IMPACT OF NIOSH EDUCATION AND RESEARCH CENTERS

ON WORKPLACE PRACTICE

By

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ABSTRACT OF THE DISSERTATION

Impact of NIOSH Education and Research Centers on Workplace Practice

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Multiple federal efforts to improve occupational safety and health (OSH) in the United States were implemented over the course of the twentieth century. The development of the Occupational Safety and Health Administration (OSHA) to implement safety and health standards was an initial step to improve workplace safety and health nationwide. An additional effort was the creation of the National Institute for Occupational Safety and Health (NIOSH). That agency, in turn, created Education and Research Centers (ERCs) to provide continuing education and graduate level training in occupational medicine, occupational health nursing, occupational safety, and industrial hygiene. Many training programs were created by both the ERCs and other agencies, causing the Institute of Medicine (IOM) in 2000 to call for an evaluation of all worker training programs to determine whether they are effective. Such an evaluation is important because despite the figures showing that workplace deaths and injuries have decreased, we really do not know whether it is the training programs or other factors that have the desired effect of improving worker safety. This thesis addressed that issue.

Using a multimodal effort for obtaining data, the research evaluated how the ERCs have impacted the workforce. The research utilized qualitative methods, including key informant interviews, to indicate the impact the ERCs have had on workplace safety and health. Additionally, the research conducted a quantitative survey of former ERC students to identify how effective the ERC training programs were in providing information so they can make appropriate health and safety decisions in their workplace practices.

This research shows that the ERCs provided training that has made a positive impact on worker health and safety. Key informants identified safety and health training as effective in producing changes in the workplace. Furthermore, the surveys identified trainees as having increased their knowledge and learned new skills. Trainees identified changes needed in their workplace, and the training has provided them with some of the knowledge and skills to make those changes.

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I am grateful to my colleagues across the United States who provided me with valuable insight into the field of occupational safety and health. So many are doing such incredible work to protect workers, ensuring that they go home safe every day. Keep up the amazing work that you do.

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List of Abbreviations

CDC	Centers for Disease Control and Prevention
CE	Continuing Education
CFR	Code of Federal Regulations
DOT	United States Department of Transportation
EPA	United States Environmental Protection Agency
ERC	Education and Research Center
GAO	United States Government Accountability Office
HAZWOPER	Hazardous Waste Operations and Emergency Response
IOM	Institute of Medicine
MSHA	Mine Safety and Health Administration
NIEHS	National Institute of Environmental Health Sciences
NIH	National Institutes of Health
NIOSH	National Institute for Occupational Safety and Health
NLRA	National Labor Relations Act of 1935
NSC	National Safety Council
OSH	Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
OTI	OSHA Training Institute
OTIEC	OSHA Training Institute Education Centers
PPE	Personal Protective Equipment
SARA	Superfund Amendments and Reauthorization Act of 1986
TBP	Theory of Planned Behavior

TRA   Theory of Reasoned Action

US DOL   United States Department of Labor

WIA   Workforce Investment Act of 1998

Chapter 1: Introduction

Multiple federal efforts to improve occupational safety and health (OSH) in the United States were implemented over the course of the second half of the twentieth century. The development of the Occupational Safety and Health Administration (OSHA) to implement safety and health standards was an initial step to improve workplace safety and health nationwide. An additional effort was the creation of the National Institute for Occupational Safety and Health (NIOSH) in 1970. NIOSH, as part of the Centers for Disease Control and Prevention (CDC), has a mission to:

> generate new knowledge in the field of occupational safety and health and to transfer that knowledge into practice for the betterment of workers. To accomplish this mission, NIOSH conducts scientific research, develops guidance and authoritative recommendations, disseminates information, and responds to requests for workplace health hazard evaluations (CDC. Retrieved December 22, 2010).

NIOSH created Education and Research Centers (ERCs) to provide continuing education (CE) and graduate level training in occupational medicine, occupational health nursing, occupational safety, and industrial hygiene. Many training programs were created by both the ERCs and other agencies, causing the Institute of Medicine (IOM) in 2000 to call for an evaluation of all worker training programs to determine whether they are effective. Such an evaluation is important because despite the figures showing that workplace deaths and injuries have decreased, we really do not know whether it is the training programs or other factors that have the desired effect of improving worker safety. Using a multimodal effort for obtaining data, this thesis evaluated how the ERCs have impacted the workforce, and document how workplace injury and illness rates have responded to ERC training efforts. The research utilized qualitative methods, including

key informant interviews and case studies, to indicate the impact the ERCs have had on workplace safety and health. The research conducted a quantitative survey of former ERC students to identify how effective the ERC training programs were in providing information so they can make appropriate health and safety decisions in their workplace practices. The survey asked what improvements are needed in the structure and substance of the ERC training programs to keep them up to date. Additionally, a series of surveys were distributed in a select group of courses at UMDNJ-School of Public Health. The surveys included a pre-training questionnaire that was distributed before training started to identify readiness for change; a post-course survey that identified any expected changes due to the training received; and a follow-up survey sent via an online survey tool three-months post training to identify if any of the expected changes were implemented at the workplace.

Keeping workers safe on the job is considered one of ten greatest achievements of public health in the United States in the twentieth century (CDC 1999a). For example, the rate of unintentional work-related fatal injuries fell from 37 per 100,000 workers in 1933 (NSC 1998) to 4.0 per 100,000 in 2005 (CDC 2007). During this same time period the workforce more than tripled, yet the annual number of deaths decreased from 14,500 to 5,100 (CDC 1999b).

In 1970, the federal government passed the Occupational Safety and Health Act that created OSHA to develop workplace standards to protect workers from injury and illness. The purpose of the Act is:

> To assure safe and healthful working conditions for working men and women; by authorizing enforcement of the standards developed under the Act; by assisting and encouraging the States in their efforts to assure safe and healthful working conditions;

by providing for research, information, education, and training in the field of OSH (OSHA 1970).

ERCs were established under Section 21a of the OSH Act in December 1977 (NIOSH 1977a, NIOSH 1977b). In 1986, additional justification for the ERC program was published in the Federal Register (NIOSH 1986). Additional legislation to address worker safety and health includes the Asbestos Health Emergency Response Act of 1986, implemented to protect workers who conduct asbestos abatement projects. Safety and health training for other hazardous waste workers has been mandated since 1987, when OSHA created the Hazardous Waste Operations and Emergency Response (HAZWOPER) Interim Final Rule (1987). The HAZWOPER Final Rule established on March 6, 1989 also mandated that workers receive safety and health training before working on hazardous waste sites. The HAZWOPER Standard requires that workers receive a minimum of 40 hours of safety and health training on specified topics before they work at sites covered by the regulation. Additionally, workers are required to receive 8 hours of refresher training annually, to update their knowledge and skills.

In 1992, OSHA developed a document that provides a list of their standards that require training as part of the safety regulations. The document lists over 100 federal regulations that require training (USDOL 1992). The training components for these standards vary in duration and content, but the common element is that training is required to help ensure the safety of workers. These standards include safety and health training for Personal Protective Equipment, Confined Space, Lockout/Tagout, Fall Protection, Trenching, and others. The OSHA document lists three steps to evaluating training program effectiveness: 1) student opinion, 2) supervisors' observations, and 3)

workplace improvements. OSHA states "the ultimate success of a training program may be changes throughout the workplace that result in reduced injury or accident rates" (US DOL 1992).

GRANTS FOR OSH TRAINING CENTERS

NIOSH Education and Research Centers

The federal government has provided grants for OSH training through NIOSH since 1977. The funded programs, the NIOSH ERCs, provide CE and graduate level training in occupational medicine, occupational health nursing, occupational safety, and industrial hygiene. Additional focus areas have since been established since the ERC program was initiated, including topics such as agricultural safety, ergonomics, injury prevention, and others. In the program announcement, NIOSH stated through "continuing education, outreach, training and research activities, ERCs will significantly impact the practitioner environment in a measurable way" (NIH 2005).

Hazardous Waste Training Centers

Since 1987, the National Institute of Environmental Health Sciences (NIEHS), an institute within the National Institutes of Health (NIH), has also provided grants for hazardous waste training. The program, established by the Superfund Amendments and Reauthorization Act of 1986 (SARA), Section 126(g), authorizes a grants program for training and education of workers engaged in activities related to hazardous waste removal or containment or emergency response (PL 99-499 1986). Long-term goals of the NIEHS-funded training programs should be to assure that workers become and remain active participants in determining and improving the health and safety conditions

under which they work and that avenues for collaborative employer-employee relationships in creating safe workplaces are established. The program announcement states that grantees must show "positive impacts of training activities on work practices and overall worker protection from on-the-job hazards" (NIH 2005). Through these programs, several hundred thousand workers have been trained. Additionally, many other public and private entities provide CE in OSH topics.

OSHA New Directions Grants/Susan Harwood Training Grants

In April 1978, OSHA established the New Directions Grants program (now known as the Susan Harwood Training Grants program). The purpose was to develop OSH training and education for employers and workers. Each year, program announcements identify high hazard workplaces or other industries for which the program will focus. Through these programs, more than 1.3 million workers have been trained since 1978 (OSHA 2010a).

OSHA Training Institute Education Centers

The Occupational Safety and Health Administration has been providing training through their OSHA Training Institute (OTI) since the 1970s. They focus on providing training to Federal and State compliance officers, State consultation program staff, and the private sector on a space available basis (OSHA, 2010b). In 1992, the OTI expanded their reach by providing non-financial cooperative agreements with other training and educational institutions to create centers known as OSHA Training Institute Education Centers (OTIEC). The purpose of the OTIEC was to increase the number of training programs available to the private sector and non-OSHA Federal personnel. In 1992, four OTI Education Centers were awarded. The program currently has 26 Centers.

EVALUATING THE EFFECTIVENESS OF OSH TRAININGS

In 2000, IOM developed a report entitled *Safe Work in the 21st Century*. Within that report, the IOM made ten recommendations, five for the current OSH workforce and five for the future OSH workforce. One of the recommendations was to "evaluate current worker training and establish minimum quality standards" (IOM 2000). The report continues, "OSHA should join together with NIOSH, NIEHS, unions, industries, and employer associations to evaluate the efficacy of OSHA and other worker training programs" (IOM 2000).

It is difficult to evaluate whether reductions in workplace illness and injury rates are the direct result of training programs because many variables, including training, management commitment to safe work practices, and workplace culture, confound these linkages. As a result, the impact of safety training has not been widely studied. A few researchers, however, have found that training does impact workplace practice (Berger 2000, Burke 2006, Washington 2006). These researchers all measured the impact of training through the implementation of new practices and their consequences. Several variables, including the method of instruction, how often the knowledge and skills are utilized at the workplace, and resources for implementing change, were shown to affect the ability of training to impact workplace safety.

The general lack of information about the effectiveness of training programs on workplace safety and health is problematic. It leaves open the question as to whether the laws and policies put in place to protect workers are having the desired effect. To understand the issue more thoroughly, this research first analyzed the concerns and

policies that created the ERCs. It then reviewed the historical data on ERC trainings and

the reduction in workplace injuries. The timeline created by the historical data served as a

guide to elicit information from key informants about whether the decline in rates can

actually be linked to ERC training programs. Finally, this research conducted and

analyzed a survey of ERC trainees, to determine whether they feel they have been well

served by mandated trainings. The findings from this work served an important and

timely purpose as the federal government now requests evidence from the ERCs that their

training programs have actually made an impact in the workplace.

RESEARCH QUESTIONS

Research questions to be addressed in this thesis include the following:

1. How have the ERCs met the policy mission of "providing education and training

   in occupational safety and health, increasing the number of trained professionals

   in occupational medicine, occupational health nursing, industrial hygiene, and

   occupational safety"?

2. What effect does training provided by the ERCs have on the practice of OSH in

   the United States?

3. Have ERC trainings kept up-to-date with improvements in technology and

   changes in OSH legislation? If not, what changes need to be made for the ERCs

   to fulfill the intended policy goals set out for workplace health and safety?

THEORECTICAL FOUNDATION

This research will 1) identify how policies put forth in the OSH Act were incorporated into programs providing OSH education and training and 2) how these policies spread knowledge about OSH in industry, as a result of the training and education provided by the ERCs. The Theory of Planned Behavior (TBP) will be used as a theoretical model for this research. The TPB states that human behavior is based on three major factors: attitude toward the behavior (behavioral beliefs), subjective norm (normative beliefs), and perceived behavioral control (control beliefs). There are background factors that influence the beliefs, and these include personal factors, demographic factors, and environmental factors (Ajzen and Manstead 2007). It is particularly suited for this research because not all behaviors that are taught in the training courses are implemented in the workplace. Behaviors may or may not be implemented due to factors external to the trainee. For example, a supervisor may be a gatekeeper for certain behaviors to be implemented at the workplace. Individual trainees may have certain attitudes that affect the implementation of safety behaviors. For example, wearing certain safety equipment may be perceived as less "macho", so an individual may not wear personal protective equipment that will provide the appropriate level of safety for their job tasks.

OSHA policies are intended to reduce worker illness and injury rates. Over 100 of the OSHA General Industry Standards include training requirements. Additional training is required in the construction and maritime standards and the Mine Safety and Health Administration (MSHA) has developed specific training requirements for workers in mines. Benefits of training to employers include a better trained workforce,

compliance with regulations, reduced workers compensation premiums, reduced

exposures among workers, and increased productivity (Berger 2000). Although it is

difficult to make a direct correlation between workers receiving training and a reduction

in injury and illness rates, training does provide a means to increasing knowledge and

skills, and it may lead to behavioral changes. This research will help to identify how

policy has impacted workplace practices. Specifically, the research will focus on the

development of the ERCs. These centers have provided graduate and CE for 30 years,

however, no research has been initiated to identify the scope and impact they have had on

worker safety and health.

METHODOLOGY

The research for this project will be conducted in stages. Phase 1 consists of a

thorough evaluation of the legislative and administrative documents leading to the

establishment of the ERCs. The results of Phase 1 will address how workplace health

and safety appeared on public agenda, the factors leading to opening the policy window

for making change, and the role of institutions in the establishment of the ERCs. These

issues, as outlined by Kingdon (2003), are part of the process in which public policy is

created. An historical time line will be created, including dates for key legislation and

policy changes, numbers of workers trained by the ERCs, and reductions in occupational

injury rates.

Phase 2 includes interviews of key informants at multiple levels (stakeholders in

the development and implementation of the ERC programs), including a former director

of NIOSH, program directors at ERCs, and other health and safety professionals who

present or manage OSH training programs. Individuals will be asked to provide their perspective on the impact that the ERCs have made on OSH issues in the United States. Program directors will also be asked to provide specific examples of experiences that their students have had after graduating from the ERC program.

Phase 3 consists of a web-based survey of former students/trainees who have completed graduate and CE programs through the ERCs. The survey asks questions related to how effective the ERC training programs were in providing information so trainees can make appropriate health and safety decisions in their workplace practices. Additionally, the survey asks what improvements are needed in the structure and substance of the ERC training programs to keep workers up to date. Phase 3 also consisted of a three-part survey of trainees who attend an occupational safety and health course at the University of Medicine and Dentistry of New Jersey – School of Public Health. This phase of this research selected registrants from the NY/NJ ERC to participate in a pre-and post-course evaluation. The purpose of this is to identify specific changes that can be attributed to a particular training course. The first part of the evaluation identified motivation for attending the training course and understand systems in place at the worksite that address the safety culture of their particular worksite. It was distributed to course participants when they arrived for the first day of the training course, before the start of any of the course instruction. The second part included several questions that identify any changes to safety behavior that course participants intend to make due the material presented in class. This was implemented at the conclusion of the training course, as they complete the final course evaluation. The third part was a follow-up evaluation to identify if any of the behaviors they intended to make have actually been

implemented at their worksite. This occurred three months after they had completed the training program.

Identifying the precise extent to which the ERC programs have had impact on reducing workplace injuries and illnesses is impossible. However, by using a multimodal effort for obtaining data, a picture of how the ERCs have impacted the workforce, and in turn helped reduce workplace injury and illness rates, is displayed. Multiple safety interventions are needed to effect illness and injury rates. Training the workforce, as provided by the ERCs, is one important intervention. Other interventions include a focus on management, for example, developing a safety management culture and program within an organization. Training is a part of the safety management system, but it also includes development of safety policies, procedures, and committees to provide a means for discussion and implementation of safety and health issues. Interventions may also focus on the type of work conducted. For example, changing a workplace process to include a safer or less hazardous procedure would have an impact of worker safety and health. Again, training would be a key element of the process, as workers would need to be re-trained to understand the issues involved with the new process or materials with which they are working.

This research utilized case studies, interviews, and survey data to identify the effect the ERCs have had on the field of OSH, and help to identify how the ERCs have been effective in reducing illness and injury. The literature review includes information on Theory of Planned Behavior, and knowledge and technology transfer. A discussion of policy innovators and policy entrepreneurs is provided, to provide a description of the formation of the OSHA legislation that led to the development of the ERCs.

