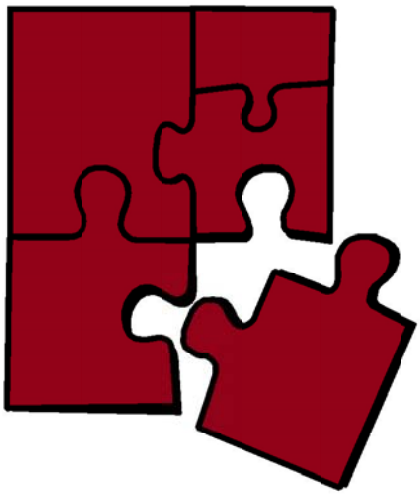
CDC
Workplace Safety and Health

Report from the National Conference on



Workplace Safety & Health Training

Putting The Pieces Together & Planning For The Challenges Ahead

Co-Sponsoring Agencies

National Institute for Environmental Health Sciences

Occupational Safety& Health Administration

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

NIOSH

Chapter Quotes

Any discussion of OSH policy, regulations, and standards prompts a variety of views and reactions. Major players, including insurance companies, the Federal government, accrediting bodies, standards organizations, business consultants, and labor unions described their roles and views of current and proposed policy needs.

Perspectives and practices in OSH training continue to evolve in response to various target populations and situational factors, and in efforts to find and use resources more effectively. Approaches can range from instilling an OSH awareness in young future workers, promoting management commitment needed to ensure an effective OSH training program, and enabling workers to assume more active roles in OSH programming and training.

Techniques for developing training interventions are now geared for traditional hazard control in known high-risk work settings as well as for newer threats such as workplace violence. Federal agency programs in support of OSH training, and technologies to enhance the training process, have influenced training development.

Evaluations of OSH training—when measured in terms of increased awareness of hazards, greater knowledge of risk factors and their control, and performance of safe work practices—invariably show successful outcomes. Less clear are links between these positive indicators and reduced workplace injuries and illness. Hence, evaluations must not only take account of specific training results but other workplace factors as well.

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The opinions expressed in this report represent the comments of participants at the conference and are not necessarily the position of the sponsoring agencies.

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Foreword

In 1999, members of the occupational safety and health community met in St. Louis, Missouri to "put together the pieces" of a picture of health and safety training, including current practices and future needs. Occupational safety and health training in the next decade will take place against a backdrop of rapidly changing workforces and workplaces. These changes create new issues and opportunities for trainers, and these issues and opportunities comprise some of the important pieces discussed in this conference.

This conference was the first time that more than 600 people from a broad range of organizations had come together to deliberate on occupational safety and health training. This report is a summary of those deliberations. While the importance of training was the focus of this meeting, it should be acknowledged that training is just one element within the hierarchy of preventative action.

NIOSH appreciates the efforts of the Occupational Safety and Health Administration (OSHA) and the National Institute of Environmental Health Sciences (NIEHS) in co-sponsoring the conference and of the many people who participated in its planning and implementation.

John Howard, MD
Director, NIOSH

Executive Summary

This report summarizes the content of a fall 1999 national conference on occupational safety and health training. The conference addressed emerging issues in training especially in light of challenges posed by a global economy, advances in telecommunications, changes in workplace conditions and organizational practices, and changes in workforce demographics. The scope of the subject matter covered and the manner of addressing topics through plenary, panel, and breakout sessions enabled numerous views to be expressed among stakeholders and other participants.

The report is divided into five sections. The first section, **Needs and Challenges**, introduces the main theme of the conference. Presentations described in this section emphasize aspects of workplace and workforce changes and their implications for occupational safety and health (OSH) training. For example, the growth of new technologies, products, and services produces ever-changing jobs and thereby imposes nearly continual training demands on workers to ensure adequate job skills. How best to formalize and package OSH training to fit new, dynamic job situations needs to be addressed. Even more formidable is the fact that the workforce is becoming more diverse in culture, language, literacy levels, and related capabilities. These challenges, combined with the growing numbers of temporary or contract workers who do not have the same relationship with management as regular employers, present special difficulties in meeting current OSH training needs. Noted too is the problem of how to provide adequate OSH training to the increasing number of low-wage workers, many of whom have the most hazardous jobs.

Partnerships and collaborative efforts by various stakeholder groups are seen as ways for coping with the above challenges. The roles of the Federal agencies in offering resources and assistance to employers and labor groups are mentioned, as are those of State and regional centers in targeting specific worker groups. An approach that combines various skills—adult education, organizational management, communication, and research—is seen as important for designing suitable curricula, learning materials and delivery mechanisms for reaching

groups with special cultural or other needs. Also viewed as a critical development is the use of computerized techniques and new telecommunications and web-based technologies for enriching learning possibilities even for those at remote locations.

In the **Policy, Regulations, and Standards** section, various stakeholders examine their roles in promoting effective OSH training. These stakeholders include insurance companies, Federal agencies, accrediting bodies, standards organizations, business consultants, and labor representatives. Although roles varied, common ideas expressed by the participants are as follows:

- OSH training should be part of a comprehensive hazard control program. The effectiveness of training alone is less certain. This is seen as consistent with the Occupational Safety and Health Administration (OSHA) effort to promote an overall OSH program standard.

- OSH training as well as other control measures should target the conditions that present the highest risk of work-related injury or disease. At the conference, an insurance company representative commented that a policyholder's major source of real or potential loss is the focus of the insurance company's training efforts rather than compliance with any standard. Similarly, an OSHA representative promoted the importance of targeting training and training resources to segments of the work population who are exposed to agents posing the highest incidence of injury, disease, or fatality.

- Voluntary standards should be set for acceptable OSH training practices. These should include competencies required for those who deliver training and related professional services. Concerns about the quality of many workplace training programs emphasize the need to institute policies to assure more responsible efforts. OSHA welcomed efforts to document effective OSH training practices and consider them in framing training requirements.

- All levels of a company workforce should receive OSH training as a means of reinforcing its goals. A business consultant, among others, stressed that safe behaviors and safe work practices demand OSH training for senior

management, first-line supervisors, as well as the workers.

Reactions to the idea of formulating a national policy on OSH training drew varied responses. Elements of the policy proposed by labor include:

- Establishing local worker resource centers for consultation purposes jointly funded by Federal and State agencies or trade and labor organizations;
- A national training standard to address all training issues rather than specific requirements for each standard;
- Efforts to demonstrate training effectiveness.

The third section, **Current Perspectives and Practices,** contains reports illustrating various approaches for meeting the challenges of delivering OSH training to different target groups and conditions. Foremost are examples of collaborations between State agencies, community associations, and business and labor groups. Some partnerships offer OSH workshops in capacity building for employers, managers, or others having prime responsibility. Similar partnerships provide direct training and other interventions designed to meet the specific needs of at-risk groups such as painters, farmers, and young workers. Included in this section are reports of OSH training programs in companies that represent a cross section of industries and services. Common to all are the importance of top management commitment and worker involvement in defining safety objectives and ways to achieve them. In nearly all cases, the importance of process is emphasized (for example, safety audits and fault analyses) as opposed to outcome in setting safety performance goals.

An insurance company servicing agriculture employers whose workforce was largely Hispanic describes their special OSH training needs. The insurance company efforts include use of bilingual field agents as trainers, training materials in Spanish, and use of culture-based teaching methods.

Variations of employer-directed versus worker- centered approaches to OSH training are highlighted. Examples include (1) educating and holding managers responsible for worker safety and health training, (2) training workers as onsite safety specialists, and (3) training that enabled workers to reduce workplace

hazards.

This section also includes discussion of OSH training issues in developing countries and multinational corporations. The lack of OSH training for at-risk workers and the lack of OSH knowledge among health care providers are viewed as major problems in developing countries. Solutions include statutes requiring training for workers in hazardous jobs, additional courses in university medical schools and schools of public health to prepare professionals, and public information campaigns to create greater awareness of work-related hazards. The latter is seen as one function of occupational health centers that would serve as a base for OSH training efforts. The inferior status accorded women workers in many nations is also recognized as a problem. The International Labor Organization has been implementing programs for women with OSH training and educational components to effect change.

In the **Developing OSH Training Interventions** section, topics include curriculum development, trainer attributes and instructional techniques, government training resources, and use of new technologies. Beyond typical needs assessment approaches based on injury and illness cases or hazard analysis, other factors are identified in order to make training content fit particular objectives. One effort described in this section went beyond legal requirements by training mine workers in industrial hygiene skills and use of environmental sampling instruments. Other efforts, designed for apprentice workers in construction, high school students, and those in vocational programs, sought to create increased worker awareness of both general and specific hazards. The benefits of using peer instructors are also recognized, as are select roles for outside training consultants. The latter includes designing a training program, mentoring an organization's personnel who have training roles, as well as measuring training results. Introducing realism into the training sessions and promoting trainee participation in working through case studies and problem-solving exercises are viewed as critical to a successful training experience. Presenting narratives in the form of short stories based on injury and investigative reports are reported to be particularly effective.

The separate and overlapping functions of three Federal agencies in facilitating OSH training efforts are noted in this section. Aside from issuing and monitoring

compliance with OSH standards, OSHA supports programs offering direct training of workers, providing technical assistance to employers, and disseminating materials for use in OSH training. A major effort of the National Institute for Occupational Safety and Health (NIOSH) is to support the training of safety and health professionals who play key roles in OSH activities in all sectors. The network of NIOSH Education and Research Centers (ERC's) that trains these professionals also includes outreach programs that offer safety and health training to local employers, workers, and schools. Through its research programs, NIOSH also furnishes updated technical information for use in OSH training and conducts research on the effectiveness of training. The National Institute of Environmental Health Sciences (NIEHS) training efforts are focused on workers who perform hazardous waste site cleanup and related activities. Besides providing an extensive training program for these workers, NIEHS also conducts numerous workshops and other activities to examine varied approaches to address special training problems. These have included techniques for teaching a low-literacy workforce; training modules for use in minority, non-English speaking populations; and improved peer training and worker participation methods for enhancing the quality of OSH training.

Other discussions in this section concern the use of new technologies in OSH training. Computer technology, use of the Internet, CD-ROMs, DVDs, and Web satellites are seen as attractive possibilities for meeting the information and skill requirements of constantly changing jobs as well as delivering such training to a diverse and scattered workforce. At the individual level, CD-ROMs and DVDs allow for instruction at one's own pace and skill level as well as convenience. Some concerns about the use of new technologies are that the potential for worker involvement in OSH training would decrease, as would the critical role of instructors in livening the learning process. Another concern is that the advanced training technologies would "lower the bar" in terms of workers acquiring skills and knowledge to perform job functions. An approach is suggested for accommodating these technologies within a hazardous waste site training program for workers.

In the final section, **Evaluation of Training and the Need for Future Research**, different forms of evaluation are discussed in the context of behavior-based versus systems-based approaches to OSH training. The bias in viewing the

outcomes of behavior-based and other forms of OSH training solely in terms of worker actions (not including similar measures on their superiors) is highlighted. Additionally, it is stressed that qualitative assessments of training, for example self-reports of whether and how training has affected one's work practices, can be as important as quantitative data, especially in gaining insights into transfer of training messages. Because any positive changes produced by training can be moderated by worksite conditions, evaluation plans must factor in these extra-training considerations as well. These considerations are included in OSHA efforts to perform a programmatic assessment. A database on training as an effective intervention strategy shows certain elements to be key to obtaining successful learning outcomes. Activities emphasizing hands-on exercises, case studies, and problem-solving exercises geared to real events are acknowledged as particularly significant. Because gaps remain in developing a true OSH training technology, a plan is described for promoting a more orderly and organized research approach to attaining this goal.

Special methods are described for performing training evaluations. Testing for knowledge through exercises involving simulations of real situations either in picture or story form are noted, as are economic impact studies and efforts designed to yield multiple measures of training effectiveness. An evaluation plan that allows for participation of all company stakeholders (trainers, workers, supervisors, and managers) is described as an alternative to traditional use of outside consultants or others competent to do these tasks. The merits of the approach are discussed along with the needs for training personnel undertaking these activities. Workers who were so trained, and who participated in training evaluations within their respective companies, report on their experiences.

Contents

Acknowledgements

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Introduction

Conference Purpose and Planning Process

In 1999, a national conference to discuss emerging issues in the occupational safety and health field with a focus on training effectiveness was sponsored by the National Institute for Occupational Safety and Health (NIOSH), the Occupational Safety and Health Administration (OSHA), and the National Institute of Environmental Health Sciences (NIEHS). These sponsoring agencies saw the importance of anticipating challenges to meet workplace training demands posed by the growth of telecommunications, world trade, labor migration and other factors, and the need to generate a consensus on strategies to meet them.

