Enhancing Occupational Safety and Health through Use of the National Skill Standards

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In a voluntary national effort, U.S. industry, education, labor, and government have initiated the development of standards for job skills and competencies in jobs in 15 economic sectors. The aim of the skill standards is to maintain a globally competitive workforce. Efforts to include occupational safety and health knowledge and skills as core elements in these standards are described. The first skill standards to include occupational safety and health competencies were developed for the manufacturing sector, evaluated by 3,800 workers in 700 companies, and published. National skill standards can stimulate extensive training in occupational safety and health, with resultant application to a larger percentage of workers than ever before. Key words: certification; critical work functions; key activities; workplace safety and health; skill standards; training.

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n the last decade, a profound transformation has occurred in the way the world conducts business. Reasons for this transformation include the rapidly changing and unpredictable economic markets, increasing global competition, new forms of work organization, and a shortage of workers with high-level skills, education, and training.¹⁻⁵ This transformation has created new demands for American employers and workers to be globally competitive. As these demands are addressed, new opportunities will occur for enhancing the safety and health of the workforce. The need that occupational safety and health training be included as an integral part of worker development has been recognized as an important strategy for enhancing the prevention of occupationally related injuries and illnesses. Workplace injuries and illness still take a great toll on workers and are costly to businesses and consumers.^{6,7} Training is an axiomatic part of hazard control and prevention strategies,⁸ and has been found to be effective in reducing the occupational injuries and illness.^{8,9}

PROBLEM

The demand for skilled workers is growing in every industry in the United States.^{10.11} Jobs for workers without the skills to implement new technologies are rapidly disappearing. In 1950, approximately 60% of manufacturing jobs were considered to be unskilled. By 1998, 30% were unskilled; and by the year 2005, this number will shrink to 15%.12 By 2005 (if the economy continues to grow as it did in the late 1990s), the Big Three automakers will need more than 250,000 new workers, the information technology industry will need more than 1 million technicians, the health services industry will need approximately 800,000 new workers, and the retail industry will need approximately 400,000 more skilled salespeople.^{5,13,14} The National Federation of Independent Business cited the shortage of skilled, trained workers as the number-one problem of their members.¹⁵ Finally, a survey by the National Association of Manufacturers¹⁵ reported that:

- 90% of manufacturers experience shortages of qualified workers;
- 60% report that workers lack basic math skills;
- more than 50% find deficiencies in basic writing and comprehension skills; and
- 63% say employees lack basic job skills such as arriving on time and staying at work all day.

Furthermore, expectations for today=s workers are high. The "new" workers are empowered to make decisions that their supervisors previously used to make. These new workers may help design their own workplaces, collaborate with their peers to set schedules and hire other team members, talk directly to customers and suppliers, conduct statistical analyses, manage quality, coordinate projects, build consensus, control overtime, and coach other employees. Employers need workers who have the occupational, participative, academic, and safety skills to function in the globally competitive envi-

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ronment.^{16,17} The supply of highly skilled applicants for new jobs has not kept pace with demand in this evolving era of high-tech revolutions and shrinking product cycles.¹⁸ Thus in this new era of global competitiveness, the traditional ideas about educating and training employees may need to be reviewed for modernization and modification.¹⁹ New approaches such as the voluntary National Skill Standards might be one way to address the shortage of skilled workers. If occupational safety and health can be added to these standards, there is an increased likelihood that there will be more focus on morbidity and mortality prevention in the workplace. This paper describes the efforts to include occupational safety and health in the National Skills Standards.

METHOD

Goals of the National Skill Standards

In response to the need for skilled workers, Congress enacted the National Skill Standards Act of 1994.¹³ The Act seeded an effort led by industry and labor to create a voluntary national system of skill standards, assessment, and certification for various sectors of the U.S. economy. The primary goals of the national skill standards are to:

- help fill the shortage of highly skilled workers;
- identify the skills needed for high-performance workplaces;
- identify the paths for obtaining these skills;
- identify the knowledge people need to succeed in their industries; and
- offer an advantage to businesses, employees, future workers, and job seekers who want to shrink the gap between skills and job demands.