Chapter 2: Literature Review

THEORY OF PLANNED BEHAVIOR

Ajzen as an extension of the Theory of Reasoned Action (TRA) (Azjen 1985)

developed the Theory of Planned Behavior (TPB). The TRA developed in 1975 by

Fishbein and Ajzen has three general constructs: behavioral intention, attitude, and

subjective norm. This theory states that behavior is based on the attitudes one has

towards a behavior and subjective norms (Fishbein and Azjen 1975). Miller (2005)

defines attitudes as the sum of beliefs about a particular behavior weighted by evaluations

of these beliefs. For example, if one believes that exercise is good for you, then they

weigh the benefits of exercise versus the other variables (i.e., time, comfort). If one

believes the benefits from exercise outweighs negative factors, then one will start

exercising. Subjective norms are defined as the influence of people in one's social

environment on his/her behavioral intentions. If friends, relatives, or others who are

influential in your life think that exercise is useful, then you may be inclined to exercise.

Behavioral intention is defined as a function of both attitudes toward a behavior and

subjective norms toward that behavior, which has been found to predict actual behavior.

If one's attitudes toward exercise are positive, and they have supportive peers, this may

lead to your intention to exercise, which in turn, will lead to a behavior change.

The TRA is designed to predict volitional behaviors to help understand their

psychological determinants (Ajzen 1985). The TRA focuses on a person's intention to

perform a behavior, and that the intention is the immediate determinant of performing the

particular behavior. There are several factors that affect the performance of that

behavior. External influences on behaviors that are not fully under one's control include

internal and external factors. Internal factors include individual differences, skills and abilities, will power, and emotion. External factors include time and dependence on others. These external factors are significant in the study of OSH interventions. As will be discussed later, and through the survey implemented in this research, the ability to implement knowledge and skills learned in training may be dependent on supervisors, equipment available at the worksite, and other factors.

The TPB, developed by Ajzen, provides a framework for identifying the determinants of health behavior. The TPB includes consideration of non-volitional factors as determinants of behavior (Ajzen 1985). It has been used in many areas of health-related behavior change, including condom use for AIDS prevention, exercising, donating blood, adhering to low-fat diet, using illegal drugs, and wearing safety helmets (Ajzen and Manstead, 2007). The TPB, building upon the TRA, and states that human behavior is based on three major factors: attitude toward the behavior (behavioral beliefs), subjective norm (normative beliefs), and perceived behavioral control (control beliefs). There are background factors that influence the beliefs, and these include personal factors, demographic factors, and environmental factors. The TPB is shown in Figure 1.

Sheeran (2002), in a meta-analysis of 422 longitudinal studies, identified that intentions accounted for 28% of the variance in behavior. This is an important aspect of the theory, and relates to the practice of OSH. Many people are taught the knowledge and skills to protect themselves, and think it is very important to do so. However, through the interviews conducted in this research, it has been identified that safety behaviors are not implemented because of external factors. Several of the interviewees

mentioned that the supervisor at the workplace has control over the types of safety controls in the workplace.
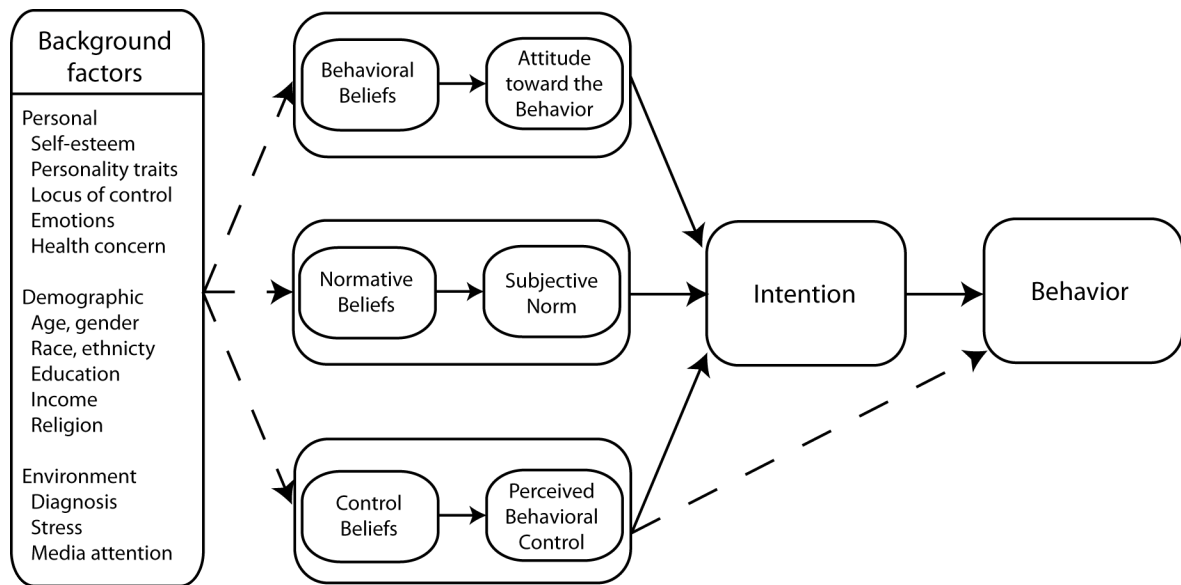
Figure 1: Theory of planned behavior (Ajzen and Manstead 2007)

The TPB theory has been utilized for research in OSH issues (Sheeran and Silverman 2003, Johnson and Hall 2005, Welbourne and Booth-Butterfield 2005, Levin 1999, Cole 2010, Fogarty and Shaw 2010). A purpose of utilizing the TPB is to predict unsafe behavior. Fogarty and Shaw stated that occupational health and safety interventions focus on controlling the physical work environment and work procedures. However, the research they conducted looked into the underlying links between work climate and behavior. Fogarty and Shaw studies aircraft maintenance workers in the Australian Defense Force to identify what factors affect safety behavior. The study identified that over 50% of the variance was explained by intentions, group norms, and

personal intentions. These results lead to the conclusion that management attitudes and group norms are important predictors of behaviors that violate safety rules.

Sheeran and Silverstein (2003) evaluated three interventions that could promote health and safety in the workplace. They point out that according to the TPB, the most immediate and important predictor of behavior is the person's decision to act. The study they conducted used different intervention messages to identify the one that would be most effective to increase attendance at a safety and health training course. They found that volitional intentions were a stronger predictor of behavior than the TPB. The volitional phase is where one creates an action plan to change behavior. For example, TPB addresses the intention to change a behavior, while volition addresses the intention to change a behavior at a certain time. In Sheeran and Silverstein, the intervention message that included volition lead to twice as many people attending the training course.

Johnson and Hall (2005) applied the TPB to predict safe lifting behavior. They identified that implementing ergonomic design principles is the most effective control when manual lifting tasks are required. Barriers to ergonomic design often lead to implementation of safe lifting techniques as the principal method to control hazards. It is difficult to motivate behavior change if workers and management do not have an understanding of the mechanism of how to lift properly. The study conducted identified that TPB was an effective model in explaining safe-lifting behavior. Additionally, behavioral control was the largest predictor of safe-lifting behavior, followed by subjective norms, and attitudes.

Welbourne and Booth-Butterfield (2005) examined the ability of TPB to predict fire chief's intentions to use structural fire safety recommendations outlined in a NIOSH

publication. They hypothesized that perceived behavior would be a strong predictor of intentions. They found that attitudes, norms and perceived control were significant predictors of safety intentions. They further state, "fire fighters intentions to engage in safe behaviors on the job are related to their own beliefs about the value of the behaviors, the beliefs of how others feel about these safety behaviors, and their perception of how easy or difficulty it is to carry out these behaviors" (Welbourne and Booth-Butterfield 2005, page 151).

Levin (1999) studied the TRA and TPB models as predictors of health care workers' glove use. Additionally, she included an expanded TPB model that included perceived risk in her analysis. The results show that intention, attitude, and perceived risk were significant predictors of behavior. Health care workers were less likely to wear gloves if they had a negative attitude toward wearing them. All three models were useful in predicting behavior change. Perceived control was the strongest predictor of glove use, so Levin concluded that the TPB was an important predictor of glove use. It is noted that the extended TPB is a viable model to study injury prevention.

As discussed, several studies have been completed that indicate the usefulness of the TPB in understanding behavior change in OSH practices.

TRAINING EVALUATION AND TRAINING EFFECTIVENESS

Training evaluation and training effectiveness are two separate constructs. Both of these are important to understand as training programs are assessed. Training evaluation is a measurement technique that examines the extent to which training programs meet their intended goals (Alvarez 2004). Training effectiveness is the study of

variables that likely influence training outcomes at different stages of the training process (Alvarez 2004). Evaluation measures are utilized throughout the process of development and implementation of a training program. This continuum of evaluation includes formative, process, summative, impact, and outcome evaluation. Windsor and colleagues (1984) note that formative evaluation is used in the developmental stages of program development. Process evaluation documents and describes specific program activities that are taking place. Summative evaluation provides summaries of the effectiveness of a program, and enables decision makers to plan and allocate resources. Impact evaluation assesses the overall effectiveness of a program. Impact evaluation determines if changes in behavior can be attributed to the program efforts. Outcome evaluation assesses changes in morbidity, mortality, or other indicators for a specific group of people.

Wang and Wilcox (2006) state that evaluation is important to be included in all phases of training program development. These phases include analysis, design, develop, implement, and evaluate, commonly referred to as ADDIE. Although evaluation is included as a phase of the process, it should not only be addressed at that phase. Specifically, Wang and Wilcox focus on formative and summative evaluation. Formative evaluation intends to provide information on improving program design and development. Summative evaluation is conducted to determine whether intended training goals and outcomes are achieved. Training benefits to individuals and to organizations is achieved through summative evaluation. The goals and objectives that were specified in the analysis stage are evaluated to identify whether they were achieved through the training program. Reasons to conduct summative evaluation are that it will justify the training budget and human resource investment; it will validate the interventions that

were designed and implemented; and it will demonstrate to organization decision makers the value of the investment in the training (Wang and Wilcox 2006). Additionally summative evaluation may help to identify gaps in needed training and serve as a basis for development of future training programs.

Impact evaluation is important to determine how training programs have changed workplace practice, and whether they have reduced workplace injuries and illnesses. Taschereau (1998) defines impact evaluation as "the assessment of the direct and indirect effects of activities and programs on individual, institutional, and sectoral performance and/or on policies and the consequences for the welfare of the larger community." (page 1) This research will focus on the first part of Taschereau's definition by identifying how NIOSH-funded OSH training programs affect individual and institutional performance, thus reducing worker injuries and illnesses.

Kirkpatrick (1998) has developed a model to evaluate training programs. At the foundation Kirkpatrick's model is that programs must meet the needs of the learners. Without that focus, programs will not be effective. The model is comprised of four levels of evaluation: reaction, learning, behavior, and results. Level 1, reaction, includes how the participant reacts to the training program. This reflects satisfaction with the program, and data is gathered by a survey at the completion of the program. Level 2 is learning, defined as the extent to which participants change attitudes, improve knowledge, and/or increase skill as a result of attending the program. A pre-test/post-test evaluation determines how much has been learned. Level 3 is behavior, defined as the extent to which change in behavior has occurred due to a training program. This level is evaluated by observation of employees conducting skills that they learned in a training program and

apply at their job site. The last level, Level 4, is results, defined as what has been accomplished because of attending a training program. This level is hard to evaluate, as it includes cost-benefit analyses of the training program and its impact at the worksite. It answers questions such as: Did the training program increase workplace safety? Did the training program reduce injuries and illnesses? These questions are difficult to assess because of confounding issues that can affect injury and illness rates. Despite the difficulties in measurement, it is important to determine whether training programs do impact workplace conditions.

Kirkpatrick's model can be broken down into short-term and long-term outcomes. Short-term outcomes include the measurement of the first two steps in the model, reaction and learning. Reaction evaluation captures how the trainee reacted to the training program. The following are examples of questions that may be asked to capture reaction to training: Did the trainee enjoy the course? Was the trainee motivated by the material presented? Did the training hold the interest of the trainees during the course? Learning outcomes measure the amount of learning that is due to the training program in which an individual participated. The evaluation of learning outcomes is usually conducted at the end of a training program, often in terms of a post-test. The post-test can measure the knowledge gained during a training program, but does not ensure that the information learned in the training will be applied at the workplace. The measures of the short-term evaluations may not have a causal relationship with learning outcomes, but may be useful in changing the training design and implementation (Wang and Wilcox 2006).

Long-term outcomes can be measured using Kirkpatrick's third level, which is behavior. The goal of a training program is to change behaviors of the participants. In the case of the NIOSH program, the goal is to reduce injury and illness by creating a safe workplace. Worker behavior is a part of ensuring a safe workplace. Wang and Wilcox (2006) suggest a time period of three to six months after training needs to pass before an evaluation of knowledge or behavior can take place. This is due to the fact that workers may not be able to implement new skills or knowledge in their work setting for a period of time.

The Kirkpatrick model has several weaknesses, including overemphasis on the reactions of trainees and low correlation between reactions and performance (Rajeev 2009). Brown (2002) states that the Kirkpatrick model does not provide enough information on other variables that influence the transfer of training information to the workplace. Other factors that Brown identified include trainee readiness for change, motivation, opportunities for practice and feedback during the training program, lack of similarity between training and worksite, and workplace organization and policies

Many training programs use a variation of Kirkpatrick's four-level evaluation model. For example, Tannenbaum (1993), Holton (1996), and Kraiger (2002) expand upon the Kirkpatrick model. Tannenbaum added post-training attitudes and divided behavior into two outcomes for training: training performance and transfer performance. In this model, learning is related to training performance, training performance is related to transfer performance, and transfer performance is related to results. Holton included evaluation of learning, transfer and results in the model. Reaction is not part of this model. The focus of this model is that learning is related to transfer and transfer is

related to results (Holton 1996). A model developed by Kraiger identifies three areas for evaluation. These include training content and design, changes in learners, and benefits to organizations. This model includes reaction, as a measure of training content.

The need to evaluate training has been documented by many researchers. The IOM recommends that current worker training programs are evaluated and that minimum quality standards are established (IOM 2000). The report states that OSHA should join together with NIOSH, NIEHS, unions, industries, and employer associations to evaluate the efficacy of OSHA and other worker training programs (IOM 2000). Berger (2000), Burke (2005), and Washington (2006) found that training does impact workplace practice. Several variables, including the method of instruction, how often the knowledge and skills are utilized at the workplace, and resources for implementing change, were shown to affect the ability of training to impact workplace safety. Cohen and Colligan (1998) conducted a literature review seeking information that would assess if OSH training programs had beneficial effects in reducing the risk of work related injury or illness, and factors that were critical to successful training programs. They state that most of the OSH training evaluations included only in-house assessments that measured trainees reaction to the program. The researchers also report that evaluations that measure the impact training had on workplace practice or the extent to which training knowledge was absorbed were rare and recommended that multiple measures of effectiveness be conducted. Their literature review of 80 studies showed that 119 of the 138 training programs evaluated demonstrated a positive change due to training.

ENHANCING WORKPLACE SAFETY PROGRAMS

Improving workplace safety has been an initiative of the federal government since United States Congress passed the first worker protection act in 1790 (Light 2002). Indeed, Congress has implemented measures to protect workers since the early 1900s, including the National Labor Relations Act of 1935 (also known as the Wagner Act), the Federal Coal Mine Safety Act of 1952, and the Federal Mine Safety Act of 1969. The Wagner Act states "experience has proved that protection by law of the right of employees to organize and bargain collectively safeguards commerce from injury, impairment or interruption." (NLRA 1935) One purpose of the Wagner Act was to allow access to unionization without retribution against the workers. This allowed for the unions to represent workers and negotiate for increased worker safety protections, as well as financial and other workplace benefits.

Many of the initial safety and health regulations were unsuccessful in increasing safety and health protections in the workplace. The OSH Act of 1970 created an opportunity for the United States to address critical issues facing workers. President Nixon spoke of the OSH Act, designed to reduce workplace deaths and injuries, as one of the most important pieces of legislation ever passed by Congress. In 1969, over 12,500 workers died and over 2 million were injured (Woolley 2010). Exposures to lead, cotton dust, coal dust, asbestos, and other toxic substances cost the United States economy over $1.5 billion in lost wages and over $8 billion in lost productivity due to absenteeism (Light 2002). The purpose of the OSH Act is "to assure safe and healthful working conditions for working men and women" (OSH Act 1970). It required employers to reduce the hazards in the workplace, provide worker protection standards, and created an

agency to inspect and enforce those standards. It also created NIOSH. NIOSH was given the powers to "conduct, directly or by grants or contracts, education programs to provide an adequate supply of qualified personnel to carry out the purposes of the Act" (OSH Act 1970). In 1975 OSHA estimated the demand for OSH professionals based on industry demand at 5130 annually (Harris 1983). A survey of industry managers conducted in 1977 by John Short and Associates, under contract from NIOSH, confirmed that training programs were not producing enough OSH professionals (Harris 1983). Both of these studies projected the demand for OSH professionals over a period of time, and both identified a deficit of professionals (OSHA at 23,340 and Short at 21,270). Harris (1983) states that neither of these trends held true during the early part of the 1980s. Thus, both estimates were likely wrong.