Conference planning stressed a collaborative effort by multiple stakeholders (Appendix A) to assure broad input in the presentation and discussion of issues. Conference planners represented government, academia, labor and unions, employers, the insurance industry, and professional and trade associations. NIOSH took the lead in developing the conference program and coordinating related activities.

The meeting was organized around five themes:

- Issues concerning the changing workplace and work force
- Methodologies for training
- Evaluation of training

- Systems of safety including training
- Policies and resources to meet projected training needs

Plenary sessions addressed central issues related to these themes with breakout, small group presentations, and roundtable discussions designed to examine topics in detail. The goal throughout these sessions was to engage the audience and facilitate dialogue.

The end product was a program consisting of 60 separate sessions with more than 250 presenters and facilitators in addition to 600 attendees. The conference was held October 24–26, 1999 in St. Louis, Missouri.

Nature of Conference Report

Dr. Alex Cohen, a retired NIOSH employee with experience and expertise in occupational safety and health training, and a presenter at the conference, produced this conference report. The report contains summaries, commentaries, and highlights of major points made in the various plenary, panel, and small group sessions. This format was chosen because of the breadth of topics covered, the diverse manner of treatment, and the ensuing discussions, which proved nearly impossible to capture in a proceedings report.

These highlights are organized into five sections whose titles deviate somewhat from the original five themes, but offer a more meaningful and coherent flow to the subject matter presented and discussed. Participants whose contributions are reflected in the highlights are identified in Appendix B for each section and/or topic session. The author apologizes in advance to those whose presentations were not acknowledged.

Reporting now on a conference that took place over three years ago raises the question of the currency of the conference information. Admittedly some issues raised then have been superceded by others currently considered more important. But the reader will note that most of the issues are still germane and of concern to the training community. To demonstrate the currency of these issues, an updated listing of literature pertinent to many of the topics covered in the conference has been added to the report, and constitutes Appendix C.

Section 1 ' Needs and Challenges

Commentary

Occupational safety and health (OSH) training is acknowledged to play a key role in reducing risks of work-related injury, disease and deaths. Numerous OSHA standards require training as one means of hazard control. Although reported workplace morbidity and mortality in the United States are decreasing, the number of reported cases is still substantial. Therefore, improving the effectiveness of training efforts and other interventions aimed at workplace hazard prevention and control is important. However, the workplace and the workforce are changing in response to advances in technology, demographic shifts, and global economic factors, and these changes complicate the task of training. Although the current literature on adult learning and OSH training is extensive, it reveals gaps in information about critical determinants, the strengths and limitations of various approaches, and the best strategies for dealing with these developments. By bringing together a variety of training community stakeholders to share ideas and experiences, this conference sought a broad spectrum of views to address the challenges to OSH training posed by workplace and workforce changes.

A list of literature references related to the topics in this Section is found in Appendix C.

Highlights

Workplace Changes and Training

Workplace changes in the United States include a shift from a manufacturing economy to one that is dominated by services. Because occupational hazards in the service sector tend to be more variable and diffuse than those encountered in manufacturing, training may have to change to require more varied, alternative

approaches to ensure learning of safe work practices.

In addition, the organization of work is increasingly shifting to a flatter profile with a reduced management-to-worker ratio. Although the provision of a safe, healthful workplace is the responsibility of management, workers in these settings can be expected to play a greater role in OSH efforts and thus should receive appropriate training and information about hazards, control measures, and preventive actions.

Expectations are that escalating rates of social, economic, and information change will transform or replace the current workplace as we know it. New technologies, methods, products, services, and industries will appear, only to be replaced by others at an ever-increasing rate, and each may have their own safety and health risks. Given these circumstances, it is envisioned that 75% of the workforce will need retraining to maintain their ever-changing jobs, and that workers will need to be completely retrained three to four times over a 50-year work history. Furthermore, new workers to the labor force will have to be trained as lifelong learners to responsibly participate in the future of their occupations. In each case, OSH training will have to be formulated and packaged in ways to fit new, dynamic job situations.

In the future, knowledge-based work (as distinct from manual or psychomotor work) is expected to dominate the economy. New organizational structures may consist of a core of permanent employees maintaining key competencies, ringed by a temporary and highly decentralized task force linked to each other and to the core by intercommunication networks. In this situation, the delivery of training (presumably through online programs) will differ from the instructional approaches currently available. Investments in technologies must be made to assure that worker knowledge will keep abreast of job changes and relevant OSH needs.

Workforce Changes and Training

The workforce has become diverse in terms of cultural backgrounds, language skills, literacy levels and related capabilities. More workers speak English as a second language and are still required to fulfill complex job tasks. To compensate for this, job training in general—and occupational safety and health training in

particular—must be tailored for particular workers. The advent of a global workforce tied together by the Internet and other forms of network communications places a heavy demand on distance learning techniques that also must accommodate these factors.

The contingent (contractual or temporary) work- force is growing. Contingent workers have less developed relationships with employers and are subject to frequent job changes. This places this group at a higher risk for work-related problems. The fact that contingent workers are typically young, have less education and job experience, and receive less safety training when engaging in more hazardous work than direct hire workers has exacerbated this situation. Training and other strategies to meet the occupational safety and health needs for contingent workers, given their make-up and the assorted tasks they undertake, pose a significant challenge.

Additionally, a large number of workers hold multiple jobs that may add up to more than 40 hours per week. They are typically listed as having full-time employment but may need various types of OSH training to cope with the job demands and hazard controls specific to each job setting and employer. Issues of work overload and job/family conflicts loom as added safety and health factors.

The workforce continues to age as “baby boomers” and older workers opt to defer retirement to maintain their income level or health insurance or for other reasons. Risks of work-related injury and disease are expected to decrease among older workers because of their greater experience, maturity, and engagement in less hazardous jobs than young workers. On the other hand, when compared with middle-aged workers, fatal and severe injury rates are still high for older workers, perhaps because of difficulty in adjustment to changing workplace demands. Both young and old workers have excess lost time due to injury and illness during the first year of employment. Targeting these groups for training must include approaches that recognize age differences in motivation and learning, among other considerations.

Low-wage workers are one of the fastest growing segments of the workforce. Current estimates show that half of all new jobs are temporary or low paying. Most low-wage workers are women and/or non-Caucasian. These workers often

have limited education and lack health insurance. In addition, these workers frequently do not develop relationships with employers, which have been shown to help protect against long-term risks from workplace injury and disease. Training plans that can build job skills in these groups as well as address concerns about workplace hazards can be difficult to develop, but successes exist that offer examples to build on. One example dealt with hotel housekeepers, a largely non-English speaking workforce with a high school education. Through an empowerment approach, the housekeepers, working jointly with management, were able to gain skills in job analysis and hazard control that addressed both productivity and safety concerns.

Other Related Issues and Challenges

A panel discussion in this session raised other points bearing on workplace safety and health training issues. Some of these points were the following:

- Safety and health training designed to reduce adverse outcomes caused by unsafe acts or operator errors is shortsighted. Effective training needs to focus on work environment factors (defined as production methods, control systems, organization and management practices), and be tailored to meet worker needs for protection in each work setting.

- Evaluation of training effectiveness needs to be more holistic. That is, evaluations should consider not only worker behaviors but also workplace culture and environmental factors.

- Workers in manufacturing, though decreasing in numbers relative to the service sector, still face the most significant workplace risks and thereby warrant continued efforts to improve their training as well as other measures for hazard control.

- Nontraditional employment relationships, subcontracting, home-based businesses, and virtual offices will greatly complicate training efforts aimed at meeting technological advances and fostering a positive environment for worker protection. Indeed, a compelling need exists to redesign training methods to take advantage of new telecommunications and web-based

applications that can meet the challenges posed by fragmented and temporary employment. There are concerns that worker involvement and empowerment, considered key elements in successful occupational safety and health program practices, may be undermined by these developments. These will have to be addressed and options considered for gaining worker input in the development and implementation of such programs.

In coping with these workplace/workforce developments and the challenges they present to occupational safety and health training, numerous references were made to the need for partnerships and collaborative efforts among various players. At the international level, it was proposed that developing countries would benefit greatly from the lessons learned in more economically advanced nations with regard to setting appropriate occupational safety and health standards. Experts in developed countries could serve as mentors to governments, employers, labor inspectors, and workers for developing countries. Use of virtual classrooms and distance learning techniques were noted as useful ways of communicating international safety and health training to some populations.

Within the United States, Federal agencies such as NIOSH, OSHA, and NIEHS provide information and offer consultation to employers and labor groups, but some unorganized groups of workers (e.g., immigrants and minorities) remain uninformed. Greater efforts to reach these workers, perhaps through state and regional health and safety training centers, were recommended.

At the individual agency level, NIOSH has been working with specific occupational groups to develop training materials and to fund grants that include evaluations of training interventions. NIOSH has also collaborated with community organizations and vocational associations to assess the roles that these groups may play in reinforcing workplace safety and health messages. Another potential area for collaboration would be to combine efforts of specialists in adult education, organizational theory, and research design. Such combined skills could provide data that are critically needed on successes and failures in curricula, materials, and delivery mechanisms in workplace safety and health training, with special regard to context and culture factors.

Section 2 ' Policy, Regulations, and Standards

Commentary

Any discussion of policy, regulations, and standards related to OSH training prompts a variety of views and reactions. Questions include: Have the benefits of OSH training as a means of reducing work- related injury and disease been sufficiently demonstrated to justify policies, regulations and standards governing the conduct of such practices? If so, how should the policies, regulations, and standards be framed to demonstrate accountability or compliance, given the array of industries and occupations with different hazards, and limited training resources for small employers, among other factors? Is there more merit in having a stand-alone OSH training policy or standard with broad applicability, as opposed to the current practice of folding specific training requirements into regulations that pertain to a particular industrial operation or work hazard? What is the place of OSH training in the hierarchy of workplace hazard prevention and controls? What other factors (for instance workplace culture and climate, or management commitment), are needed to enhance its intended objective(s)?

A list of literature references related to the topics in this Section is found in Appendix C.

Contributors to this section acknowledged how major players promote effective OSH training. Mention was made of the roles played by insurance companies, the Federal government, accrediting bodies, standards organizations, business consultants and labor's view of current and proposed policy needs in this area. Common or crosscutting themes expressed by the participants were the following:

- Combining OSH training with other workplace interventions is a concerted programmatic effort to reduce work-related injury and disease and can produce substantial results. The effectiveness of OSH training as a sole

intervention is less certain and limited.

- Directing OSH training and other forms of hazard control to those conditions that represent the highest risk of work-related injury and disease can be an effective use of training resources. At a minimum, an OSH training plan should target work practices and behavioral factors that contribute most to hazard risk and risk management.

- Setting at least voluntary standards for acceptable OSH training program practices, and establishing competencies of those delivering OSH training, can provide quality control.

- Providing OSH training to all levels of the workforce in a company can promote total staff knowledge of the goals of the training and reinforce its objectives.

Reactions to the idea of establishing a national policy on OSH training drew varied responses. Some proceeded to outline needed elements of a national policy. The elements included the establishment of the following:

- Local worker resource centers to be funded jointly by Federal and State agencies, insurance companies, or trade and labor organizations for consultation purposes

- A national training standard to address all training issues rather than specific requirements for each workplace standard

- Programmatic efforts to examine the causes of workplace injuries and illnesses, and support demonstrations of the effectiveness of training

Aspects of education were also to be addressed, such as including requirements for engineering graduates and other professionals to be fully cognizant of OSH training approaches; and to have students, beginning in secondary schools, gain a basic awareness and understanding of workplace health and safety before they enter the workforce.

Highlights

Player and Stakeholder Views

A variety of stakeholders, representing large sectors of the safety and health community, described their perspectives on safety and health training. Insurance, government, consulting, and labor representatives described the rationale for current practices, along with apparent deficiencies.