The standards *will not apply to professionals and managerial employees*, who often have their own certification or licensing programs that cover occupational safety and health, and environmental safety professionals. Examples of these programs are the Board of Certified Safety Professionals, the American Board of Industrial Hygiene, and the Institute of Hazardous Materials Management.

Currently, training in occupational safety and health is not systematically conducted, nor is it systematically provided to the majority of the workforce.⁸ However, implementation of the National Skill Standards Act presents a unique opportunity to ensure the inclusion of occupational safety and health knowledge as a core component in the skill standards. Thus, when new, young, or career-changing workers train for the skills as specified in these standards, they will also receive occupational safety and health training.

The National Skill Standards Board

The skill standards legislation created a nonpartisan, private-sector board—the National Skill Standards



Figure 1—Framework of the national skill standards.

Board (NSSB).¹³ The NSSB facilitates voluntary industry partnerships, develops a national framework, serves as a clearinghouse of information, provides quality assurance of the system, and provides linkages among stakeholders. Members of the NSSB are appointed by the President and the U. S. Congress. The NSSB divided the U.S. economy into 15 industry sectors. These sectors are: Manufacturing, Sales and Service, Education and Training, Hospitality and Tourism, Utilities, Information Technology/Telecommunications, Construction, Finance and Insurance, Mining, Health and Human Services, Transportation, Public Administration, Agriculture, Scientific and Technical Services, Business and Administrative Services. Standards will be developed for each sector over the next ten years.

Description of the Skill Standards

Figure 1 illustrates the framework of the national skill standards. The standards address employer responsibilities and worker skills.

National skill standards describe the following:

- The work to be performed, including
 —critical work functions (see NSSB definitions at end of paper) and
- —key activities required at the workplace
- The quality of the work performance required
- The level of knowledge and skills (competence) required to perform the work
- Performance indicators needed to measure success

By using the standards, an employer, school counselors, and workers should be able to determine the



Figure 2—Certification Framework: three tiers of worker certification. From Wilcox and West,¹⁵ used by permission).

academic, employability, and occupational or technical skills and knowledge needed for various careers.

Applicability of the Skill Standards

The national skill standards may have broad applicability and impact across the nation for employers and workers, communities, parents, teachers, trainers and educators, students, state and federal agencies, and others with stakes in developing the future workforce. Through the skill standards program, it is believed that workers will be provided with the information they need to succeed and advance in their chosen careers. They will be offered opportunities to participate in national certification programs—for core skill standards initially, then for concentration skill standards, and finally for specialty (trade-specific) certifications (Figure 2).

Because the standards will include and require occupational safety and health knowledge and skills, they assure that workers will acquire occupational safety and health knowledge and skills to become certified. Thus, worker certification that includes occupational safety and health components can be an important means of increasing awareness of these issues and thus preventing or reducing worker injuries and illnesses.

Many trade organizations already have specialty (trade-specific) skill standards and offer worker training and certification. The NSSB, with its voluntary partnerships, has not yet produced trade-specific (specialty) standards. In some cases, trade-specific standards may be more comprehensive than the national skill standards. However, in other cases trade organizations may need to modify their trade skill standards to match the level of the national skill standards. This need for upgrading may be particularly evident with technical skills and knowledge in the field of occupational safety and health.

Establishing a Skill Standard

Establishing a national skill standard for each of the 15 NSSB-defined sectors involves a convening group of various organizations within an industry sector. These organizations may represent employers, associations, professional organizations, employee representatives, public interest groups, community-based organizations, and civil rights organizations responsible for recruiting and organizing a cohesive coalition within an industry sector. This convening group becomes a Voluntary Partnership after meeting the criteria of the NSSB. Each Voluntary Partnership is an autonomous entity charged with developing the skill standards for a given sector, and responsible for developing methods for assessing and implementing the skill standards. In addition, they will prepare the framework for worker-certification programs and fund the development of certification exams for core and concentration skill standards. In the manufacturing sector, where the first skill standard occurred, the voluntary partnership that coordinated all the efforts was the Manufacturing Skill Standards Council (MSSC).