There was no academic mechanism in place to fill the estimated demand for OSH personnel. In 1976, the NIOSH ERCs were established to help train and educate more of these professionals. The ERCs are interdisciplinary programs funded through a cooperative agreement with NIOSH to provide graduate training in core areas of OSH: industrial hygiene, safety, occupational medicine, and occupational health nursing. Other areas such as ergonomics, occupational epidemiology, and other graduate programs are included as additional training areas outside the core programs. Each ERC must provide CE to meet the training and CE needs of the professionals in practice. In 1981, there were 781 graduates from the ERC academic training programs, still leaving a large deficit in the number of trained safety and health professionals needed.

From 1977 to 2007, the ERCs graduated 15,664 from the academic programs (Talty 2009). During the period from 1988 through 2007, the CE programs trained

554,182 OSH professionals (Talty 2009). Harris (1983) states that a large number of OSH personnel entered the field through CE or on the job and that the ERCs are providing valuable training meeting a workforce need. The ERCs provide life long learning opportunities that continue to provide education on safety and health issues.

Treschan (2001) reported that if training is not linked to employers, then the increase in the labor market will not meet any relevant demands. He proposes that sectoral employment strategies be utilized to address the disconnect between the labor-market supply and demand (Treschan 2001). This is precisely the approach that NIOSH took with the development of the ERCs. In 1970, a deficit in the OSH labor market was identified, and the federal government proposed the development of the ERCs to meet the projected number of workers in the industry.

Gillen and colleagues (2004a) conducted a study to identify construction workers' perceptions of management's role in improving safety practices. This qualitative research identified several reasons for increased safety and health at the workplace. These included:

> length of training of joint health and safety committee members, empowerment of the workforce as measured by the expectation of worker initiative, top management role in OSH, encouragement of a long-term commitment to the workplace by employees, regular safety audits, systematic hazard assessment, regular safety training, good housekeeping, safety controls on machinery, and the seniority of the workplace. (page 246)

Workplace training was identified in two of the items above: time invested in training joint labor and management health and safety committees, and the resources to provide safety training on a regular basis. Training, an important part of an overall workplace safety and health program should help to reduce injuries at the worksite. These same

researchers (Gillen et al 2004b) also examined construction managers' perceptions of safety practices. They identified several qualities of an injury prevention program, including management commitment, employee involvement, and safety and health training. These elements should be part of an overall safety commitment from management to aim towards "zero injury objectives".

Shannon et al. (1997) identified several variables in general industry that are related to reduced injury rates. These include housekeeping, safety controls on machinery, joint labor/management safety and health committees, safety training and safety audits. They report that longer periods of safety training and safety training provided on a regular basis reduced injury rates. Similarly, Gillen's study (2004b) also identified that if training is poorly conducted, it will be an obstacle to reducing injury rates.

JOB TRAINING PROGRAMS

Lifelong learning provides an opportunity for workers to continue gaining knowledge and skills to improve their situation. This may include improving safety skills needed to protect themselves, increasing their marketability for a new job, or receiving education to change their career goals. The NIOSH ERC program is one type of jobs training program specific to increasing the number of OSH professionals available in the United States. More recent jobs programs include the Workforce Investment Act (WIA) of 1998. As the title of the legislation indicates, the WIA was established to consolidate, coordinate, and improve employment, training, literacy, and vocational rehabilitation programs (P.L. 105-220). The WIA replaces and consolidates over 70 job-training

programs that were legislated in the United States, and repeals the Job Training Partnership Act, the Adult Education Act, and several other related job training program statutes. The WIA includes five titles that address different focus areas that address the development of statewide and local workforce investment systems, job corps, national programs, administration, and adult education and literacy.

The WIA was implemented to change the way employment and training services were delivered (USGAO 2008). Each state is required to develop Workforce Investment Boards to oversee the direction of the program. The Workforce Investment Board determines the strategic priorities, current and future employment projections, and types of skills needed by the workforce to fill the identified workforce needs. Training is provided for the types of jobs that are in demand. The GAO (2008) reported that evaluating impact and enhancing monitoring would improve accountability of the WIA program.

Job training programs can lead to increased worker productivity. Formal employee training programs have seen 19% increases in their productivity over similar firms that did not provide training for their workforce (Reich 2002). The NIEHS developed a minority worker training program in 1995. This program provides safety and health, construction trades, and job skills training to unemployed or under employed minorities.

OSHA requires training for many types of employment and job specific tasks. In 1992, OSHA published a document listing all the safety and health standards that include training components (OSHA 1992). The training components fall within a specific industry sector, which include general industry (29 CFR 1910), maritime (29 CFR 1915,

1917, 1918), construction (29 CFR 1926), agricultural (29 CFR 1928), or federal

employee programs (29 CFR 1960). The United States Environmental Protection

Agency (EPA), the United States Department of Transportation (DOT), and other

agencies have safety and health training requirements as well. Additionally, states have

the capacity to implement additional training requirements that exceed the federal

standards set out by the United States Department of Labor (DOL). For the general

industry standards, OSHA requires training in 15 subparts of the standards (USDOL

1992). Within these 15 subparts, over 80 specific training programs are required. These

range from employee emergency plans, to respiratory protection from asbestos and lead,

and to hazardous waste training. For the maritime standards, OSHA requires training in

shipyard employment (29 CFR 1915) in nine subparts, marine terminals (29 CFR 1917)

in one subpart, and longshoring (29 CFR 1918) in one subpart. In total there are 31

specific training requirements for the maritime industry. For the construction industry,

training is required in 18 subparts of the federal regulations. In total over 40 specific

training programs are required. These include training on cranes, steel erection, personal

protective equipment, and others. In the agricultural sector, OSHA requires training in

two subparts. These include roll-over protection for tractors, and guarding of farm

equipment. These extensive requirements clearly call for agencies such as the ERCs to

aid states in providing a coherent set of trainings.

The NIOSH ERCs provide training and education in general industry,

construction and agricultural programs. A review of the NIOSH ERC website shows lists

80 training topics in safety and health issues ranging from construction safety

management to hazardous waste management (NIOSH-ERC 2009).

Materna and colleagues (2002) describe an example of a safety and health job training program where lead-based paint contractors are provided with educational seminars and technical assistance to try to change workplace behaviors. The authors state that they did not achieve their goals in terms of program impact, but they did see moderate changes in the workplace practices of the lead-based paint contractors. They conclude that their training and technical assistance program is effective in changing workplace practice, and that those changes can be sustained over time.

TRAINING TRANSFER

The purpose of training programs is to enable to trainee to increase their knowledge and skills, and better perform their jobs. Taking the information and skills learned in a training course and applying that knowledge and skills in the workplace is training transfer, the amount of information that is learned in a training course and applied in the workplace. Baldwin and Ford (1988) conducted a review of research on training transfer and defined it as the degree to which trainees effectively apply the knowledge, skills, and attitudes gained in a training context to their jobs. They report that for transfer to occur, the learned behavior must be generalized to the job, and must be maintained over a period of time on the job. Training transfer is effected affected by training design, trainee characteristics, and work-environment characteristics. The factors involved in training program design include the incorporation of learning principles, sequence of training material, and the relevance of the training to job function. The characteristics of trainees include individual ability and skills, motivation, and

personality factors. Work-environment factors include supervisory and peer support, as well as opportunities and barriers to performing the learned skills on the job site.

Baldwin and Ford (1988) identify a lack of empirical data for each of the above factors. They reviewed many research studies in the three areas (training design, trainee characteristics, and work-environment characteristics), but note that there are limitations to them. For example, studies conducted on training design are limited by the narrow focus and the types of individuals used in the studies. Many of the studies use college students, and employ a simple memory or motor task. These types of tests generally emphasize short-term memory, and the type of learning needed for employment situations is the ability to implement skills over the long-term. Limitations of the trainee characteristics studies include the lack of a theoretical framework to guide the research and a lack of adequate criterion measures of transfer. Baldwin and Ford also report that self-reported measures of transfer do not adequately identify the individual characteristics that effect training transfer. Therefore, studies are lacking that can directly identify the effects of training on the extent of transfer that occurred. The researchers state that studies use correlates to estimate transfer criteria, such as work climate, leadership, and supervisory support.

Burke and Hutchins (2007a) also report that the extent of training transfer varied depending on the study they reviewed. They looked at several factors related to the individual learner to identify how they influence training transfer. These factors included cognitive ability, self-efficacy regarding the training task, motivation, personality, perceived utility and value of the training, career and job variables, and locus of control. Their results showed that the following had a strong or moderate relationship with

training transfer: cognitive ability; self-efficacy; pre-training motivation; anxiety/negative anxiety; openness to experience; perceived utility; career planning; and organizational commitment. They reported that training with a high degree of engagement (the trainee is much more actively engaged in the training process) is more likely to be effective than more passive training approaches.

Training transfer depends on factors besides the knowledge and skills learned in a training course. For instance, it is influenced by support systems at the workplace. Brown (2002) states that a person who thinks a skill will be useful to them will be more likely to acquire it. The person will be more likely to transfer learned skills to their job if their supervisor expects they will use the skill, and if their annual performance appraisal will include how well the skill is implemented. Brown also states that individual understanding is linked to behavior, individual behavior is linked to mutual understanding, and mutual understanding is reinforced by organizational structures. Implementing skills on the job will more likely take place if the work site embraces the concepts that are learned in training courses.

The type of training provided also is important in training transfer. As the method of safety and health training becomes more engaging, the effect is greater for knowledge gain, safety performance improvement, and reduction of negative outcomes (Burke et al 2006). Training programs that include more engaging training programs were three times more effective than the least engaging in knowledge acquisition. The research conducted by Burke and colleagues (2007b) suggests that professionals developing training programs should focus on the type of training methods employed because more engaging activities will have better outcomes. They identified three degrees of engagement in

training: low, medium, and high. Low degree of engagement in training includes training that uses oral, written, or multi-media presentations by an expert, but lacks active participation by the learner. Trainees do not engage in hands-on activities nor do they participate in group or individual learning activities. Medium degree of engagement in training includes programs that include lectures with an emphasis on discussion and feedback. High degree of engagement in training includes programs that have significant interactivity between the material presented and the learner. Training will include hands-on training, self-assessments, and tabletop exercises.

Reinforcement of training concepts is an important factor in training transfer. The actions that take place after the training impacts the likelihood of the behavior being changed in the workplace. For example, reinforcement includes positive reinforcement from a supervisor recognizing when an employee has performed their job in a safe manner (Burke et al 2007b).

The TPB has been utilized to study the intentions and changes of health behaviors in different settings, including in OSH. The TPB incorporates background factors that include personal, demographic, and environmental factors that influence beliefs. These beliefs include behavioral, normative, and control beliefs that influence an individuals intention to change behavior, as well as their actual behavior changes. The TPB is useful to study the impact OSH training programs have on workplace safety and health practices.

Workplace safety has been an initiative of the federal government for over 200 years. However, until the establishment of OSHA in 1970, there was no one agency that was responsible for worker protection standards and enforcement. The OSH Act

established training programs, including the NIOSH ERC. The NIOSH ERCs were created to help train workers in OSH, filling the workforce demands for OSH professionals. Other job training programs have been established to develop a cadre of OSH professionals.

The literature identified effective methods to transfer what is learned in a training course to the workplace. For it to be effective, the learned behavior must be generalized to the trainee's job, and must be maintained over a period of time. Several factors effect transfer, including personal characteristics of the trainee, the design of the training course, and work-environment characteristics.

Training program evaluation is a multi-staged process. Program staff conduct needs assessments, process evaluation, outcome evaluation, and impact evaluation. All these steps are necessary to fully understand the value of training programs. The key focus of this research is to understand how training programs impact workplace practice. The research will identify barriers and enablers that exist that influence the ability for training course participants to implement knowledge and skills at the workplace. The research will also identify other variables that affect learning, and how they impact the way training programs can be successful in providing safety and health information.

Chapter 3: Methods

This research will utilize both qualitative and quantitative methods to analyze the issues related to effectiveness of the NIOSH ERCs. Three phases were utilized to assess the effectiveness of the programs. The initial phase involved a review of the literature to understand the background and principles that are relevant to help further the research into effectiveness of OSH training programs. The research includes review of documentation and policy records for the establishment of the NIOSH training programs, as well as other safety training programs that have similar goals. The second phase was conducting key informant interviews. These interviews served to develop the questionnaire that was implemented in the third phase. The third phase was the data collection through an online survey. The survey was administered to participants in ERC training courses from across the United States. The third phase also included select courses from the NY/NJ ERC to participate in a pre-, post-course and follow-up evaluation. The purpose of this is to identify specific changes that can be attributed to a particular training course.

An application was made to the Rutgers University Institutional Research Board to gain approval to conduct phase 2 and 3 of the research. The IRB granted expedited approval to conduct the key informant interviews. Since the purpose of the key informant interviews is to gain information on what questions to ask in Phase 3 of the research, that questionnaire was not included in the initial IRB application. However, the protocol was approved and an amendment was submitted when the final questionnaire was completed. The IRB approved the final questionnaire, and it was administered to the

survey sample. The third phase was also submitted to the UMDNJ IRB, and was granted

approval to conduct the research.

PHASE 1

A literature review was conducted to identify the extent of impact evaluations of

occupational health and safety conducted. The literature shows that several evaluations

have occurred, but limited data exist on the impact that ERCs have on the workplace.

Many studies previously conducted are from other disciplines, or on other types of safety

and health training. Although these studies are relevant, and provide background

information for this research, it does not adequately identify the impact ERCs have on

workplace practice, or how well they are meeting their intended mission.

The literature review also identified trends in occupational fatalities. Data back to

1992 was collected. The occupational fatality rate in 1992 was 5.2 per 100,000 workers;

in 2007 the rate was 3.8. These data were tracked and compared with the number of

workers trained by the ERC CE programs. The number of workers trained in 1992 was

23,194; the number of workers trained in 2007 was 41,326.

PHASE 2

The second phase of this project was to conduct key informant interviews to assist

in the development of a questionnaire that was distributed in the third phase. The

participants of the key informant interviews were selected based on their knowledge of

safety and health training issues, the NIOSH ERC program, training methodology, and

transfer of training to the workplace. A total of 14 key informant interviews were

conducted. The key informants included Continuing Education Program Directors at other NIOSH ERCs. These individuals have many years of experience in developing and evaluating CE courses in OSH. Another key informant was the Director of NIOSH. He was able to provide a strategic thinking approach the evaluating the ERCs. Additional key informants are Directors of other National programs that provide education and training to the occupational health and safety workforce. The researcher wanted to get the perspectives of individuals who have direct experience and involvement in the ERC and those who do not have direct involvement of the ERCs.

Each interview was conducted over the telephone, with the interview recorded. The interviews each lasted approximately 30 minutes. During each interview, notes were taken to highlight key areas of interest. Additionally, the recordings were replayed to identify themes that had emerged from each interview, and across all interviews. The data collected from the interviews served to form the basis of the questionnaire distributed in Phase 3.

The key informant interview protocol was developed by the researcher utilizing information learned through discussion with the Committee and from the literature review. A set of questions was developed and used a guide to the interview. However, the interview process allowed for discussion to flow and explore issues that were raised by the interviewee. The questions are included in Appendix 1.

The methodology utilized for the key informant interview process included several steps. The first step was to gather and review existing general information on CE programs, and specific information on OSH CE programs. Additional information was gathered on training transfer from classroom to the workplace. This was conducted

through the literature review and discussion with the Committee. The next step was to identify what was being discussed from those that would be interviewed. A series of questions was developed that was used as a guide for the interviews. The selection of key informants to be included in the process was discussed with the Committee. It was determined that a combination of those employed by ERCs and others external to ERCs should be interviewed. Each interview was conducted via the telephone, as interviewees were from across the United States. The interviews were approximately 30 minutes in duration. Interviews were digitally recorded and notes were taken during the interview. A synopsis of each interview was written that included the key themes and issues raised by each interviewee. A review of all interviews identified recurring themes and issues. These themes were utilized to inform the development of the questionnaire that was used in Phase 3 of the research.

PHASE 3

The third phase of this research is comprised of two sets of questionnaires. The first set of the questionnaires is a three-part survey of students who participate in OSH courses at the UMDNJ-School of Public Health. The three parts of the questionnaires will measure pre-training readiness (completed before the course starts); identify any changes they intend to make due to the training received (included as part of the program evaluation at conclusion of course); and follow-up with the trainees 3 months post training to identify if any of the intended changes were implemented.