Insurance Views

The majority of insurance companies focus on a policyholder's major sources of loss or potential loss rather then compliance with any standard. Because of policy constraints, most insurers opt to use a train-the-trainer approach in offering OSH training programs to their company clients. The trainers are trained to help workers understand workplace exposure risks and necessary controls. Many such train-the-trainer programs are created by the insurance company or developed from informational materials such as those from OSHA. Insurance companies acknowledge that mandatory OSH training for specific hazards does not ensure its effectiveness. Hence, they stress the need for post-training, followup activities, organizational changes, and behavior-based measures to demonstrate whether the training objectives have been met. Recognizing that mandating training for all potential workplace exposures is unlikely, one insurance company favors a systems-based model whose elements would include voluntary risk assessments for targeting problem exposures, adapting training along with other control measures deemed appropriate for risk reduction, and establishing organizational or other changes that would reduce risks.

In this regard, the stakeholders stated that an ideal way to produce demonstrable results is to make OSH training part of a comprehensive hazard control program. This related to the occupational safety and health program rule proposed by OSHA in 1998 (29 CFR 1900.1) that includes components addressing management commitment, worker involvement, worksite inspections and analysis, hazard control options, emergency response, and OSH training. Reflecting on issues regarding OSH regulations, a participant questioned which exposures deserve specific regulations, what the nature of employer obligations for OSH

training would be, and how training regulations can be measured for effectiveness and compliance.

OSHA Views

At the time of the conference, OSHA perceived training as a critical action to take in further reducing workplace injuries and illnesses in the U.S. For example, OSHA's rulemaking efforts were then focused on enacting an OSH program standard and an ergonomics standard, both of which included training requirements. A number of other priority actions were either ongoing or planned.

One of these actions was targeting training either to the segments of the worker population with the highest incidence of work- related injuries, fatalities or disease, or to the hazardous agents that pose such threats. Examples of targeted worker populations include new workers, who have a higher rate of injuries than experienced workers; and workers employed in small businesses (fewer than 20 employees), who are more likely to be killed on the job than those working in larger companies (more than 100). The agency welcomes strategies to address the needs of these at-risk groups. OSHA described working with small business development centers in several States in efforts to design suitable training plans but admitted that more assistance at the local level was needed.

A second effort has been directed to convince employers, unions, and the public of the importance of training in terms of lives saved, injuries avoided, and reduced costs to business. Empirical evidence is being gathered on the benefits of training through consultant evaluations of company safety and health activities. Available data show that companies that place a strong emphasis on worker retraining had the most effective occupational safety and health programs. Programs with a strong worker training component generally showed fewer injuries and illnesses.

OSHA invites training professionals to provide examples from their experience that–illustrate the contributions of training to reduced workplace injuries and illnesses. OSHA also welcomes input from these professionals in shaping training rules that are workable and effective. Demonstrating the benefits of training through measurable results will be basic to OSHA's formulations of employee

training requirements.

A third OSHA activity is providing support for direct training and education of workers through grants to various non-profit organizations, course offerings at OSHA regional OTI Education Centers, and disseminating training products through distance learning technology, CD-ROMs, and the Internet.

Professional OSH Consultants Views

A representative of a business consultant firm offering OSH services made three points regarding training. One was that OSH training components should encompass the proper design, management, and inherent safety features of an operation to ensure that all workers are informed of all hazards and suitably protected. To do this, a strong emphasis should be placed on eliminating workplace hazards though engineering solutions or control methods other than dependency on worker behaviors to reduce such risks.

The second point was that establishing safe behaviors and safe work practices through worker training requires that all levels of employees, including senior management and first-line supervisors, exhibit similar behaviors which support the training experience.

And third, the representative stressed that training must be considered a shared value within an organization among employees at all levels. Understanding that training is a value creates an atmosphere that instills knowledge and realizes its benefits. Although the development of this viewpoint and how best to nurture it was not elaborated, others noted that worker involvement and input in developing training plans can enhance the capacity for worker learning.

Labor's Views

Labor's views of the current status of OSH training include mention of several deficiencies. One deficiency was that most training programs lack quality control. For example, in many workplaces, training is an afterthought, or a perfunctory exercise where workers attend a 15-minute classroom session, or view a videotape or computer program on safety issues. In other businesses, training is only carried out to comply with regulations. Of the more than 100 OSHA standards

that require worker training, few contain guidelines or requirements on how to enhance training effectiveness.

A second deficiency concerned current resources for training. It was noted that most training activities, consulting services, and supporting materials are primarily targeted to employers, developing professionals, or employer representatives. The need to widen the audience for training was stressed, as was the need to mandate training for supervisors, foremen, and company owners. Training in this latter instance was believed necessary for an understanding of the importance of worker training and the development of a comprehensive safety program. Mining Safety and Health Administration (MSHA) regulations regarding comprehensive miner training have been extremely effective in enhancing mine safety and health, but no such rules exist for other workers who also face serious workplace hazards. One labor representative said this disparity reinforces the need to establish a national training policy that should be based on a national commitment to training. He went on to say that employees should not report to work unless a high quality OSH training program has been implemented.

Quality Assurance and Standards Development Issues

Several accrediting and standards-development bodies have set forth requirements to assure quality products and competent providers of services. The following are examples of standards that relate to OSH training.

Accreditation and Certification

The public needs assurance that those responsible for assessing workplace hazards and designing hazard control systems have the needed skills and competencies to undertake such tasks. Requiring certification and licensing of these professionals is one way of gaining this confidence. The Accreditation Board for Engineering and Technology (ABET) approves curricula and educational objectives in university and college programs for preparing engineers, industrial hygienists, and others who work in the occupational safety and health field. Criteria and objectives for gauging program merit include safety and environmental and worker protection issues. Thus, program graduates are

presumed to have needed competencies in these areas. Becoming a Certified Safety Professional (CSP) by the American Society of Safety Engineers conveys a similar assumption. An important consideration is whether graduates of these accredited programs and CSPs engaged in OSH have sufficient knowledge of training approaches. This relates to the question of the kinds of certification or licensure that should be required of those expected to perform training services aimed at protecting the health and safety of U.S. workers.

ANSI Z490.1

In an effort to assure quality products and services, training experts from various sectors of industry, trade associations, and small and large businesses have been engaged in developing the American National Standards Institute (ANSI) Z490.1 Standard, which is voluntary and is set forth in *Criteria for Accepted Practices in Safety, Health, and Environmental Training*. In design and purpose, the standard can be used to assess the services of external service providers, or to audit and improve their company training programs. The standard covers all facets of training including training development, delivery, evaluation, and training management. Tied to each of these components are conditions for satisfying specific requirements. Table 1 outlines the components and conditions for accepted practices in training under ANSI Z490.1.

This standard offers explanations or illustrations of ways to satisfy the various requirements. Included are examples of core competencies, instructor credentials, organizational controls, and model curricula. In connection with training program management, and as mentioned earlier, the draft standard emphasizes that training by itself cannot assure a safe, healthful, and environmentally sound workplace, nor can it assure regulatory compliance. Rather, training must be integrated into an overall safety, health, and environmental program.

ISO 14000

Requirements for workplace safety and health training are also contained in standards intended to address international environmental management concerns. The International Standards Organization (ISO), in collaboration with the United Nations, has developed the ISO 14000 series that establishes a

management system for controlling and monitoring the environmental compliance activities of a company. The focus of environmental activities includes those concerned with the handling and disposal of hazardous materials and waste products, air and water pollution controls, and air and water management. A primary requirement of the environmental management system is that the company must be in compliance with the "law of the land." For U.S. companies, "law of the land" means compliance with all applicable OSHA, U.S. Environmental Protection Agency (EPA), and Department of Transportation (DOT) regulations. Other elements of the environmental management system contain the need for policy statements and actions that commit the company to do the following:

- Identify and assess existing and potential problems and risks
- Communicate the information to those who have a need to know
- Respond and manage those problems and risks

Among requirements for implementation are several that address worker training, awareness, and competence in dealing with environmental issues. Training requirements set forth are nearly identical to those described in the ANSI Z490.1 draft standard. Particular emphasis in the ISO 14000 standards is given to auditing requirements for ensuring compliance. Because of the auditing requirements, aspects of training in a given company are under continual review. Although voluntary, the incentive for companies to adhere to the ISO 14000 environmental management standards is that the standards have market value. That is, proponents of these standards, and others, argue that a strong market exists for environmentally friendly products, and a preference among consumers has emerged for companies that are "clean."

National Skill Standards

The ANSI and ISO standards dictate training requirements for employers to ensure that their workforces are informed of workplace risks, and knowledgeable of safe work practices and self-protective measures. Alternatively, the National Skill Standards include OSH competencies for particular skills needed to perform work functions at basic and advanced levels in various sectors of our economy.

These standards were established by the National Skill Standards Act of 1994, and are being developed through a voluntary partnership of labor, industry, academia, and government for use in education and the workplace. They are intended to ensure a high performance labor force. In this regard, training institutions—high schools, community colleges, universities, union/trade apprenticeship schools—may choose their curricula and instructional methods to meet the level of competencies set forth in the skill standards.

NIOSH is collaborating in this standards development [Palassis et al. 2004]. They view the effort as a way to increase the level of safety education and safety awareness for all workers and students. A first set of skill standards developed for the manufacturing sector was published in 2001.

Especially relevant to the subject of standards were efforts reported to update tasks, skills, and knowledge needed by hazardous waste and demolition workers bearing on current OSHA training requirements. The training content appears to be outdated for these types of jobs.

Section 3 ' Current Perspectives and Practices

Commentary

Occupational safety and health perspectives and practices on training continue to evolve in the recognition of various target populations and situational factors, and in efforts to find and use resources more effectively. Approaches can range from instilling an OSH awareness in young persons who are already working or will constitute the future labor force, to educating employers about the commitment needed to ensure an effective OSH training program without sacrificing productivity. Complicating matters is the growth of multinational companies, a global economy, and the diversity of the U.S. working population. Indeed, strategies for addressing workplace safety and health concerns must now take account of groups that could present distinct language, cultural, and traditional challenges to training efforts.

Other longstanding situational challenges remain. OSH programs need to consider practical approaches for large employers as well as smaller ones, suitable strategies to meet the OSH needs of the assorted manufacturing and service sectors of our economy, and involving workers in program planning. Resources available to undertake occupational

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A list of literature references related to the topics in this Section is found in Appendix C.

safety and health training are limited. This means priorities, partner, and leverage efforts must be set by Federal, State, and local community agencies; and insurance, trade, and labor organizations to enable positive training results.

Platform speakers and panelists elaborated on the above-mentioned challenges. Examples of collaboration at all levels—among State, community, business, and labor groups, and various other interested parties—were described in developing and delivering targeted OSH programs. Formal needs assessments were discussed to identify problem areas that dictate interventions through training or other means. OSH approaches to training and other means of hazard control revealed a variety of strategies. These strategies included customized approaches to fit specific groups such as non-English speaking workers, high school youth, and farm owners. Where noted, positive results from these efforts seemed mostly based on anecdotal observations.

OSH programs in companies that represent major business sectors highlighted management commitment and worker involvement. Most emphasized process (e.g., safety audits, fault analysis of operations) as opposed to outcome measures in stressing goals of achieving excellence in safety performance rather than mere compliance with regulations. Worker efforts in taking over responsibility for safety training and providing other direct inputs into the OSH program were perceived to have merit.

Concerns for workers in developing countries are just being recognized as more and more of their economy shifts from agrarian to manufacturing activities. Whether lessons learned from the OSH experiences in the United States and

other fully industrialized nations can work elsewhere remains an open question.

Highlights

State and Local Approaches

Efforts to address OSH concerns at the State or local level fall into two groups. One group addresses OSH issues as a whole or to a broad audience. The second group is more selective, either in targeting a specific OSH objective or a specific occupational group. For both groups, the nature of delivering the training can take a variety of forms.

Examples of the General Approach

Reflecting the general approach, the Indiana Bureau of Safety Education and Training partnered with individual business, labor, trade, and academic organizations to offer the OSHA 10-hour Outreach Program. This program was particularly useful in giving an overview of workplace safety and advancing OSH training. The Bureau added other subjects identified as important to a particular audience, which served to enrich the experience.

The Michigan Safety and Education Division offered safety administrator courses designed to provide company safety directors, managers, and supervisors with knowledge and skills to establish an OSH program. This course featured a case study, participatory approach that gave the employers an appreciation of factors critical to basic program elements such as management commitment, employee training and involvement, worksite analysis, and hazard prevention.

The training section of Oregon's OSHA has conducted both quarterly OSH workshops throughout the State as well as onsite classes for specific groups. They adapted the workshops into a course, delivered through the Internet, with interactive student and instructor features. They also partner with industry and labor groups to offer classes on specialty topics. These classes are designed to build skills for employers and employees to make them self-sufficient in OSH activities.