RESULTS AND DISCUSSION

Including Occupational Safety and Health in the National Skill Standards

NIOSH took the initiative to join the national skill standards effort to support the integration of occupational safety and health in the core and concentration skill standards for each sector. The inclusion of occupational safety and health requirements in the skill standards for each sector will make safety and health an integral part of the way workers do their work—rather than making it an "add-on" or separate component of work. In 1997 NIOSH became a partner in the first skill standard effort, focused on the manufacturing



Figure 3—Concentration areas for manufacturing skill standards.

sector.^{20–22} Other organizations also need to foster the inclusion of occupational safety and health. The American Industrial Hygiene Association has provided collaborative support since 1999, and the American Society of Safety Engineers provided review and comments on the final draft of the MSSC skill standards.

During the development of the national skill standards for manufacturing, the MSSC Standards Committee defined six concentration areas in the manufacturing sector (see Figure 3) and drafted skill standards for each area. These standards were then reviewed by the remaining committees of the Council. After revisions, the concentration skill standards for the manufacturing sector were subjected to a national "validation" study, which involved 3,800 workers from 700 union and nonunion companies in 14 manufacturing sub-industries. The validation process meant assessing whether the Concentration Standards (critical work functions, key activities, performance indicators, occupational and technical skills) met the requirements of specific jobs among the 3,800 workers who participated.

Occupational safety and health was incorporated into the MSSC standards through three primary avenues:

- A concentration skill standard called Health, Safety and Environmental (HSE) Assurance was developed to reflect tasks done by workers whose primary concentration area is safety and health.
- Occupational health and safety was integrated into several critical work functions, key activities, and performance indicators (see definitions at the end of the paper) within each of the other five concentration areas in manufacturing (production, maintenance and repair, logistic and inventory control, quality assurance, and production and process development); these areas represent work-related functions and employers' responsibilities.
- Occupational health and safety was incorporated into the Occupational and Technical Knowledge and Skills sections of the standards, which refer to workers' responsibilities.

In the skill standards for manufacturing, occupational health and safety responsibilities for both workers and employers align well with the regulations of the Occupational Safety and Health Act. Overall, more than 20% of the language in the manufacturing skill standards pertains to occupational safety and health. For example, in the Production Concentration Skill Standard, two of eight critical work functions are devoted to safety and health, eight of 39 key activities contain health and safety language; and six of eight occupational and technical areas also contain health and safety language.

Examples 1 and 2, below, show employers' responsibilities expressed as critical work functions with their related key activities—one within the health, safety, and environmental assurance (HSE) concentration area and the second in the production concentration area.

Example 1. Key occupational health and safety activities in a critical work function. Concentration skill standard: Health, Safety and/or Environmental (HSE) issues. Critical work function: Conduct HSE incident and hazard investigations.

Key activities:

- Investigate HSE incidents
- Investigate HSE hazards
- Document findings of HSE investigations
- Suggest corrective actions
- Check that appropriate action has been taken to correct HSE problems

Example 2. Key occupational health and safety activities in a critical work function. Concentration skill standard: Production. Critical work function: Maintain a safe and productive work area.

Key activities:

- Perform environmental and safety inspections
- Perform emergency drills and participate in emergency response teams
- Identify unsafe conditions and take corrective action
- Provide safety orientation to other workers

Chart 1 presents the first of the ten critical work functions in the HSE assurance concentration for manufacturing as well as the accompanying occupational and technical knowledge and skills. The chart does not

HSE1

Critical Work Function: Train workers in health, safety and/or environmental issues.

Critical work functions describe the major responsibilities involved in carrying out a