Course participants completed the pre-training readiness at the beginning of the training courses offered by the UMDNJ-School of Public Health. The second part of the

evaluation, the identification of intended changes to be made due to the training, was

completed at the conclusion of the training course, as part of the post-course evaluation

form. A total of six courses were selected to complete these surveys, with a total of 60

participants completing the assessment. The third part, the follow-up assessment was

conducted utilizing Zoomerang.com, a web-based survey instrument. A survey was sent

to each of the participant's email address three months after they completed the training

course. Each of the individual responses was incorporated into the web-base survey,

providing the change(s) that the each individual provided in the post-course survey. The

survey was sent three months after the participant completed the training program. Two

reminder emails were sent. The first reminder was sent one week after the initial survey

was sent; the second reminder was sent one week after the first reminder was sent.

The second questionnaire developed is based on the data collected in the key

informant interviews and the literature review. The survey questions were developed in

concert with experts in research methodology (the Committee) and piloted on five

individuals. The questionnaire was then administered to 1309 professionals who attended

courses at ERCs across the United States. The course participants who received the

questionnaire had attended a course between three and six months before the survey was

administered.

The participants who received the questionnaire were selected based on their

participation in a training course provided by one of the 17 ERCs. The researcher

requested email addresses from each ERC CE director for participants in courses three to

six months prior to the implementation of the survey, which corresponds to January 10 to

April 10, 2011. Of the 17 ERCs, seven provided email addresses to be included in the

survey. The survey was sent to a total of 1568 email addresses on July 10, 2011.

The questionnaire was implemented using Zoomerang, an online survey

instrument. Conducting the through an online system has several advantages.

Zoomerang allows surveys to be sent to large numbers of individuals, with features that

include the ability to email participants who have not completed the survey. This feature

allowed for follow-up announcements to be sent only to those who have not completed

the questionnaire. The online implementation of the survey allows for skip logic. Skip

logic provides the ability for the survey to be dynamic in the sense that only relevant

questions are asked, based on the previous response. If a question response is 'no', then a

follow-up question related to a 'yes' answer is skipped. The survey instrument is

included in Appendix 2.

At the same time the on-line survey was administered, participants from courses

presented by the NY/NJ ERC were selected to complete a three-part evaluation. During

the first part of the evaluation, participants completed a pre-training survey to identify

motivation for attending the training course and gather information on the systems in

place and safety culture at the workplace. The second part was implemented at the

conclusion of the training course, at the time when they complete the course evaluation.

The survey included several questions that identified any changes to safety behavior that

course participants intended to make due the material presented in class. The third part

was a follow-up evaluation that identified if any of the behaviors they intended to make

were actually been implemented at their worksite. This occurred three months after

participants completed the training program. A total of 20 people completed the three parts of this process.

STATISTICAL ANALYSIS

The key informant interviews were utilized to answer the research question "How have the ERCs met the policy mission of providing education and training in OSH, increasing the number of trained professionals in occupational medicine, occupational health nursing, industrial hygiene, and occupational safety." Several questions were directed towards the importance and utility of the ERCs in training workers for careers in OSH. The questions focused on both the graduate education and continuing education courses provided by ERCs. The key informant interviews were analyzed for content and themes. The interviews were recorded, and copious notes were taken during the interview. The recordings were reviewed several times to identify the key themes from each interview. After each interview, additional notes were written to further expand the notes taken during the interview process, and provide the researchers thoughts on that particular interview. Each interview was reviewed several times to expand the notes, identify themes, and extract statements that provided information to answer the question listed above, and to provide the basis for the development of the survey that will be distributed to ERC CE course attendees.

Survey analysis yielded descriptive statistics about the study participants, including their age, work region, and number of years experience in OSH, number of years employed in current job, number of safety and health courses attended in the previous 12 months, and their work discipline. Many questions were based on a seven

point Likert scale, ranging from strongly agree to strongly disagree. Likert scale data are ordinal data. These responses will be analyzed using modes and a distribution of the responses. The level of agreement to the statements provides an understanding of how training provided by the ERCs effect the practice of OSH in the United States. Additionally, the open-ended survey questions were analyzed for content and themes that will help inform how the ERCs have impacted workplace practice.

The results of the three-part survey were analyzed to determine if individuals have implemented the safety and health measures they intended to when they completed their training course. An individualized survey was developed, based on the responses received at the conclusion of the training, and sent so that the researcher could identify if changes were made in the workplace. If changes were not made, questions asked if the participant could identify why the changes were not implemented.

Chapter 4: Results

PHASE 1

The research identified that workplace fatality rates have declined from 1992 to 2007. There were 6,217 workplace fatalities in 1992, a rate of 5.2 per 100,000 workers compared to 5,657 workplace fatalities in 2007, a rate of 3.8 per 100,000 workers. At the same time, the number of professionals trained by the ERCs has increased from 23,194 in 1992 to 41,326 in 2007. These data are displayed in Figure 2. It is not implied that training provided by the ERCs causes a reduction in workplace fatalities, however, training may be a part of the reason why the rates have declined.

Figure 2: Occupational fatalities vs. number trained by ERCs, 1992 to 2007
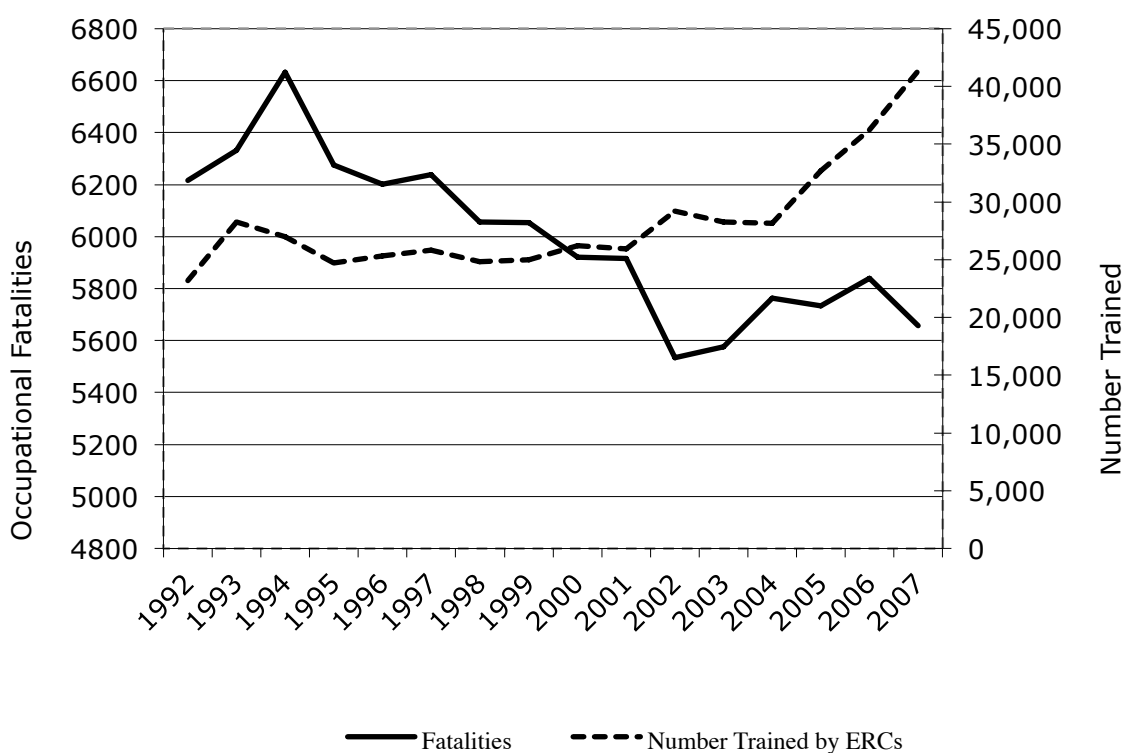
PHASE 2

KEY INFORMANT INTERVIEWS

Interviews were conducted with 14 safety and health professionals from across

the United States. The individuals were selected based on their experience in safety and

health, and specifically, their expertise in delivering safety and health training. It was

intended to include safety and health professionals from within the ERC programs and

from other training providers. ERC professionals constituted about half of the interviews

conducted. An alphabetical list of those interviewed is included in Appendix 3.

Interview 1 (I1): This interview was with a Continuing Education Director at an

ERC.

The key findings from this interview were that ERC programs provide quality training

programs that have an impact on the work practices of safety and health professionals.

Training reduces injuries and illness. Students have told her that they will take

information learned in her courses and say they will implement the information. As an

example she stated that the Hearing Conservation courses provide students with

knowledge that they should be protecting workers by conducting audiograms and

providing personal protective equipment. As part of her training courses, she conducts

post-course evaluations. The assessment was conducted by mail about one year after the

student participated in the training. The questions wanted to identify if the training

course had a financial impact on the organization receiving the training, or if there was a

reduction in loss time due to injuries after the training. These assessments were not

successful, as the response rate was minimal. She also conducted an email assessment,

focusing on individual behavior, which had a more successful response rate. The evaluation asked if there is anything that you learned in the course that will change your workplace practice. She has received both positive and negative responses. A limitation of the evaluation is that it only gets to the intent to change behavior, not whether a behavior change has occurred. She does not go back to the work site to actually see if the behaviors have been implemented. She stated it may be more effective to capture impact from a contract course, a course in which all the attendees were from one organization. When many people from the same organization attend a course, it may be easier to look at the impact of organization changes that relate to the training received.

The motivation that employers have to send employees to CE programs includes ensuring that their workforce is compliant with relevant regulations and having a qualified or certified workforce. Employers are required to provide a safe and healthful worksite, and training will help meet that requirement. Specific regulations require that workers be trained in the hazards they will face. Some employers will send workers to the training just to meet the requirements, and others will try to expand the capacity of their workforce. The employers who expand capacity will send their workers to training to increase their abilities or gain a certification that will benefit both the individual and the employer. For example, an employer may send a worker to a review course to help pass the American Board of Industrial Hygiene certification exam. These workers would then be able to provide additional training to other workers, and better serve the needs of the employer.

Each trainee may have different motivations to attend training courses. Some are attending the courses because their employer has sent them to meet a requirement.

Others may attend because they are motivated to increase their knowledge and skills, so they can take additional workplace responsibilities. CE points may also be a motivating factor for individuals to attend a training course. Courses with CE points are perceived to be more professional than courses without CE points, and courses provided through a university is more highly regarded than if it were to be offered through a for profit organization.

The ability for trainees to transfer the training form the course to the worksite is limited. She questioned how much change an individual can make within an organization, and may be better to look at courses with many people from on company. One way that she tried to make courses more relevant to attendees and hopefully increase the ability to impact workplace practice was to conduct a pre course and post course assessment. The pre course assessment would identify the training needs for each particular training course, and the post course assessment would identify if those needs were met in the training. However, this became an onerous process and has been dropped from the tasks she conducts.

Interview 2 (I2): This interview was with a Continuing Education Director at an ERC.

The key findings from this interview are that ERCs provide knowledge and skills that can be effective in making a positive change in workplace behavior. To determine if the courses are effective, ERCs would need to see if skills learned are applied. Additionally, the skills that are taught provide a mechanism to reduce injuries and illnesses. An example provided is the training provided in physical assessment for occupational health nurses, industrial hygiene, and ergonomics. In the ergonomics

courses, students are taught proper lifting techniques and other mechanisms to move heavy objects. These skills are important because they have changed the way work is conducted in automobile manufacturing facilities. If you look at the changes in the automobile manufacturing facilities between the 1970s and now, significant changes have been made, and those are the effects of the training provided by ERCs and others.

ERCs have been effective at providing training to meet workplace needs, and provide education to assist in the development of the OSH workforce. The current market conditions are changing, and he is not sure how the OSH field will respond. Some ERC programs, both academic and CE, are struggling to attract people to the training. The current need for OSH professionals is not the same as it was when the grant program started in the 1970s. The Bureau of Labor Statistics projects a need of over 6000 OSH professionals by the year 2016. However, even with the aging workforce, he does not think that those positions will be filled post retirement because of the current market conditions. Historically, the ERCs have been effective in providing training to fill the voids in workplace needs.

It is difficult to determine effectiveness of training programs. One way would be to identify if a person who participated in a training program left with skills they did not have prior to the course, and they implemented those skills in the workplace. This type of evaluation is not conducted by his organization. They do conduct a periodic survey to identify if the training has been implemented. However, it is self-reported data, and response rate is low.

The provision of CE credits does influence attendance of training courses. An example is that Certified Industrial Hygienists need to maintain their certification, and are

required to have a certain number of credits each year. Courses that provide CE credits are perceived to be more professional that those that do not, however, he feels it is a perception and not necessarily reality. Additionally, he feels that course offered at a University can bring credibility to the program.

Several factors are important to increase the likelihood of trainees effectively transferring the training to the workplace. Interactions with the instructor are important. The interaction can be through hands-on training or discussion. Training that provides hands-on activities allows trainees to actually develop a new skill in class that may be applicable to their workplace. If it is, then they now can implement the new skill in their workplace practice. Discussion is another method that will allow transfer of training to the workplace. If a workplace problem is discussed, the trainee may receive valuable feedback on how to deal with the problem when returning to the job site.

Interview 3 (I3): This interview was with a Deputy Director of an ERC, who also serves as the Director of Continuing Education, Outreach and Diversity at her ERC.

The key findings from this interview were that ERCs are meeting their policy mission of increasing the number of OSH professionals. The ERCs are interdisciplinary in nature, meaning they provide training in various disciplines of OSH, and include cross training between and within those disciplines. The ERCs are successful in meeting their mission of providing graduate and CE in the four core areas of OSH, as well as providing education in non-core areas such as occupational injury research prevention and agricultural safety. One area in which this ERC has identified for improvement is that many safety engineering students do not return to the ERC for CE. In her region the safety engineers primarily attend professional conferences to attain their professional

education instead of attending the CE courses at the ERC. Industrial hygienists and nurses do return to the ERC to complete CE courses. Another area for improvement is attracting occupational physicians to Occupational Medicine residency programs. She sees that physicians in practice who oversee occupational health programs are not board certified in occupational medicine, and lack of understanding the occupational health issues for workers. These physicians also are not attending the CE courses.

To determine if training is effectively transferred to the workplace, the ERC conducts a post course survey 90 days after the training to determine if the training has had an impact on their workplace practice. The survey is conducted for all trainees and is conducted electronically. If the response rate was low, they conduct follow-up phone calls. Training is effective in changing workplace behavior. The impact surveys have shown that trainees are changing their workplace practice. A few skills that she has found that have improved due to training are industrial hygiene students are better able to calibrate equipment and are keeping better records. It is hard to determine if the training is reducing injury and illnesses, because it is hard to measure why an injury did not happen. The worksites are safer than they used to be, as indicated by reductions in injury rates across the US. But she feels that training does reduce injury and illnesses.

Students are motivated to attend CE courses to maintain their professional licensing. Several disciplines require maintenance of licensing through attendance at CE courses. The courses she provides have CE credits, and she feels this is an important reason that professionals enroll in courses. She reported that IH and nursing students are most influenced by the CE points. She also feels that professionals want to expand their knowledge and skills base by attending CE courses. They will attend courses on

emerging topics to gain knowledge in a particular area. An example is occupational health nurses performing audiometric or spirometric tests are required to attend training in those areas. These courses provide both knowledge and skills for them to effectively perform the testing on workers.

Training courses that offer CE points are perceived as being more professional than those without CE points. Courses offered through a university are also perceived as more professional. The training methodology used has an impact on learning. Courses that provide skills and have hands-on training should be a smaller class size. Large conferences with dynamic speakers can also be effective training. It depends on the topics and what the objectives of the program.

Several training methods were mentioned when she was asked about methodologies that improve transfer of training to the workplace. Hands-on training is effective since participants can learn and perform a skill in the course, and be able to bring that skill back to their workplace. Additionally, small group discussion is useful, as participants can learn how to solve problems, and be able to transfer the problem solving skills to their workplace.

Interview 4 (I4): This interview was with the Director of NIOSH.

This interview focused on issues of safety and health training and policy issues related to OSH training and education. Effective training is two pronged. The first prong provides the education of individuals to know basic information in the field, and know how to find information once they complete training. It is impossible to teach everyone all the information they need, but that they have the ability to find more specific information. The second prong is to provide information on gainful employment once

they have completed the training program. The ERCs do provide this two-pronged approach and are an effective model for OSH workforce development. They include graduate education in specific disciplines, and provide CE for practicing professionals. The planning for OSH training conducted by ERCs is good, however, implementation suffers because of a lack of resources. An area for growth is how future needs are assessed. For example, an area to look at is how OSH specialists can expand their practice areas, and where is the OSH practice going in 10-20 years. The scope of practice should increase for the occupational health and safety specialist to areas include areas not normally included in their scope of practice, such as infectious disease and influenza. Currently, most OSH professionals would defer their involvement in these areas to the medical professionals. However, with the increasing use of respiratory and personal protective equipment, OSH professionals can provide input into the decision making process in these areas. These types of analyses should be conducted to identify where the field of OSH is going in the next 10-20 years. As we saw with response to the World Trade Center collapse, fire fighters utilized existing skills in a new context. However, the basic principles were the same as previously experienced.