Examples of the Specific Approach

Regarding more focused programs, California State Department of Health Services has sponsored regional seminars for contractors engaged in painting and building remodeling where the potential existed for lead exposures. The goal of the seminars was to reduce lead poisoning risks among contractor workers, family members, and building occupants. Because the target group contains many small business owners, seminar attendance was a challenge, as was achieving business owner receptiveness to training that might dictate workplace changes with added operational costs. For this reason, contractor trade associations, labor unions, and worker's compensation carriers all participated in the planning and outreach activities for the training seminars. Evaluations of the program found that clear public health messages, followup technical assistance, and strategies that consider the realities of small contractors produced favorable results.

The University of New Mexico School of Medicine targeted training to health care providers who serve rural areas where working populations had diverse cultural, economic, and educational backgrounds, and where little if any OSH infrastructure existed. In this instance, continuing education training modules were developed for the providers based on data from known exposures and outcomes of workers with occupational and environmental health complaints. The modules were designed as problem-solving exercises based on case studies or recent local events, and also incorporated cultural factors to ensure a relevant, realistic context. The modules were delivered in a variety of clinical settings throughout the region as well as to staff members of the state health department. This effort resulted in greater attention to OSH issues among public health officials, health care providers, rural health clinic staff, and workers in the affected rural region. Physicians have requested additional modules to cover other topics, and modules to translate OSH information for use in community workshops are planned.

The Iowa Certified Farms Program also targets the OSH needs of a select population. In this program, the Iowa Center for Agricultural Safety and Health partnered with local rural clinics and health insurance companies to develop an innovative plan to deliver safety and health services to the local farming

community.

The basic concept was to offer financial incentives to farm owners to motivate them to remove or modify farm work hazards, as well as to gain their participation in health screening programs to prevent high-risk disorders. Incentives were given to farms that obtained certification. Gaining certification meant a 10 percent rebate on the farm owner's health insurance premium.

In operational terms, a Safe Certified Farm had to satisfy three requirements:

- The farmer completed a set of occupational health screening examinations at a clinic and maintained a monthly log of family injuries and illnesses.
- The farmer received one-on-one instruction during the clinic visits about harmful farm exposures and related health concerns.
- The farm obtained a minimum score on a safety audit of the farm conducted by a trained farm inspector.

A study comparing injury and illness data for matched groups of certified versus non- certified farms is ongoing to demonstrate the merits of this approach. The University of Nebraska Medical Center and the Nebraska Blue Cross-Blue Shield Insurance Company is piloting a similar program.

Young Worker Centered Approaches

A special category of OSH training includes both State-run and local community programs directed at high school students and working teens. This audience is targeted because of the relatively high incidence of injuries in agricultural, retail, and other jobs where the highest numbers of teenagers work. In addition, OSH training and supervision in these jobs is typically lacking. Another reason for targeting this group is that two thirds of all workplace injuries occur within the first five years of employment, and half of these in the first year. Consequently, employers want secondary and vocational school graduates to possess workplace readiness skills including those that can help deter these events.

The Missouri School to Work Safety and Health/Child Labor Consultation

Program offers one model where regional coordinators go into the classroom to offer a one-hour interactive session on child labor safety and health issues. Materials used in these sessions are obtained from national curricula, and copies are disseminated to teachers, students, counselors, and school-work coordinators. Additional materials are distributed to parent-teacher organizations and employers to enhance their awareness of child labor laws and safety and health needs of young workers.

Other models have used community institutions and youth organizations to carry the message. A joint program developed by a university and the Oakland, California School District brought together students, parents, employers, and community leaders to furnish health and safety information for teens just entering the workforce. Teens trained on these materials, in turn, taught their peers in classrooms and community settings throughout Oakland.

A youth teaching program in Illinois directly trains high school Future Farmers of America (FFA) members to make agricultural and rural safety and health presentations to elementary school students. In addition to receiving training and information on content, the FFA members are instructed in ways to organize community groups, publicize local concerns, and gain resident support for the program.

The Massachusetts Department of Public Health and an education development center have jointly developed an introductory course called Safe Work/Safe Workers for use by schools, job training programs, and youth organizations. The course includes a trigger videotape and interactive learning activities including hazard mapping, role-play exercises, and a game of prevention strategies. Packaging the activities in this way was geared to capture the attention of the youth audience.

A more formal approach to training for youth is a project funded by NIOSH involving vocational schools that prepare students as electricians. The curriculum was the product of a formal needs assessment, focus group discussions, and internal and external scientific reviews. First, field trials included use of an interactive video program on electrical hazards to promote student knowledge and attitudes about electrical safety. Teacher input was also solicited to refine the

training. This work was preparatory to introducing the project in a national sample of vocational schools and evaluating its effectiveness in motivating student awareness and concerns for work-related electrical hazards.

Sector-Specific Approaches

The conference included descriptions of exemplary OSH approaches in individual companies representing various sectors. They included the oil, mining, food service, chemical, health care, and construction industries. Common to all were ideas that gave cogency to the needs for top management commitment and worker involvement in defining safety objectives and ways to achieve them. In nearly all cases, the presenters emphasized the importance of process indicators as opposed to outcome measures in identifying needs for hazard prevention or control. Hence, reports of an injury or even a "near miss" were viewed as process indicators, and investigations were intended to look "upstream" for root causes and means for correction. This was best illustrated in a hospital program where sharps injuries among laundry staff were traced to medical and nursing staff not using sharps boxes for proper disposal, and the need for additional and strategic locations for the boxes.

In this case and others, worker input was vital in identifying problems. Acknowledging worker suggestions for best work practices was viewed as a critical element. For example in the food industry, a local worker's union in a food processing plant produced a safety video and the workers conducted all the safety training. An oil industry presentation was given by workers who explained that after completing safety courses conducted by their national union, they became responsible for the safety training of all employees in their company. Such measures were seen as enabling workers to take ownership of the safety program and considered a positive development in making workplace safety and health a company value. In these OSH programs, trainers encouraged striving for excellence rather than mere compliance, and for zero tolerance to injury. The role of training in producing the above results was acknowledged but not detailed. Stress on refresher training was noted in one case. Another stressed the importance of customizing delivery formats to fit time constraints and different group preferences for the instruction.

Special Cases

One insurance company described their role in addressing farm worker safety and health issues. The challenges in this situation were formidable. Apart from the hazards posed by farm machinery, pesticide exposures, and strenuous work tasks, the workforce was largely Hispanic, presenting both language as well as literacy issues in OSH training. Materials available for training were typically generic and not relevant to the situations at hand. The need to meet production quotas competed with training during work hours. Consequently, training sessions held before or after the work hours invariably were unpopular. Additionally, workers were apprehensive about reporting hazards or injuries to their superiors for fear of losing their jobs.

The insurance company made special efforts to address these problems. These efforts included using claims representatives and field agents who were bilingual, producing safety training materials in Spanish, and tailoring the contents to those operations and tasks for which the employer's records indicated frequent injuries and disabilities. In addition, the insurance company directly assisted in worker safety training, using in some cases culturally specific (games, photo-novels) teaching methods. The insurance company recognized the field foreman or supervisor as the key person onsite who was responsible for the safety of the field workers, and conducted train-the–trainer programs covering the same materials for the supervisors.

Presenters described examples of collaboration that were viewed as resourceful ways to meet the OSH needs of various businesses or work settings. One was in the City of Austin, Texas where 15 large companies formed a consortium to provide general OSH training to contractors who would be offering their services to businesses of all types and sizes in the area. This made training affordable to contractors who were not able to pay for OSH training that was required to fulfill certain task orders. Since an employer of contract workers would have been responsible for this training, the consortium program was viewed as reducing the employer's liability for in-house training.

Another example of a special case took the form of a proposal to develop a "Workforce Health and Safety Consortium" in the State of New York. The

Consortium's mission was to pool OSH content expertise already residing in State agencies (such as Departments of Health, Labor, and Environmental Conservation), private associations, professional societies, and trade groups. This Consortium would use existing statewide videoconferencing, distance learning, and satellite communications capabilities for delivering the Consortium's products to consumers. The proposal contained a description of the role of the School of Public Health at the State University of New York at Albany in creating an educational component of this program that could offer a credit-based curriculum and possibly advanced degrees in occupational safety and health. The challenge for both of these efforts is whether they can adequately fulfill the specific OSH needs presented by the diverse workplaces and worker groups they intend to serve.

Employer- and Worker-Centered Program Approaches

Whether an OSH training program is employer-centered or worker-centered falls along a continuum of practice. The following situations are examples of programs along this continuum.

As an example of an employer-centered approach to OSH, a major engineering corporation stressed the importance of establishing safety as a workplace value and issuing a policy endorsing a zero-accident goal for its entire workforce. An Environmental Safety and Health (ESH) system was designed to implement this policy, and a series of manager training and education workshops were held to specify the manager's leadership roles and responsibilities in meeting the goal.

For employee education, this corporation put emphasis on behavior, hazard recognition skills, standards, and stop-work authority. A variety of media was used for the safety and health training including hands-on activities, interactive CD-ROM, classroom exercises, a Web-based course, and e-mail distribution of documents. The company viewed success in worker training as driven by the ESH management system and believed that there were profits from endorsing a policy of zero accidents. The ESH program extended to workers from outside the corporation, too. That is, one criterion for the company selection of contractors, subcontractors, and outside worker groups for different projects was their past

safety performance records. Upon selection, contractor personnel were invited to participate in the ESH leadership training.

Worker involvement in and responsibility for aspects of OSH training has become more common. Two examples concerning ergonomics demonstrate important contrasts. In one, volunteer shop floor workers from various departments were given specialty ergonomics training in sessions that lasted from three to nine months long. These included meetings with engineering and supervisory staff in efforts to address real or potential problems as seen from the worker point of view. Once trained, these workers (referred to as “ergonauts”), returned to their regular work units where they then served as onsite experts in addressing ergonomics issues.

In the second example, worker groups were trained, usually as the result of employer-union agreements, to develop skills in identifying ergonomic hazards and means for their control. The training in this case employed popular education techniques. The techniques included pooling of group experiences and problem-solving ideas to increase knowledge of ergonomics issues and also methods for effecting needed workplace changes. In ongoing trial applications in construction work, the learning framework for participants included:

- Descriptions of their work-related musculoskeletal pain and disorders and the affected body areas

- Analysis of risk factors in their own jobs and redesign ideas

- Discussions of barriers to implementing the redesign measures and strategies for overcoming the challenges

Preliminary findings showed that the participants actively engaged in the learning process and enjoyed the experience. In terms of outcomes, proposed feasible solutions for reducing risk factors were noted. Though supervisory “change agents” were convinced of the merit of the recommended changes, the decision to go forth was slow, and the workers had moved on to other jobs before they could be implemented.

Issues in Developing Countries and Multinational Corporations

Workers in developing countries face increased hazards owing to increased industrialization and shifts from state-run economies to privately owned businesses, with attendant efforts to cut costs. The lack of OSH training for workers at risk and the lack of OSH knowledge among health care providers were viewed as major problems in these countries. Solutions to these problems include new statutes and policies that require training for workers in hazardous jobs, added courses in medical schools and schools of public health to prepare needed professionals, and national training days sponsored by occupational health centers to create greater awareness of work-related hazards.

The work of the International Labor Organization (ILO) to overcome the subordinate status of women workers in many nations also included OSH considerations. The ILO undertakes collaborative efforts with governments, unions, and employer organizations. To address the specific needs of women workers, the ILO has designed national-level programs with OSH training and education for building confidence in women workers. The program formats include workshops and train-the-trainer approaches. The ILO has undertaken these programs in the Philippines, Brazil, India, and the Seychelles with some success. Obstacles remain, such as gaining support from male leadership to organize and conduct OSH training courses.

The challenges presented to international corporations in managing a global workforce and global OSH programs include various language and cultural factors. Also, program practices must adapt to the diverse and changing working conditions found in different parts of the world.

Three components of future education and training were stressed as being key to sustaining a global economy.

1. **Smart workforce:** This workforce is one that is highly educated, skilled, engaged in a healthy lifestyle, and knowledgeable about hazards and stress. This includes workers who could act as decision makers on the shop floor and activate controls that could safely and accurately perform tasks for many workers.

2. **Smart technology:** For example, the Internet could be used as an asset to ensure that most relevant information is communicated to domestic and global partners in a timely manner. Smart technology also suggests use of computers in ways that would not overload and unduly stress those who have to make decisions on the basis of such systems.