concentration	Key Activities	
	Key activities are	Performance Indicators
Concentrations are the major areas of front- line work cover- ing families of related jobs. Separate stan- dards were iden- tified for each concentration.	the duties and tasks involved in carrying out a critical work function	Performance indicators correlate to the key activities. The performance indicators provide information on how to determine when someone is performing each key activity competently
	Determine priorities for health, safety and/or environmen- tal training needs	Analysis of health, safety and/or environmental tasks is conducted at the job level. Health, safety and/or environmental records are analyzed to identify training needs. Results of training assessments are documented. Training plans with clear objectives are developed based on analysis. Worker input regarding training needs is solicited.
	Prepare health, safety and/or environmen- tal training materials	Training content meets industry, government and company standards. Training materials have the correct content to meet the training needs. Training materials are updated continuously. Training materials are clear, worker-friendly, and appropriate for the audience. Training materials are available and accessible to all relevant parties.
	Conduct health, safety and/or envi- ronmental training for employees	Employee records document that training has been delivered. Training schedules are developed. Evaluations indicate worker understanding of the training materials. Appropriate workers receive training. Test results and certifications achieved indicate effective training.
	Document required health, safety and/ or environmental training	Training attendance records are on file. A training profile for each job is developed and maintained. Test results and certifications are maintained. Documentation is available to appropriate parties. Feedback from trainees is requested and documented. Confidentiality of the outcomes of health, safety and /or environmental assurance training is maintained.
	Plan future health, safety and/or envi- ronmental training.	Training plans include appropriate content. Training is designed for the specific needs of individuals. Appropriate workers are asked for input into content of training. Training plan includes effective evaluation and follow-up process. Worker feedback is included in future training.

Chart 1—Example of a critical function in Health, Safety, and Environmental Assurance.

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Concentration Area: Health, Safety and Environmental Assurance

Knowledge and Skills

Describes what a worker needs to know or be able to do to perform the critical work function

OCCUPATIONAL AND TECHNICAL KNOWLEDGE AND SKILLS

These are the technical knowledge and skills needed to perform the critical work function.

Skill Category	Specific Knowledge and Skills	Specific Knowledge and Skills
Business Policies and Procedures	 A. Knowledge of how to define safety requirements for use in job descriptions. B. Knowledge of relevant company confidentiality policies and procedures (i.e., confidentiality, security, proprietary, policy, procedures and ethics). 	C. Knowledge of current business direction in order to plan for training. D. Skill in integrating safety, health and environmental training into work processes and schedules.
Training Needs Assessment	 A. Skill in information gathering using surveys, OSHA logs, workers comp reports, department incident statistics, job analysis and skill analysis, near miss and hazard reports, safety work orders and observations to determine training needs. B. Skill in job hazard analysis in order to determine training needs. C. Knowledge of the skill level of employees in order to develop suitable training materials D. Knowledge of training and certification required by government regulations, suppliers, customers, contracts and industry standards. 	 E. Knowledge of the costs of health, safety and environmental incidents and the value of training. F. Knowledge of training required by ISO 9000 and government standards. G. Skill in interpreting government regulations to identify training needs cor- rectly. H. Knowledge of standard operating procedures for specific equipment or operations.
Training Delivery	 A. Knowledge of manufacturing processes, hazardous materials, and environmental impacts to determine training objectives, content and target populations. B. Knowledge of workplace and process terminology to effectively communicate with the audience. C. Skill in preparing training materials using appropriate technologies and instructional methods for presentation to diverse groups. D. Knowledge of qualified training vendors and materials based on technology, price, and quality. 	 E. Skill in developing a feedback system to respond to employee questions and comments about health, safety, and environmental issues to develop appropriate training. F. Skill in developing resources easily accessible to workers and management. G. Knowledge of methods for updating training, as equipment, people and processes change. H. Knowledge of adult learning principles.
Training Evaluation	 A. Skill in evaluating training to ensure the quality of the training program. B. Knowledge of evaluation techniques used to assess training effectiveness C. Knowledge of how to develop and use participant feedback to determine if the training was useful and understood. 	 D. Skill in evaluating training effectiveness by analysis of post training incidents for frequency and severity. E. Skill in the use of methods to evaluate instructors and training materials.
Health, Safety, and Environ- mental Rules and Regula- tions	 A. Knowledge of certification requirements for particular jobs. B. Knowledge of company-specific health, safety, and environmental standards. C. Knowledge of the principal of the hierarchy of controls for HS&E hazards. D. Skill in reviewing industry, government, and company standards to incorporate new information and regulations into training materials. 	 E. Knowledge of Job Hazard Analyses to assess the effectiveness and need for existing rules and regulations. F. Knowledge of regulatory requirements regarding training records. G. Knowledge of how to fill out appropriate environmental reports.
Safety Documen- tation	 A. Knowledge of how to develop and maintain a training profile that documents who was trained in what areas and who is still in need of training. B. Knowledge of which personnel should have their training documented. 	C. Knowledge of what training documentation forms are required, where to find them and how to complete them (e.g., attendance forms).