The major strength of the ERCs is the power of their intellectual property. The ERC personnel are highly educated, well published, and leaders in the OSH field. The other strength is that they generate knowledge for the OSH system. The ERCs would gain from collaborating more with the corporate world. Some firms have larger footprints in OSH, and could potentially help add additional resources to the scarce ones provided by NIOSH. Other areas of improvement include the development of a national marketing plan for OSH and the ERCs.

ERCs should be evaluating their programs by conducting 360-degree evaluations. This type of evaluation would get data from past program participants, as well as the ERC program staff. The questions to ask would include the relevance of the training to their career and the quality of the training. The evaluation would also gauge how successful the program graduates are and what types of careers they have selected. The evaluation should seek to identify gaps in the training. Answering the question "Is training effective in changing work place behavior?" was difficult. There is a tension between attribution errors that cause injury and illness. Should the blame be put on the worker or the system, and many times the attribution error gets in the way of true assessment of causes of injury and illness. However, training increases an individual's fundamental knowledge of how they can prevent steps of a particular adverse effect form being triggered. If a set of conditions are totally in control of the individual, as opposed to interacting with a complex set of machinery, then changing behavior could be most effective.

I4 suggested that questions look at how and what type of training was able to make a difference in their workplace practice. He suggested asking "What is the one thing that you learned that made a difference in the jobs you have in the field after you left the program?" Training provides enriching experiences that increase an individuals' general fund of knowledge, but whether or not it made a difference in your job is a different thing.

Interview 5 (I5): This interview was with a Continuing Education Director at an ERC.

The key findings from this interview were that ERCs are doing a solid job in meeting the core mission of training OSH professionals in the core disciplines of industrial hygiene, safety and occupational health nursing, but were challenged in occupational medicine. Some of the strengths of the ERCs are their interdisciplinary education, experience and longevity of faculty, and that they are a valuable resource to the OSH field. Areas of improvement included the need to analyze the nature of professions targeted for the ERC training, improving funding levels so that ERCs can conduct better impact assessments, and changing the nature of the training to include new areas of expertise, such as globalization of OSH programs.

Motivation for sending workers varies with the program. Compliance is a big part of it. There are a segment of employers who want to keep current with safety and health issues in their sector. They view the universities and ERCs as a reputable and strong place to send their folks for that type of training. If corporations want there employees to remain certified in particular fields, employers must provide an opportunity for their employees to attend CE courses. Individuals benefit by increasing their knowledge and retaining their certification. They have a chance to interact workers from other firms and industries, which provides a good exchange of networking and actually how different workplaces do certain parts of health and safety programs.

The ability of the training to change workplace behavior varies considerably depending on the nature of the course. Open enrollment courses tend to provide skills that workers can use almost immediately. This ERC received feedback from their students that the firm wants to know what the worker will get out of the course.

However, the benefit at the workplace will be greater when there are more people from one workplace in a course.

The ERC Director suggested several types of questions to ask. These include identifying the mixture of technical training, delivery methods, and limitations of the training. Workers should be asked to identify the biggest challenge to improve safety and health in their work environment, and what types of training would help to achieve a safer work place.

Interview 6 (I6): This interview was with an Assistant Continuing Education Director at an ERC.

The key findings from this interview is that employers are motivated to send workers to training so they meet safety and health requirements and that their employees gain knowledge and skills to provide specific practices for their workplace. For example, firms provide bloodborne pathogen training to ensure compliance with a specific training requirement in that area. Other firms are on the cutting edge, and are interested in providing new information to their employees, which can give them an edge in the marketplace, while others are interested in exceeding the minimum governmental requirements to help ensure a safe workplace. Additionally, some firms want to invest in their employees, and provide training opportunities so they can become certified in a particular discipline such as becoming a certified occupational health nurse.

The ERCs are effective in providing training for professionals to progress in their field. An example is certification review training conducted for occupational health nurses, which provides knowledge to enable nurses to become a certified occupational health nurse. This type of training helps increase the competency of specific disciplines

within OSH professional practice. Other key strengths included the interdisciplinary nature of the ERCs, providing research and training in the various sectors of OSH. The ERCs allow students to participate in research and practice, and encourage working with other OSH disciplines. ERCs provide funding for students to learn specific disciplines of OSH. Continuing this funding is important for the growth of the field. ERCs are good at identifying the market for both the academic and CE programs. The advisory committee of this ERC is helpful in identifying strengths of the training, and identifying gaps in the curriculum. They have helped to identify interdisciplinary components and opportunities for the ERC. The location of this ERC provides the opportunity to partner with many national training providers. Their model includes collaboration with these national providers, so they can work with them to enhance and support their programs.

The ERC conducts impact surveys that seek to identify what the most important aspect of the training provided. It utilizes an approach that addresses the "head, heart, and hands", meaning that the most important knowledge, attitudes, and skills learned in the training courses are identified, and how the training will impact participant workplace practice. This is a self-report of what participants think they will gain from the training. Other impact assessments include a follow-up survey conducted several months after the training to how the course materials were used and what topics from the training were most important. The purpose is to determine the most important content provided in the training course, and improve the quality of the training provided.

Linking training to improved outcomes at the workplace is important, and the effectiveness of succeeding is dependent on course design or method and on the audience expectations coming into the training program. Small group activity method or other

empowerment training, where participants have more discussion and bring their own experiences into the training can be more effective than lecture in transferring the information learned in the course to the workplace. Training that engages the participants are more effective for participants to transfer the training to their workplace. The expectations of the participants are important in the transfer of training to the workplace. For example, a violence prevention curriculum utilized the small group activity method, in which the discussions were facilitated and lead by the participants. However, some participants provided post-course feedback that they would have preferred or expected gaining more technical content from experts in the field. Other participants felt that the discussion was dominated by several of the small groups. Another training program, a leadership training for nurses, utilized lecture to effectively address pandemic flu, H1N1, and preparedness, and was able to present a large amount of information in a short period of time. This type of training met the needs and expectations of the medical and nursing staff that typically expect to receive training in the lecture format. Some topics may be more effective utilizing interactive methods, while others are more suited to traditional lecture style. For example, the violence prevention training was very emotional, and the small group activity method allowed participants to express their emotions, while the H1N1 training was more clinical and utilizing the lecture format was appropriate to transmit the knowledge needed to understand the issues presented.

Individuals are influenced to attend training that has CE points assigned to the course. CE points influence attendance at training course, and the evaluations from the violence prevention program provided by this ERC stated that CE points was the reason they attended the program. Additionally, this ERC finds that they can collaborate with

others by being the partner that provides CE points for the training programs. Courses that have CE points are perceived as a higher quality because of the level of review needed to attain CE points for the training. It is also an assumption that a university sponsored course is higher quality. However, it is not necessarily accurate, but the university "brand" may influence participation in a training course.

This interviewee stated it is important to ask questions related to both the short-term impact of the training on workplace practice, as well as the long-term impact that the training would have on their career trajectory. Also, given the rapid changes in technology and media, what do students need to know about online resources, how to assess or evaluate online sources, and what is the best way to interact with technology.

Interview 7 (I7): This interview was with a Continuing Education Director at an ERC.

The key findings from this interview were that the ERC model of education is effective, training provided by the ERCs is effective, and that impact of training is difficult to determine. The ERC model includes graduate and CE provides the opportunity to implant the need for employee safety at several stages of a career. The first stage can be when the student enters into their graduate program. The graduate program provides the opportunity to engage in OSH research and learn effective workplace safety and health skills. The second stage is directed towards OSH professionals. The CE programs provide short courses on specific topics that provide knowledge and skills to effect workplace safety and health culture shifts.

A strength of the ERCs is the network developed within the ERCs. The ERCs provide assistance to each other so that the lessons learned from one ERC is shared with

others. An example of one benefit is the sharing of resources, including curriculum, instructors, marketing ideas, and needs assessment data. The ERC program is a good model to provide education and training to meet the workforce needs of the OSH community. There is a lot of change in safety and health, and the ability to provide both graduate and CE courses increase the chance of inculcating safety and health culture at many different points of time in a career. The CE programs provide an opportunity to provide updates on particular issues, including technology.

Regulation is the primary motivation for industry to send employees to CE courses. Firms need to comply with federal regulations. Training that meets the requirements of the regulations are the ones that are attended most often. This CE Director noted that in the 1990s certification review courses were in demand. She stated that the economy caused downsizing of employees, and organizations wanted to provide training to help their employees find additional types of employment. This seems to be a regional issues, as other interviewees in other parts of the country did not mention that.

Training can be effective in changing workforce behavior if effective training techniques are utilized. These include clearly stated competencies; varying the training formats and media; using credible instructors; using positive reinforcement and feedback; using a variety of examples; planning for student interaction; and engaging trainees in the learning process. At the conclusion of a training program, providers can only influence the trainees' intention to make changes in the workplace. The ability to carry out the changes in the workplace is effected by the culture at that workplace. However, if trainees do change their workplace behavior, then it is suggested that injury and illness rates should be reduced. Although reductions in injury and illness rates cannot be only

attributed to training. The ability to change the workplace culture is important to ensure that workers are able to implement new skills and knowledge learned in training courses.

Several factors effect attendance at and influence learning in CE courses. CE points influence attendance, and adds credibility for the course. University courses are perceived as more professional than others, however, courses offered by a chapter of a professional organization may be more attractive to potential students than through the ERC. This ERC collaborates with many professional organizations to ensure training needs are met in their region. Class size effects learning. Having too many people in the class does not provide the needed attention to each of the learners in the course. The type of course offered also is dependent on class size. For example, courses with hands-on exercises need to be smaller in size, while courses providing just knowledge can be much larger in size.

To measure the impact ERCs are having on the workforce, it was suggested that they identify the types of jobs in which graduates gain employment, as well as the number who become certified in a particular field of OSH (i.e., Certified Industrial Hygienist, Certified Occupational Health Nurse). ERCs should monitor the impact graduates have on others in the field of OSH. Graduates impact the OSH field by becoming trainers who provide knowledge and skills to others. This director feels that the impact of graduate programs in the ERCs is very rich, as graduates have become leaders in the OSH field in industry and government.

This ERC has conducted two studies on long-term retention and behavior change. Both have shown positive effects due to training. Although CE Directors are not required to conduct research, the funding agency is looking to identify outcomes and impact on

industry workplace improvements. Several types of questions were suggested for inclusion in the survey for CE students. These include questions that ask if they believe the training will help them be safer at the workplace; they will be able to transfer the knowledge and skills learned to their workplace; and barriers to implementing changes.

Interview 8 (I8): This interview was conducted with a Director of a national safety and health curriculum clearinghouse.

I8 was not very familiar with the ERC programs, but has extensive experience with developing and implementing safety and health training. The results of this interview focus on OSH training in general, and not on the training provided by ERCs.

The key benefits of training courses are the ability to gain basic safety and health knowledge, and an understanding of how to apply the knowledge in their own workplace. The benefit of training for employers is that, one, it meets regulations and two, employees have increased knowledge so they can share safety and health information with others in the workplace to help increase safety. With the knowledge and skills obtained in training, workers can identify and respond to safety and health hazards before they cause injuries or illness. A company may provide training to employees just to meet specific training requirements. However, the employer may also benefit from having a trained employee who understands how to recognize hazards so they can prevent a workplace injury or illness. Unions send members to training so they have members who can protect themselves and can provide that safety information to others in the workplace. Trained union members are more marketable to employers because they have already received required training courses. Training enables workers to do the job safely, and

makes the workplace safer. Training also increases job opportunities because the workers are "ready for work".

Training can be effective in changing workplace behavior. That is the end goal of training. To the extent that training is applied and uses small group activities, trainees are able to go back to their workplace with the understanding of what needs to happen to make the workplace safer. The lack of supervisory support is a key barrier to implementing knowledge and skills in the workplace, and it is difficult to make changes in the workplace without supervisory support. To effect real change, there must be a management structure in place that is willing to work with their employees.

Different training approaches are used to help in the transfer of knowledge and skills from training to the workplace. Lecture formats can be effective for teaching facts. However, the opportunity for the instructor to engage students in discussion, either in small groups or as a whole, will help trainees apply information. Trainees that have the opportunity to apply information may be better prepared to transfer the information learned in class to their workplace. For example, engaging students in discussions that draw upon student experiences allows trainees to think about situations they have faced the knowledge or skills learned is an appropriate method of training.

Transfer of training from the classroom to the workplace is a challenge. Some workers want to make a positive impact, but are restricted by their supervisor. The culture of safety at the workplace has a large influence on how effective workers can be in transferring the knowledge and skills learned in training to the workplace. If safety and health committees are in place, workers have an opportunity and mechanism to address safety and health hazards. In many workplaces, management is willing to listen

to workers, and in others, the voice of the worker is not heard. However, the training provided to the worker still provides the knowledge to be informed of and the skills to address health and safety hazards.

Evaluation of training effectiveness can be measured utilizing several methodologies. A pre/post test can be used to measure if training has been effective, specifically useful to test knowledge gain. Trainees can also be asked how they will apply the training in their workplace. To identify how changes have been made in the workplace is difficult to do, but by conducting a three- or six-month follow-up interview or survey will provide specific examples of how training impacted workplace practice. The survey can query whether trainees have implemented knowledge and skills to identify changes that have been made based on the information trainees learned in the training course and if the trainees have shared information with co-workers. These types of questions will provide an understanding of how training has directly impacted workplace practice. Knowledge questions can also be integrated to see how well they have retained information as well as how they have used the information. If there were specific issues raised in the classroom, questions can be asked to understand if the trainees have resolved those workplace issues. Open-ended questions are a good way to get the information from the trainees.

The influence on attendance of courses that have CE points depends on the target audience. Target audiences that need to maintain a certification would benefit from courses that have CE points. Other disciplines would not need CE points, and having CE points would not influence their decision to attend a particular training course. Courses that have CE points or are offered by universities are perceived as more professional than

those provided by private industry. Class size effects learning, with smaller classes being more effective than larger ones. However, larger classes can use small groups to increase the effectiveness of training. Engaging trainees in the training program is very effective in helping transfer of training to the workplace. The opportunity to share issues with other professionals is an important aspect of training.

Interview 9 (I9): This interview was conducted with a Director of Safety and Health of an international union.

The key issues identified in this interview are the benefits of safety and health training for employers and employees and how to identify the impact or effectiveness of training. The two primary benefits that employers receive from sending their employees to training are, first, that the OSHA, EPA or other private contractual requirements are met and second, employees are knowledgeable about the health and safety issues. I9 has seen a difference in attitude starting in the late 1990s, employers want to increase the knowledge of their workforce, and they want "do the right thing" by providing safety and health training to their employees. Previously, I9 stated, employers would send workers for training and they would think, "simplistically, that problems will be solved". However, trainees would learn how complex certain issues were, and through training, would understand that solutions to safety and health problems require complex thought. There is a lot of naiveté about safety and health issues in the workplace. Safety and health is more complex than just complying with OSHA regulations. It involves, in some instances, a change in culture at a workplace, not just doing a few things so that employees don't hurt themselves.

A benefit to employees is also that the training is required for them to work in a particular field, such as asbestos, lead or hazardous waste. The training provides them with the skills to be competent in their jobs. Some workers need credentials (i.e., Certified Industrial Hygienist) to gain employment, and training can provide workers with the knowledge and skills to attain those credentials. Employees want to learn because it is important to protect themselves from dangerous situations and they want information that helps them do their jobs better.

I9 is familiar with the ERCs, and has previously worked at in ERC over 20 years ago. He stated that ERCs do a good job in meeting the needs for OSH training.

A discussion of the ways to identify impact and effectiveness of training included evaluating if policy changes occurred in the workplace purchases of new equipment, did employees raise safety and health issues with supervisors, and applying skills learned in the training. These issues are important indicators of transfer of knowledge form the classroom to the workplace.

Interview 10 (I10): This interview was conducted with a Director of a governmental, national worker-training program.

The key findings from this interview were that training programs engage employers in the discourse on safety and health issues, and enable employers to see the value added of a trained workforce. A challenge for ERCs and other training programs is to ensure that employers understand the value-added that training provides. The information that trainees receive can benefit an employer, but sometimes the employers do not see that benefit. A benefit includes compliance with OSHA or other regulations. However, there is the issue that an employer has to ensure that the work is completed,

and when an employee attends training, there is a period of time of lost productivity. Programs such as the NIOSH ERCs and the NIEHS Worker Education and Training Programs provide funding so that training organizations can create a business model to effectively sustain a training initiative that meets needs of employers.