3. **Smart learning system:** This is a process that is attractive, applicable, accessible, and takes advantage of new technology, skills and knowledge.

For the global economy, a solid education plan must serve as the foundation for new career development with specialized training to meet changing job needs. General Motors (GM) is applying these concepts in its health and safety training program. Specifically, program elements address healthy lifestyle issues, education, and training for global manufacturing and global management study, which include health, safety and hazard control topics. The GM OSH research program focuses on workplace interventions for reducing stress and strain.

Section 4 ' Developing OSH Training Interventions

Commentary

Training as an intervention strategy for reducing risk of workplace injury and disease requires several considerations. Are the training objectives and training content clearly relevant to the situation(s)? Are the training materials in a form that will be understood by the affected parties? Are instructional techniques used that can facilitate effective learning? Have steps been taken to ensure that the training reaches the target group? Satisfactory responses to these questions may produce a successful training outcome, but the real impact of training can depend on other workplace influences that may reinforce or counter the experience.

Conference presentations covered training efforts geared to traditional hazard

control in known high-risk work settings as well as those concerned with newer threats such as workplace violence. Approaches included case study materials for use in small group discussions for hazardous waste site worker training, simulation exercises to enhance miner readiness to cope with mining emergencies, role-playing and game strategies for hazard awareness training for teen workers,

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A list of literature references related to the topics in this Section is found in Appendix C.

and special video and audio-tape communications for promoting safe work practices for those handling explosive materials. As presented, each approach appeared useful. Although their adaptability to other settings was suggested, evaluative data to gauge the effectiveness of these techniques for OSH training on an individual or comparative basis was limited in most cases.

Resources to help meet various training requirements dictated by law, or otherwise recommended, were noted. They included Federal agency efforts in developing OSH training guidelines, furnishing training modules, offering consultation services, conducting direct training of workers, and supporting university programs for filling professional manpower needs in OSH. Most other described projects aimed at advancing OSH training methodology were undertaken through partnerships between Federal agencies, university and trade and union groups, and in some cases, community organizations. Prominent here were variations on train-the-trainer approaches, peer trainer models, and means for OSH capacity building among workers. Uses of the Internet and new computer technology for the packaging and delivery of OSH materials to remote groups through distance learning strategies were also discussed.

Highlights

Aspects of Curriculum Development

Designing training curricula to meet situation-specific OSH goals and objectives is crucial to attaining a successful training outcome. Speakers at the conference

described approaches for developing curricula for particular purposes along with examples of their application.

Framing Training Content to Address OSH Goals

The goal of OSH training is to reduce the risk of injury and disease as well as promote work practices that ensure workers' health and well-being. In doing so, a needs assessment must be undertaken to give direction and shape to the OSH training. Meeting the legal requirements for training sets a minimum standard. Beyond that, knowledge of the industry and job operations at a worksite, OSHA 300 logs, workers' compensation cases, insurance loss runs, and injury investigations all add valuable information in defining critical subject content to the training exercise. Professional trainers may use customized techniques for gathering data on management and worker factors that also bear consideration in framing instructional content.

OSH training may include subject matter or instructional techniques designed to fulfill the goal of creating more self-confidence in worker knowledge of OSH as well as active worker involvement in company safety and health program planning. An example is the MSHA and the National Stone Association (NSA) program to teach miners as well as mine operators the basic elements of industrial hygiene, including skills in respirable silica sampling and noise measurements. The program featured MSHA-furnished instructors, hands-on training with MSHA-donated equipment, and classroom study as well as mine site fieldwork. Aspects of the training involved use of learner-centered approaches in promoting a more participatory view of the training process.

Another example is the "Smart Mark" 10-Hour Training Program for the construction trades. This program provides general hazard awareness training to those at the apprenticeship level. The course consists of 10 modules, each focused on a different topic such as stairways, ladders, scaffolds, personal protective equipment, confined space, and materials handling. Choice of topics and materials for instruction grew out of deliberations of a national joint labor/management partnership in the construction industry that represented 15 unions and 7 national employer associations. A student workbook and an instructor manual, along with slides and power point presentations, were

developed to ensure uniformity of content and ease of presentation. Workers completing the course receive a Smart Mark card indicating 10 hours of training that meet an OSHA 10-hour construction course requirement. Qualifications for course instructors include completion of the OSHA 500 40-hour train-the-trainer course that covers construction standards.

Young Worker Curricula

Special training efforts in States and communities were described that were designed to reach certain audiences at risk for work-related hazards. In these cases, students in secondary schools were the targeted groups for the training along with their parents, employers, and health educators. The focus of the training was general safety and health, hazard recognition, child labor laws, costs of injuries, and effective approaches for injury prevention. The training was believed critical because of the significant numbers of young workers killed or injured each year. As mentioned earlier, on a national level, and as part of a NIOSH Training Intervention Evaluative Research project, an OSH curriculum has been created for vocational and technical school students being trained in the electrical trades. The curriculum took into account the results of focal group discussions, teacher inputs, and internal and external policy reviews. The curriculum was designed to strengthen student recognition and evaluation of electrical safety hazards. A formal evaluation comparing the OSH attitudes and knowledge of students in schools receiving this program with those not so included will be used to determine its effectiveness. NIOSH similarly is developing an OSH curriculum for cosmetology students.

Workplace Violence Curricula

A study by the ILO found that violence in the workplace, including homicide, bullying, and harassment is becoming a problem that transcends the boundaries of any country, work setting, or occupational group. To contend with factors believed to contribute to these events, it was recommended that workplaces transform themselves from a crisis-prone to a crisis-prepared state by creating collaborative violence prevention and response teams. Representatives of labor and management would staff the teams and undertake consensus policy development and planning. They would serve as ongoing groups to assess risk

and determine appropriate responses when a crisis occurs. For this purpose, special training was proposed based on insights drawn from crisis management and conflict resolution theory. The following were suggested subjects for such training:

- Understanding extreme behaviors on the job—causes and consequences
- Dealing with threats of violence
- Assessing the risk of harm
- Planning between union and management for critical incidents
- Alleviating workplace stress through problem-solving mechanisms
- Applying guidelines for workers with psychiatric disorders
- Following OSHA guidelines on workplace violence

Trainer Issues

The design and conduct of an OSH training program often poses questions about the need for outside professionals or the development of in-house staff to undertake these tasks. Conference presentations offered different thoughts on these issues.

OSH Training Consultant Issues

Various roles for consultants in addressing OSH training needs were noted. They included defining appropriate learning objectives or competencies, developing training materials to meet them, undertaking the direct training of workers, or serving a mentoring function to those company personnel who assume training roles. Other consultant roles included serving as content experts in training programs and measuring the results of a training program. The training consultant's knowledge of the client industry or operations was viewed as a key element in providing effective service, and the importance of trainers' efforts to engage management and worker groups in training development were also

stressed. Consultant experiences gained from work in other settings were also recognized as a plus in these undertakings though concern was raised about tendencies to use "boilerplate" programs to keep consultant costs down. The National Environmental Training Association was acknowledged as a source for consultants certified in environmental health and safety training. The Association's directory lists members by geographic and specialty training areas.

Peer-Education Issues

Training workers to serve as peer trainers in a workplace OSH program is believed to have merit for a variety of reasons. Among reasons noted in several presentations were that peer trainers have

- an added motivation to protect themselves and coworkers,
- fuller understanding of the concerns of the target population,
- greater job-specific knowledge, and
- an appreciation of the company's barriers to change.

An example of a train-the-trainer program aimed at preparing workers for OSH training or to serve as onsite peer experts was a labor federation program for enhancing ergonomics safety. This effort consisted of a three-day course covering topics of basic ergonomics, adult learning, lesson planning, and union action. The program focused extensively on developing clear objectives for training programs the participants would be providing at the workplace. A participatory training approach was used and included role-play exercises, case studies, and hands-on practice in hazard evaluation and problem solving.

First results of this program included positive reports from participants on steps taken to evaluate ergonomic hazards in their workplaces and instituting positive workplace changes. At the same time, numerous difficulties were also encountered. For instance, management support for these training efforts was not always forthcoming, and scheduling training during off duty hours reduced attendance. Another difficulty was that the worker trainers lacked enough time and opportunity to conduct training among their peers. The absence of comprehensive OSH programs in some workplaces further limited efforts to

identify and correct ergonomic problems. In this instance, the role of the worker trainer was seen as motivating their peers to demand that a comprehensive OSH program be created. Furnishing more assistance to worker trainers in developing lesson plans and ways to obtain support from management were other important lessons learned from this example.

In another example, a safety professional in charge of a company's overall OSH program took on this training responsibility. In the case described, workers who chose this role were instructed on aspects of hazard communication, fire prevention, machine guarding, and powered industrial truck operations, as well as techniques for delivering this information to their fellow workers. The safety professional geared the instruction and materials to fit the capabilities of the selected workers, and monitored their performance in carrying out prescribed training functions. One benefit of this model was that delegating OSH training to workers enabled the safety professional to attend to more technical issues in hazard evaluation and control.

The benefits of peer education were seen in a program designed to train high school students to teach other teens about workplace safety and health. The study showed that young adults in their twenties who had served as peer educators when teenagers were more positively affected, as were those teens who received this form of instruction compared with training offered by adults. In elaborating on this result, it was reasoned that teen peer educators could apply new ideas in developing age-appropriate teaching activities and problem-solving approaches. Related to motivational issues, this study found that working teens who supplied at least 20% of the family's income were more interested in workplace safety and health.

Instructional Techniques

Ways for introducing more realism in training sessions, engaging worker participation, and customizing the instruction to the capabilities of the trainee group assure an active learning experience. Conference presenters offered examples for satisfying these conditions.

Problem-solving simulations were used to instruct miners how to better respond to mine emergencies and to improve their skills in hazard recognition. The

simulations were in the form of short stories based on injury and investigative reports, which brought realism to the training exercise. As events unfold in the story, questions were posed to the miners to exercise their knowledge, judgment, and problem-solving abilities relevant to the situation. An add-on feature of this technique was that each respondent received immediate feedback (through a latent image-scoring format) about the merit or consequences of the decision. To administer the training, small groups of two to five trainees were arranged to create dialogue and discussion of the events being portrayed.

The simulation approach is an effective way to develop problem-solving capabilities among miners based on their knowledge and experience because it accommodates the realistic complexities of mining operations and attendant risks. It was noted that wide use of this approach in the mining industry has led to collaborative efforts between management and workers to prevent injuries and maintain emergency preparedness skills. Some drawbacks of the simulation include the significant time needed for the development of appropriate materials and the constraints of small group instruction. Another drawback is that the exercise focuses on judgment and decision making skills, which require that workers already have some fundamental knowledge of the subject area. In this regard, simulations were thought to be most useful as a supplement to basic OSH training.

Comments on other techniques discussed in this session took account of conditions or cautions affecting their use. The following summarizes some major points:

- The benefits of case studies as a teaching tool in OSH training are contingent on the extent of group interaction and the facilitation skills of the instructor.
- Classroom training sessions require imaginative elements to actively engage students, make training more enjoyable, and improve communications. Well-informed and experienced instructors, activities designed to promote class participation, and use of visual aids customized to the situations can help promote the learning process.
- Reading materials used in OSH instruction should consider the literacy level of the target audience. A suggestion is that the material be pitched two to

three levels below the reading level of the course participants. Computer programs are available to assess the reading levels of documents and can be used for this purpose. Visual and graphic presentations may be helpful with trainees with low-level reading skills.

Government-Based Resources

Various Federal agencies share responsibilities for programs on occupational safety and health training and related functions. Three agencies with primary roles and their activities were described. Ongoing efforts are both broad and diverse, and they reflect the assorted challenges posed by traditional workplace concerns and newer priorities.

Occupational Safety and Health Administration (OSHA)

In establishing workplace OSH standards, including requirements for OSH training, OSHA offers a variety of resources for helping groups satisfy the conditions dictated by such regulations. These include courses taught by the OSHA Training Institute Education Centers, OSHA's General Industry and Construction 10- and 30-hour Outreach Program, and the Susan Harwood Grants Program. OSHA regional offices offer consulting services to employers seeking information in coping with specific problems, with special attention to small businesses. In addition, OSHA continues to develop guidelines and other instructional materials for use in formulating OSH training programs. OSHA has also established a Web site for accessing standards, directives, and other official documents with links to other agencies and private sources categorized by topic. Additionally, they have developed CD-ROMs that contain materials on different training topics, and electronic compliance assistance tools with interactive features for onsite applications in select high risk jobs and industries.

