assigning responsibility
Determining the most appropriate drug and alcohol testing programs
Acquiring, allocating and controlling human and material resources
Using performance evaluations to quantify the effectiveness of employee programs
Implementing employee participation committees

General and Applied Business, Organization and Leadership Skills

Applying management principles of authority, responsibility and accountability [2]
Ensuring that delegation of authority and responsibility are in compliance with the management system design
Applying management and behavioral science to determine system effectiveness
Analyzing process flow, management of critical paths/systems
Quantifying the economic value of the safety process
Applying project controls (budgeting, scheduling, estimating) to maximize system efficiency
Using capital budgeting techniques, activity-based cost accounting and cost-benefit analysis [2]
Organizational development
Using capital budgeting techniques, activity-based cost accounting and cost-benefit analysis
Applying methods and techniques for evaluating feasibility effectiveness, reliability and cost-benefit
Applying economics analysis
Managing the approval process
Following organizational protocol [2]
Selecting consultants and outside resources and providing adequate support
Using laws, standards and regulations as benchmarks.