Training provides a mechanism for individuals to have an avenue to be involved in decisions regarding safety and health. Training allows employers and employees to focus on prevention of safety and health, to promote safety as a means to prevent injuries and illnesses. Building a relationship between the training provider and the employer facilitates transfer of training from the classroom to the workplace. Training provides attendees with models for good behavior that could be implemented in the workplace. Minimum criteria documents can provide a framework for good behavior that can promote due diligence in OSH, and can be more effective than regulations. Those criteria can be reinforced through training and at the workplace through a labor agreement and joint safety and health program, or other way supported at the workplace. The methodology utilized in training does have an effect on transfer of training to the workplace. Ensuring that multiple people at a workplace help increase the transfer of training. Again, the connection between the training provider and the employer is a key component to increase transfer from the training program to workplace practice. Inclusion of the context of training is important when evaluating how we measure the effectiveness of training. The "stickiness or tightness of the relationship" between the training provider and the employer is an important element to evaluate. Additionally, the effectiveness of what is learned in training and how well a trainee can implement that at the job site is also important to evaluate. This interview identified the need to evaluate

relationships between training provider and the employer, not just between the training provider and the student, and then the student with their employer. The types of training that workers attend, and the need for training are determined by a direct line supervisor. That supervisor may not be a health and safety professional. That person is a gatekeeper for training, and the decision is not based on health and safety, but on if the supervisor feels there is value in sending an employee to training.

ERCs are one resource to help fill projected gap in OSH professionals, but they are limited as funding for OSH is not a national priority. The biggest opportunity is buried within the healthcare reform bill. In terms of public health workforce, OSH professionals need to find a way to attach ourselves to that funding stream. Prevention education is one way of changing the health care system, and building up the public health infrastructure is a means to attaining that end. The priority is not going to be with prevention education, and OSH training will still be at the bottom of the line for funding through the reform efforts. OSH training is not a national priority. Unfortunately we have to be masters of taking advantage of disasters in order to make a point, with ground zero (the 9/11 World Trade Center disaster) being a key illustration. It is only at times of disaster that the public pays attention to the disaster that you can make the education and prevention points that are underlying everyday life.

Interview 11 (I11): This interview was conducted with an industrial hygienist at a Committee on Occupational Safety and Health group.

Key issues identified from this interview were that ERCs serve an essential role in providing health and safety training for a range of OSH professionals, training is needed

to empower workers, and training can assist in changing the culture of safety at all levels of employees.

Employers are motivated to send employees to training for many reasons. Among employers with the best intentions, there is recognition that training is an essential part of an OSH program at the workplace. In less ideal circumstances, there are legal requirements for training such as the OSHA 10-hour Construction or General Industry Safety courses. Additionally, some employers will send employees to training so they reduce their liability should an accident occur. A benefit to the employers by providing training is that they will an educated workforce, who should be able to make appropriate health and safety decisions and help ensure the safety of the work force.

Effective training is relevant to the participant's experiences, conducted in a participatory fashion, it respects the learner's knowledge experience and concerns, it equips them with knowledge or resources that can be put into play when they return to their workplace, and that it is in a language or literacy level that makes it accessible to them. Training that is participatory is the most effective training. It can include a range of training techniques that are mixed and matched, including hands-on, small-group activities, large-group activities, lecture, videos, role playing, developing safety skits, and site visits. Training has to empower workers. If training is simply a means to transfer rules or knowledge without the ability for the trainee to become a partner in health and safety at the workplace, then the impact of the training in the workplace will be limited.

The impact on workplace change is largely dependent on the commitment of the employer or the union. If when the employee returns to the workplace there is not a commitment from the employer, there will be limited impact the training can have on

workplace practice. Training impact cannot be looked at independently of the role an employer has in implementing knowledge or skills learned by individuals in a training course. An example of this is with one of the training programs provided by this person. Because management at the facility disagrees with the relevance and applicability of some of the regulations to their work force, the impact of the training can only be limited. If the employer is not committed to making changes, the training received by the worker is limited in effecting change. The ability to have workplace safety and health policies changed due to what an employee learned in a training course would be an effective outcome of training.

Questions that were suggested to be included in the survey of trainees way to assess changes in workplace safety culture, whether the implementation of the hierarchy of controls has changed, or if workers feel more valued or empowered due to training. It is felt that many of these types of questions will lead to an answer of "no change" in the workplace. Therefore it is important to include questions about the barriers to implementation of training topics. A real deficiency to validating health and safety training is that the OSH field has not done a good job of identifying how training impacts workplace practice. This interviewee has no doubt that training is important, but without the data, the value of training will be based on anecdotal information.

CE points are not the most important reason for attending training courses. The objectives of the training and the material presented in the course are the most important reasons to attend training. Additionally, class size does effect the learning that can occur in a course. Classes that are too small or too large limit the discussion and interaction

that can occur. Classes that can utilize small group activities, hands-on, and other interactive methods are the most effective types of training.

Interview 12 (I12): This interview was conducted with a labor liaison from OSHA.

The key motivations for training identified were compliance with workplace standards and enhancing worker skills so that employees can work safer on the job. The primary motivation for employers to send workers to training programs is to comply with workplace standards. Some employers are motivated to send employees to training so OSHA does not cite them for safety and health violations. Secondary motivation is to enhance worker skills so they are safer on the job. There are employers that want to ensure that their employees are properly trained. These employers want their workers to understand how to utilize personal protective and other equipment so that they can be safe at the workplace. Employers benefit from having a trained workforce that knowing that your workforce will not take risks and will perform the job safely. Employers also know that if an OSHA inspector visits the job site, the workers will be able to demonstrate competence in particular safety and health areas. An added benefit of training for an employer is that they it creates an environment where working safely is the standard, so that when employees are hired they are trained appropriately and that all employees will adhere to safety and heath requirements.

Training provides benefits to workers because it can increase their knowledge and skills so that they will not take unnecessary risks at work. Training also creates an expectation that workers must adhere to safety and health standards.

Some of the barriers that workers face when trying to incorporate the knowledge and skills learned in training include pressure to get the job done quickly. Specifically in construction, job supervisors have a culture of getting the job done on time and under budget. This attitude may lead to cutting corners, and not adhering to the safety and health standards. Peer pressure can be an enormous positive or negative factor in the workplace. Some times workers describe the use of safety equipment as not being a "macho" way of doing the job. So there is pressure to not implement some of the safety skills and tools available to protect workers. Financial reasons are also a reason that safety and health is not implemented at the workplace. An example provided was that if an employee learns that they are supposed to have a local exhaust system for certain operations, the firm may not be able to purchase that equipment due to the financial burden it would place on the business operation. If management does not support safety and health practices by either ignoring workers that cut corners when addressing safety or by not requiring employees to follow safety standards, then employees will continue to not work safely. A strong commitment from management facilitates safety culture at the workplace. Employers who develop a safety and health management system that includes employee involvement, and is followed by all levels of employees, will create a culture of safety at the workplace. Employees at these types of employers will more likely be able to implement safety and health knowledge and skills learned in their training courses.

Training alone is not effective to reduce illness and injuries. There must be a comprehensive safety and health management plan that addresses safety and health issues from a larger perspective in place that reinforces what is learned in training. The

program should include conducting health and safety meetings that help identify hazards, reviewing accident near-misses, evaluating what was learned in training, management commitment, and funding to ensure the proper equipment and procedures are in place. These are ways to institutionalize safety in the workplace.

The ERCs have provided excellent CE programs, providing high quality training on particular topics. This person has limited exposure to the CE programs offered by the ERC. She has attended a program on H1N1 preparedness, and was impressed by the interdisciplinary nature of the training program, addressing specific hazards from a multi-disciplinary approach. A concern is that occupational physicians do not get enough CE for workplace hazards, however, she noted that she does not have a full knowledge of the scope of work that ERCs perform.

ERCs provide courses directed to professional level employees. Many of these professionals need to attain CE credits to maintain their accreditation or license in a particular discipline. Courses that have CE credits motivate people to attend training courses. People learn better in smaller groups, as there is a higher comfort level to ask questions and time for discussion. Participatory training approaches are most effective allowing participants to be engaged in the training. Effective training programs allow participants to talk about their own workplace experiences, and include exercises and case studies that are utilized so that participants are able to struggle with safety and health issues. Successful training programs will include exercises that are similar to issues workers are expected to find at their workplace.

The types of questions that were suggested to include in the survey relate to addressing barriers to changing workplace practices that are experienced at the

workplace. Additionally, determining what knowledge or skills were implemented when trainees retuned to the workplace and what parts of the training made the biggest impact on their attitudes towards safety and health.

Interview 13 (I13): This interview was conducted with a construction safety and health manager.

He suggested that employers are motivated to send their employees to training because it primarily helps them comply with city or federal regulations. As an example, workers in New York City must have specific training for work conducted on scaffolds. In order for work to be conducted the workers must attend training to receive certification in scaffold work. These types of training courses are most effective because it provides the skills necessary for the worker to complete the job, and for the employer because it allows them to continue working in regulated cities. Training that meets the needs of both the employee and the employer is the most effective type of training.

The most significant barriers to implementing what is learned in training courses are the foreman or job superintendents. Either one can either enforce or encourage the knowledge and skills learned in training, or they can tell the worker to just get to work. Often training is not encouraged by the supervisors at the job site, and there is a disconnect between the worker, foreman and superintendent. The employer must put a system in place that encourages the adoption of the training and provision of equipment. Many times, the foreman is pressured to get the job done and on time, and this pressures workers to do the job, not as they were trained, but take shortcuts to make sure the job is completed in a timely basis.

Training can be effective in changing workplace behaviors if it is encouraged by the employer and supervisors. However, some limitations to this include that the work conditions at the job site are not the same as training conditions. Some workers are exposed to conditions that they may not have seen in a training program. To make the impact of the training more effective, workers need to be observed at the job site, and if there is a gap between how they were trained and how they perform their job, they need to be told.

For training to be effectively implemented at the job site, management has to say, "I want to make a difference" and effectively implement a successful safety management system. Workers being involved in the development of safety plans and being aware of the safety management systems in place will increase the safety culture at the workplace. Peer pressure can be a positive and negative influence on workplace safety. In the positive sense, it helps to know that you are dependent on others, as well as other dependent on you to protect each other.

ERCs have been effective in providing both academic training and CE. Regulations require training, and the ERCs have been a key provider of training to meet the needs of the OSH community. Industry needs to be trained, and the ERCs provide high level training, instructors are professional and continually provide excellent programs. I13 felt that training courses provided through a University are perceived at a higher level, puts a different mind set on the training. However, CE points are valuable only to those that need them. He also feels that class size matters. Classes that have too few people will not have enough interaction, and classes that are too large make it difficult to engage all participants in meaningful discussion. He felt that discussion was

the training methodology that facilitates transferring training from the classroom to the workplace. Discussion gives program participants the ability to solve problems in a classroom setting, and through discussion they can utilize the information learned when they return to work.

The types of questions that will help identify the impact of training include the utility of the training, and if any of the information learned was implemented at the worksite. It was suggested to identify whether the employer encouraged the use of training when the employee returned to the worksite. Identifying the barriers or enablers to implementing safety and health knowledge and skills is important to understanding how effective training can be to making workplace changes.

Interview 14 (I14): This interview was conducted with an industrial hygienist at a university-based hazardous waste training center.

Employers are motivated to send employees to training because of the need to comply with regulatory standards. The force of the law moves a number of people to get the training that might otherwise not consider getting the training. Another reason employers train their workforce is to increase the knowledge and skills of their employees, so they are better prepared to face hazards in the jobs. Individuals seek training a spectrum of reasons, ranging from self-preservation to career advancement. Individuals have attended training in order to increase their knowledge and skills in particular safety and health topics. They have the need to understand the hazards they face at their jobs, and seek to gain information to help them better protect themselves while facing those hazards. Labor unions have worker-led initiatives that addressed a need to advance the knowledge and skills of the labor force in a particular industry.

Other individuals are seeking career advancement, and training provides them with the opportunity to obtain credentials that will help them move up the career ladder. A circumstance in the workplace, for example, a death or other tragedy, will be the motivation for either individuals or the employer to provide training in safety issues.

An element that will help transfer the knowledge learned in the classroom to the workplace is to include specific exercises in the training that directly relate to the work being conducted. An example is a program this trainer provides to the Communication Workers of America local union. The training utilized site-specific emergency response plan in the classroom exercises so that the employees would be familiar with existing policies, and would be able to identify if their emergency response plan was consistent with the OSHA requirements, or if it needed to be revised. Other ways to make the course more specific to individual needs would be for the instructors to encourage discussion, and provide opportunities for trainees to relate topics learned in the classroom to specific examples they may experience at their workplace. The training methodology used does have an effect on the way training is utilized at the workplace. Small group activities that include reviewing site specific safety plans, as described above, are effective in providing the trainee with the ability to understand and implement safety and health policies when they return from the training course. A lecture on factual knowledge will be less effective in helping trainees to implement the course content.

Peers and management can be barriers to implementing workplace practices learned in a training program. Trainees who have learned new information, and are excited to implement it at the workplace, can be halted by peers who do not want to change their workplace practices. Management may also see that change is a problem,

challenge or nuisance. There is a natural resistance to change from employers or peers, even though it may have a positive impact on their safety and health. Economics is also a barrier to change. Employers may not have the financial resources to change or upgrade equipment to improve safety at the workplace.

The ERCs effectively meet the NIOSH mission of training and educating the OSH workforce, and increasing the number of OSH professionals. This person is a product of the NIOSH ERC graduate program, as he graduated with an industrial hygiene degree from one of the ERC graduate programs. If the ERCs did not exist, he would not have entered the OSH field. The CE programs also provide effective training. The CE programs identify training needs, and strive to find ways to fill that need by developing and implementing courses.

It was suggested to include survey questions that identify the effectiveness of the classroom training as well as how the training was implemented in the workplace. Specific questions that relate to the classroom training include the clarity and specificity of the training provided.   The questions that are related to the workplace include how the knowledge and skills were implemented and if the trainees felt the training was directly related to their work. Additionally, it was suggested to identify is students retained the key points from the training programs.

SUMMARY OF KEY INFORMANT INTERVIEWS

The interviews confirmed that safety and health training might be effective for producing changes in workplace behavior. Training provides knowledge and skills that can help reduce workplace injuries and illnesses. One interviewee reported that national rates of injuries have decreased since 1970, but it would be difficult to attribute the

decline to increased training. ERCs are an effective model that provides graduate education and continuing education. This model helps to increase the number of OSH professionals by providing graduate education in the core OSH disciplines, and provides continuing education for those already in the OSH workforce. One interviewee reported that the ERCs have been effective in meeting workforce development needs. The major strength of the ERCs is their intellectual property. The ERC personnel are highly qualified and are able to effectively generate knowledge in OSH disciplines. Other strengths of ERCs are that they provide interdisciplinary education, the faculty is experienced, and that they are a resource to the OSH field.

Several interviewees have conducted follow-up evaluations to identify how training has impacted workplace performance. One particular interviewee identified that the assessment conducted only identified whether there was an intention to change behavior, but did not follow-up with additional assessments to determine if those intentions were implemented. Another interviewee commented that they follow-up surveys 90 days post training. These surveys had a low response rate, but did indicate changes in the workplace did take place after training was conducted.

Most of the interviewees reported that the primary motivation for workers to attend training courses is to meet a particular OSHA standard. Individuals are also motivated to increase their knowledge and skills so that they can better protect themselves against workplace hazards, or to become certified in a particular OSH discipline. Those that are certified are motivated to retain their certification, and must take courses that provide CE points. Most interviewees indicated that Universities are perceived to be a reputable training provider.

Employer motivation to send workers to training programs focused primarily on the need to meet a particular OSHA standard. Employers are required to meet OSHA standards that require that the workforce be trained in particular safety and health topics. Some employers send workers to training to try to reduce their liability should an accident occur. Other employers also want to expand the capacity of their workforce, and provide training for their employees to increase their abilities. One interviewee commented that he has seen a difference since the late 1990s, as some employers want to increase the knowledge of their workforce and "do the right thing" by providing safety and health training to their employees. Some employers provide training so that their employees can become certified in a particular content area (i.e., Certified Industrial Hygienist). Having employees with these certifications benefits both the employer and the employee.

The method of training provided can have an impact on the way that safety and health knowledge and skills are learned and implemented at the workplace. Courses that have a high degree of interaction between the instructor(s) and course participants are more likely to effectively transfer the information learned in class to the workplace. The interactive methods discussed include hands-on training, small group discussions, simulations, and case studies. Other methods, such as lecture and web-based training, could be effective depending on the audience and the type of information that is being taught. Class size may also have an impact on the way information is learned. Smaller classes tend to allow more group discussion and increase interaction, while larger classes are better suited to lectures.