National Institute for Occupational Safety and Health (NIOSH)

Providing an adequate supply of qualified safety and health professionals is a key NIOSH responsibility under the Occupational Health and Safety Act. A panel discussion described the 15 NIOSH-funded Education and Research Centers (ERCs), which offer advanced degree programs in industrial hygiene,

occupational medicine, occupational health nursing, industrial safety, and related professions. These ERCs, together with other universities that have select training grants from NIOSH, graduate approximately 700 OSH professionals each year. In addition, the ERCs offer annual continuing education courses to approximately 30,000 safety and health professionals working in the field.

NIOSH support for ERCs also includes outreach programs designed to offer safety and health training to employers, workers, schools, and others concerned with workplace safety and health. The ERCs that service different regions of the country conduct needs assessments to guide the outreach efforts that can identify particular groups at increased risk. Among the groups so targeted have been small business operators, minority workers, low-literacy workers, asbestos- and lead-exposed workers, agricultural workers, and home health care workers. Partnerships with labor unions, local community groups, and professional organizations were acknowledged as ways to reach affected groups and implement a training initiative. Another NIOSH-supported effort was the development of an OSH curriculum for students learning electrical trades as part of an overall program aimed at sensitizing teenagers to OSH in high schools. Also mentioned was NIOSH work incorporating OSH requirements in National Skill Standards aimed at defining competencies in specific occupational sectors.

The National Institute of Environmental Health Sciences (NIEHS)

This agency's support of OSH training has concentrated on hazardous waste site clean-up and related jobs. Through the Superfund Amendments and Reauthorization Act of 1986, NIEHS has funded non-profit organizations to provide OSH education and deliver training to hazardous waste site workers and emergency responders. The goal of this training is to protect workers and communities from exposure to hazardous materials during waste clean-up operations, hazardous materials transportation, environmental restoration of nuclear weapons facilities, or chemical releases.

During 1987–1999, NIEHS grantees trained over 800,000 workers throughout the country, presented 42,000 classroom and hands-on training courses, and provided 12 million contact hours of training to the EPA Hazardous Waste Worker Training Program. Workshops and other forms of networking among

NIEHS grantees offered opportunities to examine different training approaches to address a host of issues. These included: techniques to reach a low literacy workforce, development of training modules for minority populations and non-English speakers, ways for integrating emergency response into traditional OSH training, enhancement of peer training, and participatory techniques to improve the quality of training. The NIEHS program took particular pride in providing resources for developing and refining effective worker training models with particular emphasis on the value of the peer training approach.

An important product of the interaction among NIEHS training grantees was the formulation of guidelines to establish and operate an effective waste-worker training program. It was noted that this NIEHS training initiative expanded into a separate minority worker training program for urban youth, a job training course for Brownfields cleanup sites, and a program for workers involved in the cleanup of Department of Energy nuclear weapons facilities.

Workshops have served to bring the training communities together to discuss newly emerging issues such as the use of advanced training technology, the incorporation of worker safety and health into research and development of new environmental remediation equipment, and minimum criteria for hazardous materials (HAZMAT) training. Regarding HAZMAT training, mention was made of special training needs of fire fighters who routinely serve as first responders to hazardous materials incidents. How best to increase their awareness of risk of hazardous materials exposures, even in common alarms, the limitations in personal protective equipment, and the value of health surveillance and proactive health strategies were among topics of note.

Use of New Technologies

Training to meet the information and skill requirements for jobs that are constantly changing remains a challenge, as does delivering such training to a global, diverse workforce. Computer technology, through use of the Internet, CD-ROMs, and DVDs and Web satellites, offers possibilities for meeting these needs. Indeed, CD-ROMs and DVDs provide instructional materials with interactive features enabling workers to learn at their own pace and skill level. Applications of computer technology for OSH training were the subject of several

presentations. These applications included CD-ROM or DVD instruction in mine safety, with virtual reality and desktop 3-D computer simulations to further the learning experience. Web satellites and other electronic methods allow instructors to reach trainees throughout the world and contain databases of information that are readily accessible and regularly updated. Internet and Web site applications were described for information access, education, and training in two medical centers where fairly large staffs are widely dispersed or work different shift schedules. At one medical center the website topics included aspects of hazard communication, fire safety, disaster preparedness, and radiation safety. In addition, a laboratory safety Web-based program was being developed to provide users with information on infection control, hazardous waste, and animal care.

At the second medical center, the Internet and CD-ROMs served as a resource for training health care workers about latex sensitivity. In each of these cases, the computer applications offered added learning support to traditional instructor lectures and hands-on training sessions.

In support of grantees that train hazardous waste site workers, the NIEHS has sponsored workshops to review advanced training technologies (ATT) from the standpoint of benefits and limitations to the learning process. The workshop discussions noted three concerns about the use of ATT in hazardous waste site worker training that also apply to OSH training in general. One was that the goals of ATT would decrease the potential for worker empowerment and involvement in OSH training. A second was that ATT may “lower the bar” in terms of workers acquiring skills and knowledge to perform job functions. The third was the possibility of ATT curtailing the critical role of instructors in developing worker skills.

The workshop participants believed that computer-based training couldn’t completely replace hands-on classroom instruction. This was underscored by the fact that worker participation is a requirement in OSHA’s proposed safety and health program rule, which was undergoing public comment at the time of the conference. Appreciating that ATT development would proceed regardless of this concern, the workshop participants suggested the need for a systematic approach to using ATT in hazardous waste site worker training programs. The NIEHS

grantees developed a checklist to customize ATT applications to the capabilities of the group responsible for the worker training. Key considerations were the following:

- Whether workers had input into the ATT programs and were familiar with the use of such technology
- Adequacy of ATT coverage of critical subject areas
- Suitable roles for instructors as facilitators
- Allocations of ATT time
- Compatibility of the ATT offering with the hardware and software resources of the training group involved.

It was suggested that ATT programs should be implemented as demonstration projects and evaluated before being adopted.

Section 5 ' Evaluation of Training and Need for Future Research

Commentary

A near axiom in hazard control and prevention strategies for ensuring safe and healthful working conditions is that training plays a positive role. Indeed, evaluations of OSH training—when measured in terms of increased awareness of hazards, greater knowledge of risk factors and their control, and performance of safe work practices— invariably show successful outcomes. Less clear, however, are links between these positive indicators and reduced workplace injuries and diseases, which is considered the ultimate goal. It is reasoned that factors apart from the training may intervene and confound the expected relationship. Hence, evaluations must be developed that take account of not only training results but other workplace factors as well. This issue was just one of a number that were

discussed concerning the adequacy of current evaluation approaches for assessing OSH training, and ways to improve the evaluation process.

Another issue was that the behavior-based approach to training unduly focuses on worker behaviors, as if to say that correcting

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A list of literature references related to the topics in this Section is found in Appendix C.

their unsafe acts is the key to improved safety. It was argued that successful safety performance also depends on the actions of managers, equipment designers, and supervisors, and that OSH training needs to consider the behaviors of these personnel also.

Still other issues included the apparent bias in the published literature for only reporting evaluations that have quantitative data. Qualitative observations can also offer important information on lessons learned from OSH training. It was suggested that evaluation models consider ways for integrating both types of data. Techniques that add more realism into both the training and evaluation experience were described. They featured enhanced simulations and problem solving exercises that reconstruct injury-producing events or high-risk situations in different work settings. Recognizing that OSH training imposes costs on employers and is an extra burden on workers, reference was made to training conditions that appeared to optimize learning, and methods for estimating cost/benefits of OSH training. Other presentations in this session offered examples of multiple measures for characterizing OSH training interventions and the efforts of workers to play more active roles in designing OSH program evaluations.

Highlights

Forms of Evaluation

Forms of training evaluation were described through Kirkpatrick's four-level classification scheme, which is outlined in Table 2 [Kirkpatrick 1994].

The classification scheme in Table 2 creates a hierarchy of forms of training evaluation, including the advantages and disadvantages of each form in terms of ease of data collection and meaningfulness with regard to fulfilling course objectives.

In response to the Kirkpatrick classification of training evaluation approaches, concerns were raised about the emphasis on behavioral change, which workers regard as a "loaded term" in discussing OSH issues. Workers resent the expression since it suggests that the burden of workplace safety depends on their behaviors and thus the training is intended to correct aberrant actions. In contrast, the need was stressed for viewing training as one means for improving workplace safety, and in that regard, forms of evaluation should be chosen based on a systems view. A needs assessment was recommended to identify potential systems failures including manager or supervisor oversights, engineering and job design flaws, as well as worker limitations and the means for correcting them. The training process should reflect a collective change in the workplace with the goal being not mere compliance with mandated laws but a truly safe work environment. Worker input and participation in the training was deemed important as well as their participation in designing the overall evaluation.

Behavior-Based Versus Systems Approaches to OSH Training

The discussion of behavior-based versus systems approaches to evaluation highlighted the differences in and benefits of these two approaches.

Behavior-Based Approaches

In presenting the behavior-based approach, it was said that the intent of the approach is not to place blame or fault a person's unsafe actions. People repeat their actions on the basis of a history of reinforcement. Rather, the purpose is to alter the physical and social environments that reinforce or support behaviors that make the workplace as safe and healthy as possible.

Two examples were offered for illustration. In one, infirmary workers were shown to have a high rate of back injuries from patient transfer tasks despite ergonomic training and written instructions in how to lift safely. It was evident that the risk reduction techniques were not being applied since the habitual practices were judged adequate from the worker's perspective. A plan was adopted where each time a worker would lift or transfer a patient, they would receive immediate feedback from a trainer on actions performed correctly or in need of improvement. This process was repeated several times over several days until the workers were observed to be performing safe lifts in a rapid, fluid way over 90% of the time. Mention was made that more intensive feedback and reinforcement training may be needed for workers who are reluctant to change their behavior. Regularly commending workers or providing bonuses are suggested as other means to reinforce safe behaviors. It is argued that cost savings from fewer injury incidents could offset the expense of rewards.

The second example was in a paper mill where workers set safety performance targets, defined safe behaviors in operational terms, and scored their frequency. This program resulted in an observed drop in injury incident rates when workers' baseline behaviors before the program were compared with behaviors after feedback on two separate occasions. Building on this success, further reductions in injury incident rates were targeted as a safety goal in a new collaborative effort by workers, supervisors, union members, and shop personnel. Teams were formed with an individual from each team volunteering to serve as an observer and furnish feedback on the performance of coworkers. Again, improvement in safety performance was noted with a concomitant reduction in injury rates. Eventually, however, the peer observers discontinued reporting due to a lack of encouragement and reinforcement of their efforts. Lack of interest by a new company owner, among other factors, was believed responsible for this. It was not clear whether the improved levels of safe performance continued to hold. It was stated that the literature includes more than 100 published studies showing substantial reductions in unsafe acts owing to use of the behavior-based approach.

Several important questions were raised related to the behavior-based approach. One was whether the educational or literacy level of workers would complicate their understanding of job behaviors and the administration of the behavior approach. In response, it was explained that extra consideration must be given to

workers who cannot read, are inexperienced, or lack the ability to communicate. In this instance, stress is placed on proper task demonstrations and adopting non-verbal communications as needed.

Acknowledging that most behavior-based safety applications target workers, questions were asked about the behaviors of those other than workers and how they are to be addressed. Specifically, it was asked: "Who is keeping behavioral scorecards on the owners, the managers, and the supervisors in the application of the plant safety system? Who is keeping behavioral scorecards on the engineers, the job designers, and the inspectors in the application of the company safety system?" It was acknowledged that efforts are needed to find and build on successful models for gauging OSH performance at these levels as well.

System-Based Approaches

In explaining the systems approach to OSH, reference was made to OSHA's Process Safety Management Standard (29 CFR 1910.119). OSHA initially passed this standard to force oil and petrochemical companies to manage facilities through a systems approach. The 14 elements in the standard can be categorized as follows:

- Design and engineering—requirements to analyze any prospective workplace changes to forestall any new hazards
- Mechanical integrity—inspection, monitoring, and preventive measures to ensure proper maintenance and safe operations of the facilities
- Mitigation and warning—design features that would reduce the severity of injury even in cases of system malfunction, and safety devices for automatic system shut-down and warnings as opposed to relying on human controls
- Training and procedures guidelines to ensure that workers have the necessary skills to respond to system failures
- Human factors—individual worker considerations in the context of meeting job demands imposed by work processes, equipment design, and work schedules

It was stressed that a behavior-based approach is not discounted in a systems concept of an OSH program. Rather it recognizes behavior as only one component in an overall systems analysis. As stated, unsafe acts and unsafe

conditions must both be considered but more emphasis needs to be placed on improving the safety systems design rather than focusing on training and use of personal protective equipment. The inference is that engineering out a problem is a more certain hazard control approach than depending on behavior change. With this strategy, the worker is not placed so often in the position of self-blame, but can be taught to investigate incidents, identify root causes, and make recommendations to correct the failed system.