include the academic and employability skills for the HSE concentration. The other nine critical work functions in the HSE assurance concentration are: Conduct health, safety and/or environmental incident and hazard investigations; Conduct preventive health, safety, and/or environmental inspections; Implement health, safety, and/or environmental programs, projects, policies or procedures; Implement continuous improvement in health, safety, and/or environmental assurance practices; Promote health, safety, and/or environmental assurance programs; Conduct job safety and health analysis for jobs, equipment ,and processes; Maintain a safe and productive work area; Ensure safe use of equipment in the workplace; and Plan for safety in the new production processes.

In January 2001, the NSSB approved the manufacturing skill standards, and the Manufacturing Skill Standards Council announced the standards in the January 26, 2001, issue of the Federal Register (66FR8070), offering a 60-day public review and comment period. The final printed version of the standards was showcased to the public and news media during the annual conference of the Manufacturing Skill Standards Council in Washington, D.C., on May 11, 2001, with the title "A Blueprint for Workforce Excellence: Core and Concentration Skill Standards for Manufacturing." Since their release in May, the MSSC has been busy promoting the standards and planning for their implementation. Their Web site is <www.msscusa.org>. Several groups have already begun using the skill standards to develop curriculum and enhance their training programs. Sales and Service Voluntary Partnership, similarly, completed and launched their skill standards in October 2001. Their Web site is <www.ssvolpart.org>. Sales and Service Voluntary Partnership launched a nationwide credential as "Professional Certification in Customer Service" in 2002.

To promote the national skill standards, the NSSB recently launched several initiatives, including a partnership with America's Learning eXchange (ALX) and programs for job seekers, students, employers, and training and education providers, as a component of America's Career Kit (a U.S. Department of Labor project), an online resource. The NSSB has also been involved with the Regional Jobs Initiative (RJI) in a collaborative information-technology-focused project comprised of four partner organizations in Washington, D.C., Maryland, and Northern Virginia. The RJI will test the effects of using the skill-standards-implementation approach to instituting a national specialty certification(s) within a workforce development framework, for network technology occupations that crosscut industry sectors. A partnership with the U.S. Department of Education and the National School-to-Work Office has been formed promoting "Building Linkages" that asked school-to-work implementation states to join together in consortia to explore ways to integrate academic and

industry-recognized skill standards into multi-state career-pathway systems. The NSSB introduced the Use of Skill Standards and Certification in Workforce Investment Act (WIA) to U.S. Department of Education– related programs, designs, and operations.

Involvement with Upcoming Voluntary Partnerships

As the various groups and voluntary partnerships are formed for the other 13 economic sectors, NIOSH will continue its efforts to partner with these stakeholders. To this end, NIOSH began working with the Sales and Service Voluntary Partnership in February 2000.²¹ This partnership represents approximately 25 million workers, many of whom face serious safety and health hazards, especially musculoskeletal issues. Together with the manufacturing sector, they represent approximately 40% of the American workforce. NIOSH has also offered to help develop occupational safety and health skill standards for the education and training sector and the hospitality and tourism sector. Through such efforts, NIOSH hopes that model occupational safety and health core elements can be developed for use in the skill standards of all upcoming voluntary partnerships in other sectors.

Issues

A number of issues may arise from including health and safety in the national skill standards:

- The health and safety requirements of the skill standards for workers may overlap with those of health and safety profession. The NSSB has stated that the standards will apply to workers only and not to safety and health professionals. Additionally, the national skill standards establish or define common metrics by which employers or consensus standards bodies can further clarify worker training credentials or OSHA competent person qualifications for health and safety standards in areas such as work with asbestos, lead, scaffolding, and excavation.
- Key occupational safety and health activities (e.g., HSE inspections, safety orientation for employees, HSE incident investigations) may appear to overlap the function of HSE professionals. The intent of the national skill standards is not to replace HSE professionals, but to increase the knowledge and skills of workers in workplace health and safety. Certified workers (para-professional or technologist HSE) roles may well complement the practice and impact of HSE professionals. Dissemination of HSE skills for the prevention of occupational injuries and illness across the U.S. workforce clearly requires action at all organizational levels.
- Emphasis on skill standards of workers could shift the responsibility for maintaining a healthy and safe

workplace from the employer to the worker. The worker may not be empowered to expend company resources and make overarching decisions that affect safety and health. Nonetheless, the worker may be held accountable for failures in this area. Including health and safety behaviors and skills in the skill standards is intended as a tool for increasing the potential for health and safety functions at work functions—not as a surrogate for employer responsibility.