Not all the information received was positive about all aspects of the ERCs. Some ERCs are struggling to attract students into the core graduate programs, and some have difficulty attracting particular disciplines into CE courses. Training alone does not reduce safety and health issues at the workplace. Workplaces must have a comprehensive safety and health program that includes training, management and labor support, and safety plans that reinforce safety and health messages. If information provided in a training course is not supported back at the workplace, the ability to improve the safety and health conditions is minimal. There are barriers to implementing information learned in the training courses. These barriers include supervisors and managers, budgetary issues, and the need to finish a job quickly.

The issues that were identified for further research, and inclusion in the questionnaire include identifying the barriers and enabling factors that trainees have to implementing knowledge and skills at the workplace; identifying the type of training that is most effective for trainees to retain and implement at the workplace; identify if training has impacted their work place practices and if trainees have implemented new practices, policies, skills, or purchased equipment due to something they learned in the training course; identify reasons for attending training programs; and identifying if training is perceived to be valuable to individuals and to their employers.

PHASE 3

Surveys – Pre-training, Post-training, Follow-up
The first set of questionnaires was administered to participants of training programs conducted at the UMDNJ-School of Public Health between March 2 and May 4, 2011. A total of 61 participants completed the pre-course readiness and post course

intention of changes surveys. The courses included Occupational Respiratory Protection, Lead Inspector/Risk Assessor, Occupational Hearing Conservation, Confined Space Entry, Hazardous Waste Initial, and Hazardous Waste Refresher. These courses were selected because of the varying audiences, topics, and course length. A description of each course follows.

Occupational Respiratory Protection is a 3-day course, designed to teach the requirements to establish, maintain, and monitor a respiratory protection programs. The course includes hands-on training, demonstrations, and lectures.

Lead Inspector/Risk Assessor is a 5-day course that presents the legal and technical issues required of individuals conducting lead inspections and risk assessments. The course includes lectures, demonstrations, and hands-on training. This course is required for those conducting lead inspections and risk assessments.

Occupational Hearing Conservation is a 2.5-day course designed to train participants in the administrative, technical and practical aspects of an industrial hearing conservation program. The course is presented with lecture and hands-on training. The course meets the certification requirements of the Council for Accreditation in Occupational Hearing Conservation.

Confined Space Entry is a 3-day course that enables participants to recognize, evaluate, and control safety and health hazards associated with permit-required confined spaces. The training is mandated by OSHA. The training includes lecture, demonstration, and hands-on training.

Hazardous Waste Initial is a 5-day course that provides basic safety and health information for those working at hazardous waste sites. The course is mandated by OSHA. The course includes lectures, demonstrations, and hands-on training.

Hazardous Waste Refresher is a 1-day course required of all workers who have previously completed the hazardous waste initial course. The course provides updated information on regulations, or incidents that impacted the hazardous materials industry. The course includes lecture, demonstrations, and small group activities.

The pre-course readiness assessment was completed prior to the start of the training course. The survey asked participants to identify how strongly they agree or disagree with statements regarding OSH training. It also identified the reasons for attending OSH training programs. The key finding from the pre-course readiness survey is that training is valuable to participants and their work places. Training is effective in increasing knowledge, improving skills and benefits employers. Of the 61 participants, 49 strongly agree that training is beneficial to individuals, and is effective to increase safety knowledge and skills (Table 1). The next questions related to why individuals attended training programs (Table 2). Forty seven participants strongly agree that they attend training to increase their safety knowledge and skills. Forty three strongly agree that they attend training because it is beneficial to them. Only 29 strongly agree that they attend because of regulation. However, when asked which was the primary reason for attending training (Table 3), the largest percentage (23.2%) of respondents selected required by regulation, followed by training is beneficial to me and training increases safety and health knowledge (19.6%). The last questions on the pre-training readiness questionnaire related to workplace safety and health environment (Table 4). A large

majority of participants strongly agree that their employer values safety and health, is

receptive to remediating safety issues if identified, and the employer provides

opportunities for employees to review safety and health concerns.

Table 1: Pre-course readiness for training * (N=61)

	1	2	3	4	5	6	7	Median	25	50	75
Occupational safety and health training is beneficial to me	49	10	-	2	-	-	-	1	1	1	1
I value training as a way to improve my safety and health	41	17	1	2	-	-	-	1	1	1	2
Providing training to employees is beneficial to my work employer	46	8	2	1	1	-	-	1	1	1	1
My employer values training as a way to improve employee safety and health	31	14	6	3	2	-	-	1	1	1	2
Training is important to improve safety and health within an organization	48	9	2	2	-	-	-	1	1	1	1
Training helps me make decisions that effect my safety	48	9	3	1	-	-	-	1	1	1	1
Training helps me make decisions that effect the safety of co-workers	43	11	1	1	-	-	1	1	1	1	1.5
I will be more effective at my job as a direct result of the training I receive	42	11	3	3	-	-	-	1	1	1	2
Training will help me approach the way I work more safely	44	12	3	2	-	-	-	1	1	1	2
Training is an effective way to improve my safety and health knowledge	49	10		2	-	-	-	1	1	1	1
Training is an effective way to improve my safety and health skills	49	9	1	2	-	-	-	1	1	1	1
Training is an effective way to improve my attitude about the importance of safety and health	45	12	3	1	-	-	-	1	1	1	2

* 1=strongly agree, 7=strongly disagree

Table 2: Reasons for attending training programs (N=61) *

	1	2	3	4	5	6	7	Median	Percentiles 25	50	75
I attend training because it is required by regulation	27	13	5	8	3	1	4	2	1	2	4
I attend training because it is beneficial to me	43	14	2	2	-	-	-	1	1	1	2
I attend training because it is beneficial to my employer	29	18	6	3	-	2	-	1.5	1	1.5	2
I attend training because it will help me improve the safety of others	37	17	3	3	-	1	-	1	1	1	2
I attend training because it helps reduce injuries and illnesses	31	20	4	5	-	1	-	1	1	1	2
I attend training because it helps me reduce workplace accidents	32	18	6	4	-	1	-	1	1	1	2
I attend training because it will increase my safety and health knowledge	47	11	1	2	-	-	-	1	1	1	1
I attend training because it will increase my safety and health skills	47	10	2	2	-	-	-	1	1	1	1

* 1=strongly agree, 7=strongly disagree

Table 3: Primary reason for attending training programs (N=61)

	#	%
I attend training because it is required by regulation	13	23.2
I attend training because it is beneficial to me	11	19.6
I attend training because it is beneficial to my employer	6	10.7
I attend training because it will help me improve the safety of others	7	12.5
I attend training because it helps reduce injuries and illnesses	2	3.6
I attend training because it helps me reduce workplace accidents	2	3.6
I attend training because it will increase my safety and health knowledge	11	19.6
I attend training because it will increase my safety and health skills	4	7.1
Total	56	100

Table 4: Workplace safety and health environment (N=61) *

	1	2	3	4	5	6	7	Median	Percentiles		
									25	50	75
My employer values safety and health	37	7	6	4	2	1	1	1	1	1	2.25
My employer provides opportunities for me to review safety and health concerns	36	12	3	3	1	2	-	1	1	1	2
I am comfortable approaching my employer when a safety issue is identified	39	9	4	2	-	-	-	1	1	1	2
If I point out safety issues to my employer, I feel he/she will make address those issues	31	15	3	5	2	1	-	1	1	1	2
I have pointed out safety issues to my employer	33	12	6	2	1	3	-	1	1	1	2

* 1=strongly agree, 7=strongly disagree

At the conclusion of the training course, a six-question survey was administered to identify if they learned any new information in the training course, if they have identified areas that need improvement, and if they plan to implement any of those changes. Sixty participants completed the post course evaluation (Table 5). Sixty of the 61 participants completed the post course evaluation. All 60 participants had learned new information, while 59 learned a new skill. Fifty-one participants indicated that they see areas of improvement needed at their work, and 52 indicated that they expect to implement changes at their work site.

Table 5: Post course evaluation (N=60)

	Y	N
This course provided me with new occupational safety and health knowledge	60	0
This course provided me with new occupational safety and health skills	59	1
This course motivated me to identify changes in my work	55	3
Due to this course, I see areas of improvement needed at my work	51	6
I expect to make changes to occupational health and safety at my work	52	5

The changes that participants reported that they expected to make due to information learned in the course include changes to equipment needed at the worksite, implementing policies and procedures, communicate with other employees about the lessons learned in the course, and understand the hazards associated with the type of work conducted. In the Occupational Respiratory Protection course, two participants wrote that they would implement changes to the way the conduct fit-testing of respirators. Two other participants indicated they will review and update their respiratory protection programs. The participants in the Hazardous Waste Initial course indicated that the are better prepared to identify hazardous chemicals, understand the properties of chemicals, and select appropriate personal protective equipment to protect themselves against the hazards they identified. Five participants of the Confined Space Operations course identified that they will change or update their confined space entry policies, two participants indicated they will change the way they conduct confined space training for their employees, and one participant indicated they intend to change how they conduct air monitoring for confined space entries. Ten participants of the Hazardous Waste Refresher course indicated that they will look at issues related to the regulatory changes due to the globally harmonized system for hazard communication that is being implemented by OSHA.

The three-month follow-up survey was sent to 52 trainees who indicated that they intended to make changes based on what they had learned in the training course. A total of 20 have completed the three-month follow-up survey, for a response rate of 38%. The three-month follow-up surveys indicate that as a result of training, participants have incorporated lessons learned in the courses that they attended. Of the 20 participants that

completed the follow-up survey, 15 (75%) indicated that they were able to make changes

they intended to make to their workplace practice that they identified at the conclusion of

the training program. Nine trainees (47%) made other changes based on information they

learned in the training course. The types of changes made were administrative,

improvements to the training provided to other co-workers or employees, and a review

and update of workplace safety and health policies.

The three-month follow-up survey attempted to identify the types of barriers

workers had that may restrict training participants from implementing lessons learned in

training. Three participants (15%) identified that barriers at the workplace were present

that restricted their ability to implement the changes they intended to make. The barriers

were that there is a lack of manpower at their facility that impedes their ability to

implement changes; time restrictions; and that sub-contractors had not experienced that

general contractors have the knowledge to properly oversee a specific project. Two of

these three trainees indicated that the barriers at their workplace had a negative effect on

the safety and health practices. The respondent that indicated a sub-contractor did not

have the experience of a qualified general contractor stated that the general contractor

had the proper knowledge and experience to provide proper oversight to the lead

abatement work that needed to be completed. The fact that the sub-contractor did not

understand the OSH laws and proper procedures was reported to have a negative effect

on the safety and health of the other workers. Due to the information learned in the

training, the individual implemented an orientation program not only for the lead

abatement sub-contractors, but also for the entire workforce. Much of their lead

abatement work takes place in schools, and the individual reported that providing this

orientation is essential for all to understand what is taking place during the abatement project.

The three-month follow-up survey also attempted to identify what facilitates change at the workplace. Six respondents indicated types of activities at their workplace that facilitates change. These responses included management support of safety and health programs; and communication between workers.

Because of the small sample size of the three-part pre-training, post-training, and follow-up surveys, of concern is whether the 20 respondents were different from the 32 non-respondents. A chi-square test of two independent samples was utilized to analyze if there were differences for the variables ethnicity, job duty, and work setting. The chi-square results show no significant difference between the two groups (Table 6).

Table 6: Chi-square test of independence of the respondents and non-respondents to the
follow-up survey

Test Statistics[b]

	ETHNICITY	JOB DUTY	WORK SETTING	EDUCATION LEVEL
Mann-Whitney U	268.500	104.000	229.000	278.500
Wilcoxon W	733.500	170.000	694.000	468.500
Z	-.036	-.469	-.968	-.338
Asymp. Sig. (2-tailed)	.971	.639	.333	.735
Exact Sig. [2*(1-tailed Sig.)]		.667[a]		

a. Not corrected for ties.

b. Grouping Variable: Responded to follow-up

A one-way ANOVA was used to test the independence of the groups and the results showed no significant differences for the variables age and number of years of experience. The results of the ANOVA are listed in Table 7.

Table 7: ANOVA between respondents and non-respondents to the follow-up survey

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
AGE	Between Groups	86.463	1	86.463	.589	.447
	Within Groups	6895.537	47	146.714		
	Total	6982.000	48			
YEARS EXPERIENCE	Between Groups	71.185	1	71.185	.624	.437
	Within Groups	2850.000	25	114.000		
	Total	2921.185	26			

Surveys – National ERC Students

Phase 3 also included a survey that was sent to participants from seven ERCs across the nation. The survey was launched on July 11, 2011 to 1568 email addresses that were provided by the seven ERCs. The ERCs that provided email lists of course participants were the Deep South Center for Occupational Health and Safety; Illinois Education and Research Center; Mountains and Plains Education and Research Center; New York and New Jersey Education and Research Center; North Carolina Occupational Safety and Health Education and Research Center; Rocky Mountain Center for Occupational and Environmental Health; and Southern California Education and Research Center.

Of the 1568 email addresses, 62 were "hard bounced," meaning that the Zoomerang program received a message back that the survey was undeliverable to the email address. An additional 76 were "soft bounced," meaning that Zoomerang tried to re-send the survey due to some problem with the server or recipient email address, but was never able to send the survey. Also, 87 people "opted out" of the survey, meaning that they clicked on a link to remove their name from receiving additional email from Zoomerang, or declined to participate after reading the IRB statement. These individuals did not participate in the survey, and were not included in the final total of valid email addresses. In addition to those not delivered through the Zoomerang program, 75 people responded directly to me via email that they did not take or recall taking an occupational safety and health training course through one of the ERCs during that time period, they have retired since taking the course, that they are the person responsible for registering individuals for classes, but did not take the class, or they had originally registered but did not actually participate in the class. A total of 1268 valid email addresses were utilized for this survey.

A reminder notice was sent to those who have not completed the survey on July 18, 2011, one week after the initial deployment of the survey. A second and final reminder notice was sent on July 25, 2011. The total number of respondents who completed the survey was 289, which corresponds to a response rate of 22.8%.

Primary reason for attending training

The survey included two questions to identify what the primary motivation was for trainees to attend OSH training courses. The first question asked the participants to rate on a scale of one to seven how strongly they agree or disagree with statements

regarding reasons for attending training courses. Seven different reasons were provided

for the participants to rank. These included that training was: required by regulation;

beneficial to the participant; beneficial to the participants' employer; helps the participant

improve the safety of others; helps reduce injuries and illnesses; increases safety and

health knowledge; and increases safety and health skills. The reason for training that most

people strongly agreed to was that training increases safety and health knowledge. When

the number of responses who agree to strongly agree (ratings 1, 2, and 3 out of seven)

were combined, training being required by regulation was the lowest ranked reason for

attending training at 62%. The highest ranked reason for attending training was that

training increased safety and health knowledge (86%), followed closely by all the other

categories. Table 8 displays this information. The median and quartiles, based on a scale

of 1 (strongly agree) to 7 (strongly disagree), for the reasons for attending training are

included in Table 9. The data are consistent with the exception of the statements

"Training is required by regulation" and "Training helps reduce injuries and illnesses."

The median for these two statements is 2, compared to a median of 1 for all the other

statements. Additionally, the 50th percentile is lower for both and the 75th percentile is

lowest for the regulation statement. As discussed previously, it is difficult to make a

direct connection between training and the reduction of illnesses and injuries. It is easier

to identify changes in procedures and to measure an increase in the knowledge or skills

gained.

The second question asked the participant what their primary reason for attending

the course. The participants were only able to select one response as their primary reason

for attending training. Thirty-three percent of the respondents indicated that the primary

reason for attending training is that is it required by regulation. The other reasons for attending training are that the training course is beneficial to the participant (18%), that attending a training course will increase safety and health knowledge (17%), and training will help improve the safety of others (13%). Only 3% of trainees identified reducing injuries and illnesses as a primary reason for attending training. Other responses included that the training provided continuing education units to maintain certification. These data are in Table 10.