A fire at a plant that used the behavioral-based approach was described to indicate its limitations relative to a systems concept. The facility had an outstanding safety performance record and was regarded as one of the most safely operated plants in the country. However, an explosion killed six workers. The workers and union collaborated in an investigation of the incident. The investigation revealed 18 different causes that played a role in the explosion. They included issues related to system design, staffing, work procedures, training, and incident investigation. The plant did not eliminate its behavior-based training approach, but has given consideration to a systems orientation where behavior is viewed as just one factor.

OSH Programmatic Evaluations

OSHA described what they considered critical elements to include in an OSH program, and the development of a survey instrument (Form 33) for rating a company's programmatic efforts.

The following are five elements OSHA deemed critical to an effective OSH program:

- Management leadership—OSH program administration, resource allocations, personal commitment based
- Employee participation—worker involve- ment in hazard recognition and control activities
- Hazard identification—analyses of workplace conditions, job demands
- Hazard prevention and control—referencing the hierarchy of control approaches
- Safety and health training—for all levels of the organization

Three steps in OSHA's ongoing work to design a survey instrument for inspectors to measure a company's level of performance on these critical elements were described. The first was to define descriptive items as indicators of the elements that would yield reliable and valid ratings. The second was to realize the need for training OSH consultants in use of the forms, based on OSHA's first experiences in evaluating small businesses as part of the OSHA consultation program. The third step was to test the extent to which ratings on items identified with the different program elements were correlated with OSH program profiles depicting various levels of efforts. The tests indicated correlations ranging from 0.85 for management leadership to 0.57 for hazard identification, with 85% of the overall variance in such ratings being accounted for by 28 variables in the form.

These results gave reasonable assurances in the use of the form for evaluating a company's OSH program as well as defining areas where improvements are needed. Use of the form to predict safety and health outcomes was indicated as the next objective and first efforts to do so were described. These consisted of comparing Form 33 ratings of 500 high-risk small businesses by OSH consultants against the company OSHA 300 injury/illness reports for the three-year period just preceding the program evaluation. At the time of this conference, the data had been collected but remained to be analyzed. However, a preliminary review of the data suggested that companies scoring high on the OSH training element also had fewer injury and illness reports. The Form 33 will ultimately be used in the OSHA consultation program that services over 30,000 employers each year.

Research in Training Intervention Effectiveness

NIOSH has taken a two-phased approach to the issue of training effectiveness research. These two phases include the completion of a literature review on the efficacy of training, and the designing of a model that provides a foundation on which to conduct the research.

Status of the OSH Training Literature

NIOSH conducted a literature review that assessed the effectiveness of OSH training as an intervention strategy. A major portion of the report described

published reports of workplace OSH training where a training plan was established and efforts were made to evaluate its effects through some post-training measures. In these reports, evidence that OSH training can make a difference in enhancing worker awareness of hazards and in learning and promoting safe work practices was abundant. While these types of changes were taken to indicate reduced risk of workplace injuries and disease, data linking these measures with injury and disease outcomes were less certain.

An analysis of the database sought to single out certain elements or characteristics of the training as having the most positive effects on workplace safety and health. Data was fairly strong in showing the benefits of the following factors to successful OSH training results:

- Emphasizing activities that use hands-on exercises, case studies, and problem solving

- Setting performance goals for training and using feedback to mark progress both in the classroom and at the job site

- Using token rewards to reinforce the training experience

- Obtaining management commitment through policies that allow adequate time for training and support other actions that stress the importance of safe and healthful workplaces

Data bearing on other training factors such as optimal sizes for trainee classes, training schedules, and trainer qualifications was less definitive.

The NIOSH literature review on training effectiveness found that some methodologies used to evaluate OSH training experiences and isolate factors of consequence were more defensible than others. Some used quasi-experimental designs with manipulations of variables and suitable controls on potentially confounding factors. Other evaluation methodologies were not controlled: the results were derived from a post-hoc analysis of post-training surveys where the training results could have been contaminated by other workplace changes going on at the same time. Many evaluations were based on short-term results so that

the sustainability of any apparent training effect remains uncertain. Also, without evaluation data based on reduced injury and illness, the degree of correlation between these bottom-line indicators and typical measures of training effects such as knowledge gain and behavior change is unclear at best.

These method limitations suggest the need for further confirmation of the importance of different training variables. Noted in the ensuing of the NIOSH review was that its thrust was largely a quantitative one, which may miss training changes that cannot be expressed in numerical terms. The issue of improving methods of evaluation that would encompass both qualitative as well as quantitative observations was believed important. Experiences reported by trainees in applying lessons learned from training to their jobs can serve this purpose; a few studies that employed this technique are found in the NIOSH review.

The TIER Model

Recognizing a need shared by many in the OSH community, NIOSH has proposed a research paradigm for promoting a more organized, orderly approach to evaluating training interventions and identifying factors leading to successful outcomes. The model, referred to as Training Intervention Effectiveness Research (TIER), consists of four stages.

Stage 1 of TIER is formative research in which curricula and training efforts are conceived, reviewed, and structured. It involves asking questions such as the following: What are the training needs and target populations to be served? How do training goals and objectives relate to these needs and how should attainment be assessed? What instructional approach should be taken?

Stage 2 is process research in which draft training materials, proposed instructional approaches, and research instruments are field-tested. The intent here is to establish the soundness of the training materials and the validity of the assessment instruments. A question to be answered is whether there is enough confidence in the approach to warrant production of higher-cost enhancements (such as video, multimedia) and wider distribution of materials.

Stage 3 is outcome research in which a controlled evaluation study is conducted.

Questions to be addressed at this point include the following: Does the approach produce intended outcomes such as increased knowledge or appropriate changes in attitude or behaviors? Are such changes sustainable? What are the critical elements of the instruction that contributed to the desired results?

Stage 4 is impact assessment in which longitudinal studies are conducted. This final stage emphasizes research questions: Do the approaches under study meet the educational objectives identified in Stage 1? What are the intended and unintended impacts of the training on the learner and his or her environment? What effect does the training have on others who interact with the trainee? Were the approaches studied truly effective?

Examples of practical issues in OSH training that could be addressed by the TIER model include the following:

- Whether different instructional topics require common or different training elements to be taught effectively
- How different trainee populations benefit from alternative instructional strategies
- How different instructional media and formats influence learning
- How different training environments or situational factors can modify the learning experience

NIOSH applications of the TIER model in introducing OSH training materials in vocational school programs were noted elsewhere in the conference. One involves OSH training for those studying the electrical trades and is currently ongoing. A second project in planning will focus on OSH training in cosmetology programs.

Special Methods and Approaches

Presenters offered a variety of techniques to measure the effects of training in general and OSH in particular. Some were conventional, but others were more unique.

Ecological Momentary Assessment

An Ecological Momentary Assessment (EMA) is an example of a unique technique.

The EMA requires repeatedly collecting self-report data on the job from workers to obtain a measure of specific behaviors. Current applications involve use of hand-held computers that cue workers and record the time of entry for the behaviors in question. This information is gathered independently of survey questionnaires, which reduces a methods bias and totally eliminates recall concerns. However, EMA places a significant response burden on workers, requires cooperation between workers and employers, needs expensive hardware, and can impose significant data reduction and statistical task demands. Nevertheless, EMA methodology was considered a viable candidate for training impact research.

Simulation Methodologies for Training and Evaluation

Simulation methodologies were described not only as an important means for delivering training, but for evaluating it as well. One such technique uses "degraded" images where workers are shown multiple pictures of workplace hazards in which dangerous conditions are relatively difficult to detect. These degraded images are scenes with hazards that are partially hidden, poorly illuminated, viewed from an unusual angle, or under hazy conditions. Workers who are trained with these images show an increased ability to recognize common and overlooked workplace hazards. Workers trained with clear, unobstructed images of the workplace settings did poorer in the hazard detection task when given degraded images. Research on this method showed that the use of stereoscopic slides and 3-D images of the test scenes served to heighten the sensitivity of the evaluation measure. Evidently, adding realism to both the training conditions and evaluation measures makes for a more effective outcome. This was also noted in refresher training for miners in donning the self-contained self-rescuer according to a set procedure. Having miners practice the prescribed donning routine as part of regularly scheduled mine escape drills and other emergency preparedness exercises resulted in the miners maintaining a relatively high level of proficiency. Further, providing practice in this way did not detract from production.

Training Through Problem-Solving Stories and Embedded Testing

Use of problem-solving stories based on reports of incidents pertaining to workplace safety and health concerns are an effective training approach. Questions embedded at decision points in these stories ask trainees to select actions that will affect the flow of events. Immediate feedback to these responses enables the trainees to appreciate the consequences of their chosen actions as well as to other choices based on what actually occurred and how others responded. This form of interaction makes the evaluation integral to the instruction process. The trainee responses reflect their practical knowledge and skills, and the feedback dictates where further instruction may be needed. Forming teams of three to four trainees to work collaboratively in these exercises was believed important in sharing views. Conference presenters illustrated the use and value of embedded tests in OSH training in mining, agriculture, construction, and confined space applications.

Economic Analysis Evaluation

An economic analysis of an OSH program can be used to measure its effectiveness, provide leverage to obtain future resources, and justify the maintenance of the activity within the organization. It was stressed that OSH practitioners need to become more familiar with cost/benefit analyses to choose the best interventions to implement, especially in a time of budget and time constraints.

One example of using an economic model for evaluating OSH training consisted of a five-step method for a cost/benefit analysis of a program aimed at the reduction of back disorders. The goal of Step 1 was to identify the program objective (that is, to reduce back disorders). In Step 2, the evaluator specified the person-per-year costs to the organization for those afflicted with such problems. Aside from medical care, lost production time, and compensation premiums, the figure here could include indirect costs such as hiring temporary replacements. The purpose of Step 3 was to estimate the cost of implementing the intervention program, including consultants serving as advisors or trainers, worker training time, and other expenditures (for example, ergonomic task design changes). In Step 4, a discount rule was used for estimating what the costs of Step 3 would be in current-year dollars for programs not expected to produce immediate results,

as well as the savings from reducing the incidence by differing amounts. The final step was to determine the cost/benefit ratios, given the above estimates and forecasts for reduction. Computer programs are available to calculate use of different discount rules, charting program costs and savings over time to indicate break-even points, and future cost/benefit streams.

Another example of an economic approach used the Work Crew Performance Model (WCPM). This model defines short- and long-term training investments that would be needed to reduce performance variability and risk in a given hazardous operation. Shuttle car transport of coal in underground coal mining was offered as an application of the WCPM. Specifically, persons experienced in performing and supervising these tasks ranked shuttle car job tasks in terms of the variability of work crew performance they observed among workers doing the same tasks. In doing so, they identified cost linkages with the variable task performance such as injury experience, expected risk levels, or interruptions in production or maintenance. Through discussion among those making these judgments, a consensus was reached on which elements were deemed most critical to eliminating performance variability and the types of intervention required. The latter could include supervision, job redesign or training, and coaching workers to ensure the desired results. The manner of calculating expenditures to cover the latter interventions was not described. In a laboratory study offering some validity to the WCPM technique, it was shown that production increases in coal shuttle car operations by working faster were more than offset by other forms of continuous miner operation and less strain on the equipment.

Multiple Measures Evaluations

Examples of efforts to evaluate the effects of OSH training with multiple measures were made in restaurant operations and in firefighting. For restaurants, the evaluation design was to collect data representing trainee reactions, knowledge gain, behavior change, and organizational impact (injury incidence) measures in accord with the Kirkpatrick classification. The study, undertaken as a partnership between NIOSH, the National Restaurant Association, and some restaurant chains assessed use of a new OSH curriculum (special text/picture training cards plus added posters) for reducing injury occurrences in this job

sector. A train-the-trainer approach was used. Groups of restaurant managers received the new curriculum materials, and compared the results of the training experience with that offered by other managers trained conventionally. Preliminary post-training data showed the newer training to produce more favorable changes in terms of manager reaction and greater knowledge gain. Safety audits of workers trained by managers that used the new materials also indicated that workers worked more safely than those receiving the older instruction. Post-training injury rates also showed a decline for restaurants using the newer materials as compared to their pre-training incidence. The extent of this improvement could not be gauged since pre- and post-training differences in injury data for restaurants gathered during the newer instruction were still not available for comparison as of the time of the conference. Notable, but not surprising, the trade association and restaurant managers expressed little interest in the knowledge gain and safety audit results of this training evaluation. Whether the newer training could further reduce injuries and associated costs was their motivation for participating in this training study.