• Skills training alone is not adequate to prevent occupational morbidity and mortality. Occupational safety and health training will be effective only to the extent that various extra- and post-training factors are in place. These include management commitment to health and safety, motivational factors, and additional training on and off the job.⁸

CONCLUSION

Including occupational safety and health as a component of the national skill standards may help assure that future U.S. workers and workplaces have the tools and training needed to reduce or prevent occupational illnesses and injuries. A first effort is occurring in the manufacturing sector, which has developed skill standards that include provisions for occupational health and safety at all levels.

The national skill standards may also have a major effect on all academic institutions in the United States (i.e., vocational schools, community colleges, universities, and union, trade, and apprenticeship schools). In addition, the standards may affect all training institutions that strive to produce safe, competitive, competent, skilled, and qualified workers and professionals. These academic and training institutions may need to upgrade their curricula and instructional methods to meet the competency levels specified in the national skill standards. Workers who meet the criteria for competency in occupational safety and health can be tested and can receive basic certificates for knowledge and skills in their sectors. Later they may be able to upgrade their skills sufficiently to become certified in their occupations or trades. The national skill standards will also complement the existing volunteer standards (ANSI Z490.1.2001) for occupational safety and health training.²³

Common skill standards and certifications that are transferable from job to job may further increase employee mobility and have other significant labor market and economic impacts. Economic and social incentives and disincentives to train and certify employees and to maintain certification through continuing education should be the subject of future research in evaluating the potential for broad dissemination of core, concentration, and specialty HSE skills in the U.S. workforce. This research could also include piloting health, safety, and environmental skill standards within individual schools, employers, or industries, and evaluating impacts on health, safety, and environmental endpoints.

While these standards have intuitive appeal, there is a need to assess how well they are adopted or utilized and ultimately how effective they are on preventing occupational injuries and illnesses. The implementation of the skill standards will take the commitment from a broad range of stakeholders. With rare exceptions, little is known about the quality of occupational safety and health training.¹⁶ The fact that the skill standards not only identify content but require demonstrated competency is one step toward ensuring quality.

Work on the national skill standards will continue in the near future. Congress funded the NSSB until its sunset in July 2003. Two institutes arose from the NSSB, the NSSB Institute, and the NSSB Education and Research Institute to continue the work for developing n ational skill standards for the remaining sectors. As other sectors and specialty areas beyond the core skills are addressed, further opportunities for incorporating occupational safety and health into the skill standards will arise.

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Appendix

NSSB Definitions

Core skill standards: The knowledge, skills, and performance that are common and critical to all frontline jobs within an industry sector.

Concentration skill standards: The knowledge, skills, and performance that are needed for major areas of frontline responsibility, typically covering families of related jobs and occupations.

Specialty skill standards: The knowledge, skills, and performance that are unique to a particular job or occupation, to an individual industry, or to a specific company. The NSSB and its Voluntary Partnerships will not be developing specialty skill standards, since hundreds of occupations exist within each industrial sector. Instead, private organizations may use the concentration skill standards to enhance or develop the specialty skill standards.

Critical work functions: The primary responsibilities of the work.

Key activities: The major duties or tasks involved in carrying out a critical work function.

Performance indicators: Information about how to determine when someone is performing a key activity competently.

Academic knowledge and skills: The knowledge and skills associated with the academic disciplines of reading, writing, mathematics, and science.

Employability knowledge and skills: The applied knowledge and skills used to perform effectively across a broad range of occupations—such as teamwork, decision making, and problem solving.

Occupational and technical knowledge and skills: The specific knowledge and skills required to perform the tasks and activities of the work.