An examination of stressors and strains incident to fire fighting jobs and the benefits accruing from various stress intervention strategies was offered as a second example of a multidimensional approach to evaluation. The project described as a work in progress, targets firefighter officers and uses both longitudinal and quasi-experimental designs in assessing stress and stress reduction factors of consequence. Data collection measures included self-reports of job stress and strain as well as objective indices of work strains and health outcomes such as documented rates of injury, absenteeism, or apparatus incidents. These measures were being used to identify the -benefits of training in cognitive/behavioral stress reduction techniques, leadership style assessments, dietary changes, and physical exercise. Training modules to address team building and “emotional first aid” are expected to be added. The project includes a lengthy followup to assess the interventions with periodic data collection on the aforementioned measures as well as a cost/benefit analysis of the interventions. The pitfalls of undertaking protracted types of evaluations such as this were noted, where unpredictable or uncontrollable events can obscure or overwhelm the potential benefits from the strategies being applied.

Stakeholders Evaluation

An evaluation plan that allows for the participation of all company stakeholders was offered as an alternative to current traditional approaches that use consultants or others deemed competent to do these tasks. As described, a team composed of trainers, workers, supervisors, and managers would draw up the evaluation plan designating objectives, benchmarks for marking progress, and means for data collection or other observations for use as feedback to be shared at all staff levels. In so doing, this kind of evaluation stresses a collective effort to demonstrate evidence of positive change, based on training or other intervention strategies, in workplace safety and health. Rather than a single end product that indicates the results of training or another intervention, the evaluation would be framed as a continuing process to show benefits over time from OSH training and other program activities. Charting long-term OSH goals and working backwards to determine the measurable steps to achieve them were proposed as guides for when, where, and how to do data collection. Training necessary for undertaking these activities was described as part of a grant program sponsored by the NIEHS Worker Education and Training Program. Grantees supported by this program reported on their experiences in using the participatory approach in training evaluations in their respective companies.

APPENDIX A ' PLANNING COMMITTEE*

Allegrante, John
Columbia University; Society for Public Health Education

Appleman, Bernie
Society for Protective Coatings

Auld, Elaine
Society for Public Health Education

Baker, Colleen
Department of Labor and Industrial
Relations, State of Missouri

Baker, Robin
Labor Occupational Health Program, University of California/Berkeley

Becker, Paul
West Virginia University

Birkner, Ruth McIntyre
Department of Environmental Health, University of Southern California

Bresnahan, Thomas F.
American Society of Safety Engineers

Conbere, Pamela
Allina Health System

Cronin, Cathleen
Occupational Safety and Health
Administration

Cullen, Elaine
Spokane Research Laboratories, National Institute for Occupational Safety and Health (NIOSH)

Deivanayagam, Subramaniam
Tennessee Technical University and
Human Factors and Ergonomics Society

Dervin, Kathy
Division of Workers' Compensation,
California Department of Health

Dronne, Russell
Chubb and Son

Eisen, Arlene
San Francisco Public Transportation
Department

Esler, J. Grant
Kodak Corporation

Florczak, Glenn
Department of Energy

Florek, Kathryn
Catholic Healthcare West

Fore, Gary
National Asphalt Pavement Association

Frazee, Patrick
General Motors North American
Operations

Gotsch, Audrey
Department of Environmental and
Community Medicine, University of Medicine and Dentistry of New Jersey-
Robert Wood Johnson Medical School, American Public Health Association

Hughes, Joseph (Chip)
National Institute of Environmental Health Sciences

Hunt, Kate
Arthur J. Gallagher Insurance Company

Jarell, Judy
University of Cincinnati

Kohloff, Frederick
American Foundrymen's Association

LaMontagne, Anthony Sr.
New England Research Institutes,
Harvard University, Dana-Farber Cancer Institute

Larson, Susan
Midwest Center for Occupational Health and Safety

Lessner, Keith
Alliance of American Insurers

Lessin, Nancy
Massachusetts Coalition for Occupational Safety and Health

Lippin, Tobi
New Perspectives Consulting Group

Loos, Gregory
Training and Education Systems Branch, NIOSH

Maloney, Charlene
Information Resource Branch, NIOSH

Martin, Eileen
Pittsburgh Research Laboratory, NIOSH

McCann, Kathy
Liberty Mutual Risk Services

McCauley, Mollie
Management of Occupational Health
Services, AT&T

McDowell, Dennis
Centers for Disease Control and
Prevention

McQuiston, Thomas
University of North Carolina

Morawetz, John
International Chemical Workers Union Council Center for Worker Health and
Safety Education

Morris, Sharon
University of Washington

Nickels, Leslie
School of Public Health, University of
Illinois

Nolan, Steve
Loss Control, State Farm Fire and
Casualty

Richardson, Charles
National Environmental Training
Association

Schneider, Scott
Laborers' Health and Safety Fund of North America

Stephens, Douglas
Paper, Allied-Industrial, Chemical and Energy Workers International Union

Stephenson, Carol Merry
Training and Education Systems Branch, NIOSH

Trahan, Christina
Center to Protect Worker's Rights

Weinstock, Deborah
AFL-CIO

Wheeler, Cynthia
Training and Education Systems Branch, NIOSH

White, Frank
Organization Resource Counselors

Whitmire, Dewey
American Society of Safety Engineers

Wigmore, Dorothy
University of Michigan

Wilson, Kathi
Society for Public Health Education

Wolford, Rod
FOF Communications

Zerbe, Diane
Johns Hopkins University

APPENDIX B ' CONFERENCE CONTRIBUTORS*

Section I—Needs and Challenges

Platform Presentations—Workplace/Workforce Issues

Linda Rosenstock, National Institute for Occupational Safety and Health (Keynote Presentation)

Greg Loos and Paul Schulte, National Institute for Occupational Safety and Health

Panel Discussants—Related Issues and Challenges

Joseph Hughes, National Institute for Environmental Health Sciences

Frank Mirer, United Auto Workers

Susan Wilburn, American Nurses Association

Donald Elisburg, Donald Elisberg Law Offices

Ellen Rosskam, International Labor Office

Section II—Policy, Regulation, and Standards

Speakers and Panel Discussants—Player/Stakeholder Views

Charles Jeffress, Occupational Safety and Health Administration

John Henshaw, Solutia Incorporated

Karl Jacobson, Liberty Mutual Insurance Company

Lee Saperstein, Accreditation Board for Engineering and Technology

Scott Schneider, Laborer's Health and Safety Fund of North America

Robin Baker, University of California—Berkeley

Concurrent Session Contributors
Standards Development and Quality Assessment

Bill Bergfield, Laborers AGC

Tom Bresnahan, American Society of Safety Engineers

John Palassis, National Institute for Occupational Safety and Health

Edie West, National Skill Standards Board

Section III—Current

Perspectives and Practices

Speakers and Panel Discussants—State and Local Approaches

David Harrington, California Department of Health Services

Karen Mulloy, University of New Mexico School of Medicine

Carolyn Sheridan, AgriSafe Clinic, Spencer Municipal Hospital

Phyllis Straight-Millan, Oregon Occupational Safety and Health Administration

Susanna VonEssen, University of Nebraska Medical Center

Martha Yoder, Michigan Department of Consumer and Industry Services

Speakers and Panel Discussants—Special School-Centered Approaches

Michelle Brunell, Missouri School to Work Safety and Health/Child Labor Consultation Program

Betty Szudy, University of California

Karen Miles, NIOSH

Speakers and Discussants—Cross-Sector Approaches

Abel Almanza, PAULA Insurance Company

David Amacher and Randy Little, Brown and Serve (ConAgra)

Margaret Anne, Monsanto

Barry Downes, Lisa Lekawa and Edward Stubbs, Sunoco Oil Company

Bill Flanagan, Holy Cross Hospital

Katarina Holbrook, New York University/ Albany School of Public Health

Bill LaBonville, IBM

Speakers—International and Global Issues

T. Chan, General Motors Corporation

Linh Hung Le and Thu Tran Thuy, Hanoi School of Public Health

T.K. Joshi and Jugal Kishore, Center for Occupational and Environmental Health, New Delhi, India

Ellen Rosskam, International Labour Organization

Speakers—Employer/Employee-Centered Program Approaches

B. Luksis, Bechtel Corporation

S. Moir, University of Massachusetts—Lowell

Mike Squillace, IBM

Section IV—Developing OSH Training Interventions

Speakers and Roundtable Discussants—Curriculum

Janel Bertinuson, National Mine Safety and Health Academy

Marianne Brown/Linda Delp, University of California-Los Angeles

Michelle Brunell, Missouri School to Work Safety and Health

Tia Denenberg, Workplace Solutions Inc.

Bill Higgenbaughtem, International Association of Iron Workers

Karen Miles, NIOSH

Christina Trahan, Center for the Protection of Workers' Rights

Rod Wolford, FOF Communications

Panel and Roundtable Discussants—Training the Trainers

Robert Bohannon, SA and B Environmental and Chemical Consultants

Mark Briggs, Safety Management Resources Corporation

John Morawetz, ICWUC Center for Worker Health and Safety Education

Laura Stock, University of California

Betty Szudy, University of California

Roundtable Discussants—Instructional Techniques

Vicki Ainsli, Steve Hays, Kirk Mahan, Georgia Tech Occupational Safety and Health Branch

Abdollah Kashani, Safety Consulting Engineers

Michael Kushner, Services Employees International Union Training Project

Mitchel Rosen, EOHSI Centers for Education and Training

William Wiehagen, NIOSH

Speakers and Panel Discussants—Facilitative Resources

Cathy Cronin, OSHA Training Institute

Sharon Beard, NIEHS Worker Education and Training Program

Ruth Ruttenberg, National Clearinghouse for Worker Safety and Health Training

Michael Colligan, NIOSH

Leslie Nickles, University of Chicago

Ruth McIntyre-Birkner, University of Southern California

Greg Loos, NIOSH

Panel Discussants—Use of New Technologies

Kathleen McAndrew, Dartmouth College Medical Center

Clyde Proffitt, National Mine Safety and Health Academy

Chris Warholic, University of Kansas Medical Center

Ruth Ruttenberg, National Clearinghouse for Worker Safety and Health

Section V—Evaluation of Training and Need for Future Research

Speakers and Panel Discussants—Forms of Evaluation

Robin Baker, University of California at Berkeley

Michael Colligan, NIOSH

Ronnie Westmoreland, Paper,
Allied-Industrial, Chemical and Energy
Workers

Jerry Williams, Tower Automotive

Speakers—Behavior-Based Versus Systems Approaches

Glenn Irwin, Paper, Allied-Industrial, Chemical and Energy Workers

Beth Sulzar-Azaroff, University of
Massachusetts-Amherst

Speakers—OSH Programmatic Evaluations

O'Neil Smitherman, University of
Memphis

Bill Weems, University of Alabama

Speakers and Panel Discussants—Training Intervention Effectiveness Research

Larry Chapman, University of Wisconsin

Alexander Cohen, Consultant

Ted Fowler, NIOSH

Speakers and Panel Discussants—Special Methods and Approaches

Randall Beaton, University of Washington

Philip Berger, University of Kentucky

Hank Cole, University of Kentucky

Tom McQuiston, University of North Carolina

Robert Peters, NIOSH

Raymond Sinclair, NIOSH

Charles Vaught, NIOSH

William Wiehagen, NIOSH

Susan Wojcik, University of Kentucky

APPENDIX C ' BIBLIOGRAPHY

The references listed below consist of citations specific to each of the five sectional topics summarized in this report. The references include those noted in some conference presentations augmented by others found in the occupational safety and health literature and recommended for reading on the subject topic. Please note that some references have publication dates beyond the October 1999 date of the conference. This was done to update information on some of the topics reported at the meeting. Also note that the reference list is selective and not intended as a definitive bibliography on the subjects covered at the conference.

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