Table 8: Reason for attending training, percent of respondents who agree to strongly
     agree

	%
Required by regulation	62
Beneficial to me	85
Beneficial to employer	83
Improve safety of others	84
Reduce injury or illness	84
Increase my S&H knowledge	86
Increase my S&H skills	85

Table 9: Median and quartiles for the reasons for attending training *

		Training is required by regulation	Training is beneficial to me	Training is beneficial to my employer	Training will help me improve the safety of others	Training helps reduce injuries and illnesses	Training increases my safety and health knowledge	Training increases my safety and health skills
N	Valid	286	288	286	287	287	286	286
	Missing	3	1	3	2	2	3	3
Median		2.00	1.00	1.00	1.00	2.00	1.00	1.00
Percentiles	25	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	50	2.00	1.00	1.00	1.00	2.00	1.00	1.00
	75	4.25	2.00	2.00	2.00	2.00	2.00	2.00

* 1=strongly agree, 7=strongly disagree

Table 10: Primary reason for attending training

	n	%
Training is required by regulation	94	33
Training is beneficial to me	51	18
Training is beneficial to my employer	13	4
Training will help me improve the safety of others	39	13
Training helps reduce injuries and illnesses	8	3
Training increases my safety and health knowledge	50	17
Training increases my safety and health skills	17	6
Other	15	5
Not reported	2	1
Total	289	100

Intended changes

Participants of the survey were asked, "At the conclusion of the training program, did you intend to make changes to your workplace practice based on the knowledge and/or skills learned in the course?" Seventy percent (201) answered that they intended to make a change. A follow-up question asked those who intended to make a change, what change did they intend to make, and 163 responses were received. The analysis of the changes identified five themes. These themes are "awareness", "policy", "procedure", "training", and "management." Awareness refers to answers that respondents identified that they would be more cognizant of hazards in their workplace, or identify hazards or conditions for others in the workplace. Examples of comments included in the awareness theme include greater awareness of chemicals in my workplace, greater awareness of potential hazards, help increase fellow workers awareness of safety in the workplace, having the knowledge of safety, health and regulatory information allowed the participant to make more knowledgeable decisions about safety when asked, and feeling more comfortable about safety and health decisions. Examples of comments included in the policy theme related to the development of new policies or revision of existing policies.

Several participants identified that they would improve their respiratory protection written program, including improving their fit testing policy, improving the training component of their respiratory protection program, and increasing use of N95 respirators. The largest category of intended changes was in the area of procedures. These include specific safety and health protocols or procedures. Included in this category are changing or improving sampling procedures, adjusting emergency response procedures, changing the way one operates specific equipment to make it safer for the equipment operator, conducting a site walk through to be more proactive with ergonomic issues, and improving documentation and record keeping. Two hundred and one respondents indicated they intended to make a workplace change and 156 listed something they would change, two did not report a specific change. These were categorized into themes, and they are listed in Table 11.

Table 11: Identified themes of changes intended post training

	$\underline{n}$
Awareness	33
Policy	31
Procedure	74
Training	16
Management	2
Not reported	2
Total	158

Of the 201 who indicated that they intended to make a change due to something they learned in the training course, 158 (80%) indicated that they did implement the change they intended to make at the conclusion of the training course they attended.

It is important to understand the factors involved with implementing safety and health knowledge and skills at the workplace. The survey asked participants their agreement with the following statement: "I am able to implement knowledge and skills learned in training at my workplace." Eighty percent of the respondents agreed to strongly agreed with the statement.

The next question attempted to get a better understanding of the types of changes that would be made due to OSH training received. When asked their agreement with the statements starting with "due to the training received" there was a high level of agreement that training has helped them be better informed and able to make changes to workplace practices. The highest rated was that due to the training the participants were better able to make safety and health decisions, both in those who responded that they strongly agree and by combining responses that agree to strongly agree. Training has impacted workplaces because participants are better prepared to discuss safety and health issues with their supervisors, identify and correct issues that may have caused an injury or illness. Of the statements listed, the lowest ranked was the ability to change a workplace health and safety policy. These data are listed in Table 12.

The analysis of the median and quartiles, based on a scale of 1 (strongly agree) to 7 (strongly disagree), for the level of agreement to statements about training is provided in Table 13. The data indicate that the statement "I am able to change a workplace safety and health policy" is the one with the least agreement. The 75th percentile for ability to change policy is higher (4.00) than the percentiles for all the other statements (3.00). A reason for these responses is that those who completed the survey may not have the authority to effectuate change in their workplace policies. To change policy the process

involves higher levels of management and legal review, which many of the survey

participants do not have. The other statements can be controlled by the individual, and do

not need another level of approval.

Table 12: Agreement to statements about training

	Percentage of respondents who agree 1=strongly agree, 7=strongly disagree							
	1	2	3	4	5	6	7	N
I am better prepared to discuss safety and health issues with my supervisor	37	29	14	9	4	2	4	285
I am better prepared to improve safety and health issues at my work site	37	28	14	9	5	4	3	287
I am able to make better safety and health decisions	39	31	14	8	3	2	3	285
I am able to identify a safety or health issue that may have caused an injury or illness	36	32	13	8	4	4	4	283
I am able to correct a safety or health issue that may have caused an injury or illness	31	30	18	10	5	2	4	286
I am able to change a workplace safety and health policy	25	27	19	13	6	3	6	283

Table 13: Median and Quartiles for agreement to statements about training

		I am better prepared to discuss safety and health issues with my supervisor	I am better prepared to improve safety and health issues at my work site	I am able to make better safety and health decisions	I am able to identify a safety or health issue that may have caused an injury or illness	I am able to correct a safety or health issue that may have caused an injury or illness	I am able to change a workplace safety and health policy
N	Valid	285	287	285	283	286	283
	Missing	4	2	4	6	3	6
Median		2.00	2.00	2.00	2.00	2.00	2.00
Percentiles	25	1.00	1.00	1.00	1.00	1.00	1.00
	50	2.00	2.00	2.00	2.00	2.00	2.00
	75	3.00	3.00	3.00	3.00	3.00	4.00

Fifty-nine percent of the participants identified that training changed the way they address safety and health hazards at the workplace. Of these, 123 provided a specific example of how training changed the way they address hazards. The responses were coded to the same themes as identified above, and identified in Table 14. The most typical response was that the training provided specific awareness or knowledge that enabled the participant to be better prepared to identify health and safety hazards. The types of examples identified included that workers need to be more aware of the routine types of work because many accidents occur during these types of operations; specific information about a particular piece of equipment (i.e., respirator, tools); specific information about the need for ventilation; and improved understanding of environmental exposures. The next highest response category was that a new procedure was incorporated at the workplace. Specific procedures established due to the training received included implement proper body mechanics and improved assessment

techniques; establishing training procedures for soil sampling; developing criteria for respiratory protection use; and the ability to monitor for noise so that the participant can identify the best personal protective equipment (PPE) to help reduce exposure to occupational noise.

Table 14: Identified themes of specific examples of ways addressing hazards has changed since training

	N	%
Policy	8	7
Procedure	38	31
Awareness	59	48
Management	14	11
Training	4	3
Total	123	100

In order to identify how participants have utilized the training, and incorporate the knowledge or skills learned, several questions were asked to quantify the transfer of training to the workplace. The first of the questions asked if the trainee typically speaks with co-workers about health and safety issues. Two hundred fifty-three (88%) indicated that they discuss health and safety issues with co-workers. The participants were able to select as many responses that apply. Seventy percent of the participants speak with co-workers in a similar job title. The other categories included supervisor (61%) subordinate (49%), manager (46%), senior management (32%), and director (28%). Eighteen percent indicated another response, including speaking with contractors on site, health and safety officer, custodial and maintenance staff, and the public. Seventy-four percent indicated that they used the information they learned in the training course to educate others at their worksite.

To continue to identify how the training provided was integrated into the workplace, the survey asked if participants made changes to an engineering control, PPE, or safety and health procedure and policy. Table 15 shows the data for these responses. The highest response in each area was that no change was needed. If those responses are excluded, 27% of those answering yes or no indicated that they made a change to an engineering control, 33% indicated that they made a change to the PPE provided to them or others at their worksite, and 50% indicated that they made a change to a workplace safety and health policy or procedure.

Table 15: Workplace changes made due to training

	Yes		No		No change needed		N
	n	%	n	%	n	%	
PPE *	46	16	93	33	144	51	283
Procedure or policy	84	30	86	30	114	40	284
Engineering control	38	13	102	36	144	51	284

* Personal Protective Equipment

A cross-tabulation was conducted to identify the number of respondents who made multiple changes to workplace practices, and the data are displayed in Table 16. PPE, the lowest level in the hierarchy of controls, was used as a baseline for the cross-tabulation. Of the 46 who indicated a change in PPE practice, 29 made a change to a policy or procedure. Eleven respondents made changes to PPE, an engineering control and a workplace policy or procedure. Two respondents made changes to both PPE and an engineering control. Nine respondents who indicated that they did not make a change to PPE made changes to both a policy or procedure and an engineering control. Additionally four respondents who indicated that no changes were needed in their PPE made changes

to both a policy or procedure and an engineering control.

A purpose of this research is to identify how training is utilized in the workplace to improve health and safety conditions for workers. It is important to understand the barriers that exist that reduce the chance for knowledge and skills learned to be incorporated into workplace practices. Twenty four percent of the participants identified a barrier to implementing what they learned in the training course. Of these, 53 provided a response to the type of barrier that they faced when trying to implement safety and health changes at their workplace. The analysis of the responses identified five general categories. These are support from management, culture of the workplace, cost, personnel, and time. This was an open-ended question that allowed for multiple responses from each person. Some individuals had identified three different types of barriers, while other listed two or one. All the responses are included in the analysis, and are reported in Table 17. A key factor for attending a training program is to increase the safety of the workers. The barriers that were identified affected the safety and health of 34% of the participants. Identifying whether the training was helpful to overcome the barriers is important for future directions in OSH training. Forty-seven percent of the participants agreed to strongly agreed as to whether the training provided the knowledge and skills to overcome the barriers.

Table 16: Cross-tabulation of changes made due to training

			Policy Change			
PPE* Change			Yes	No	No change needed	Total
Yes	Engineering Control Change	Yes	11	2	3	16
		No	10	9	1	20
		No change needed	8	0	2	10
	Total		29	11	6	46
No	Engineering Control Change	Yes	9	3	1	13
		No	14	62	0	76
		No change needed	2	1	1	4
	Total		25	66	2	93
No change needed	Engineering Control Change	Yes	4	0	3	7
		No	1	4	1	6
		No change needed	24	5	101	130
	Total		29	9	105	143
Total	Engineering Control Change	Yes	24	5	7	36
		No	25	75	2	102
		No change needed	34	6	104	144
	Total		83	86	113	282

* Personal Protective Equipment

Table 17: Barriers identified to implementing workplace OSH changes (N=70)

Barrier identified	n
Management support	31
Cost	19
Personnel	7
Culture	6
Time	3
Not reported	4

Alternatively, the research attempted to identify what facilitates changes at the workplace. The categories identified from the analysis of the data reported include equipment, management support, labor support, safety committee, and training. Many of the responses were conditions present at the workplace that required a change to be made, not the conditions that facilitated change. Table 18 displays the data received. Management support was the most identified response to helping facilitate changes at the workplace. Additionally, having a safety committee onsite, providing or obtaining the proper equipment to conduct the operations, providing training to employees, and labor support were other conditions that facilitated changes in the workplace.

Table 18: Conditions that facilitated workplace OSH changes (N=44)

Condition identified	n
Management support	29
Safety committee	5
Equipment	5
Training	4
Labor support	1

The research also identified the type of training provided that facilitates learning. Seventy four percent (239) agreed to strongly agreed that they learn more in a highly

interactive training program. Table 19 displays the data describing whether the different

teaching modalities are effective to teach health and safety. Demonstrations were

selected most with 92% selecting agree to strongly agree. Hands-on training was next

highest with 89% selecting agree to strongly agree, followed by small group discussions

(82%) and lectures (75%).

The median and quartiles, based on a scale of 1 (strongly agree) to 7 (strongly

disagree), for effectiveness of the types of training provided are included in Table 20. The

data show that hands-on training is the most effective for teaching health and safety. The

median for this statement is 1, while the median for the other statements is 2 for small

group discussions and demonstrations, and 3 for lectures. These data show that

interactive training is more effective for teaching OSH. The order of training modality

effectiveness, starting with most effective, is hands-on, demonstration, small group

discussion, and lecture. These follow same order of interactivity, with hands-on training

the highest level and lecture the lowest level.

Table 19: Effectiveness of type of teaching modality for OSH

	Percentage of respondents who agree 1=strongly agree, 7=strongly disagree							
	1	2	3	4	5	6	7	n
Hands-on training	52	28	9	5	1	4	2	282
Small group discussions	35	31	16	11	4	2	1	282
Lectures	16	31	28	16	6	1	2	281
Demonstrations	49	36	7	2	1	2	2	281

Table 20: Median and quartiles for effectiveness of the types of training *

		Hands-on training is effective in teaching safety and health	Small group discussions are effective in teaching safety and health	Lectures are effective in teaching safety and health	Demonstrations are effective in teaching safety and health
N	Valid	282	282	281	281
	Missing	7	7	8	8
Median		1.00	2.00	3.00	2.00
Percentiles	25	1.00	1.00	2.00	1.00
	50	1.00	2.00	3.00	2.00
	75	2.00	3.00	3.00	2.00

* 1=strongly agree, 7=strongly disagree

Table 21 displays the most effective training method for participants to retain the

information learned from the training course. The participants selected hands-on training

(46%) as the most effective method, followed by demonstration (20%). The "other"

category included all the above, or a combination of methods listed. One additional

person indicated that online training was provided, but the content would have been

better presented in a hands-on format.

Table 21: Most effective training method to retain information (N=280)

	n	%
Hands-on training	130	46
Small group discussions	51	18
Lectures	33	12
Demonstration	57	20
Other	9	3

The research continued to identify the impact that training had on workplace

practices. Several questions were asked regarding the use of personal protective

equipment use at their facility. The first question asked if PPE was required for the type

of work they conduct, with 73% (210) indicating that they need PPE. Of those, 99% indicated that they have the proper PPE at their workplace. Sixty eight percent indicated that the training provided awareness of PPE needed in their workplace. And 43% responded that the training provided information that will change the way that PPE is used at the workplace.

A series of statements where participants replied with their level of agreement helped to determine how usefulness of the training program. Using the same criteria as above, those responding agree to strongly agree, 87% of the participants identified that the training provided useful information that was applicable to their jobs and that the training reinforced knowledge and skills already in place at their workplace. Eighty-five percent stated that the training they received increased their OSH knowledge and 82% stated that their OSH skills were increased. Finally, 78% reported that the training they received helped them to better perform at their job. These data are reported in Table 22. The median and quartiles, based on a scale of 1 (strongly agree) to 7 (strongly disagree), for usefulness of training are provided in Table 23. The data for each of the statement is consistent, with the exception for the statement "Training reinforced knowledge and skills already in place at my workplace." The 75th percentile for this statement was lower than all the other statements. Because survey participants have many years of work experience, it is probable that they have the opportunity to learn about the OSH issues related to their workplace. The training course provided reinforcing information to the course participants. One additional reason is that survey included participants who have completed a refresher course.

Table 22: Usefulness of training, percent agreement *

	1	2	3	4	5	6	7	n
Increased my knowledge regarding an occupational safety and health issue	43	30	12	9	1	3	2	278
Increased my skills regarding an occupational safety and health issue	39	28	15	11	3	3	2	278
Provided useful information that is applicable to my job	42	30	15	4	3	3	3	279
Helped me do my job better	38	26	14	13	3	4	3	279
Reinforced knowledge and skills already in place at my workplace	43	32	12	3	2	4	3	275

* 1=strongly agree, 7=strongly disagree

Table 23: Median and quartiles for usefulness of training *

		Increased my knowledge regarding an occupational safety and health issue	Increased my skills regarding an occupational safety and health issue	Provided useful information that is applicable to my job	Helped me do my job better	Reinforced knowledge and skills already in place at my workplace
N	Valid	278	278	279	278	275
	Missing	11	11	10	11	14
Median		2.00	2.00	2.00	2.00	2.00
Percentiles	25	1.00	1.00	1.00	1.00	1.00
	50	2.00	2.00	2.00	2.00	2.00
	75	3.00	3.00	3.00	3.00	2.00

* 1=strongly agree, 7=strongly disagree

A cross tabulation (Table 24) was conducted on the intention to make change and did the training change the way safety and health hazards are addressed in the workplace. Of the 201 who intended to make a change, 148 (73.6%) indicated that the training changed the way they addressed safety and health hazards. In addition, of the 88 who indicated that they had no intention of making a change, 23 (26.1%) did change the way they addressed safety and health hazards in their workplace.

Additional cross tabulations were conducted on the intention to make change and the type of change the training made by each individual. The data were collected on the following variables:

- The training I attended increased my knowledge regarding an occupational safety and health issue

- The training I attended increased my skills regarding an occupational safety and health issue

- The training I attended provided useful information that is applicable to my job

- The training I attended helped me do my job safer

- The training I attended reinforced knowledge and skills already in place at my workplace

Table 24: Cross tabulation between intention to change workplace practice and if the training changes the way safety and health hazards are addressed in the workplace

			Question 9: Did the training change the way you address safety and health hazards at the workplace?		
			No	Yes	Total
Question 4: At the conclusion of the training program, did you intend to make changes to your workplace practice based on the knowledge and/or skills learned in the course?	No	Count	65	23	88
		Expected Count	35.9	52.1	88.0
	Yes	Count	53	148	201
		Expected Count	82.1	118.9	201.0
Total		Count	118	171	289
		Expected Count	118.0	171.0	289.0

These questions asked the survey participants to rate their agreement to those statements on a seven point scale, ranging from strongly agree to strongly disagree. The variables were transformed into a yes/no response, with all positive agreements (rated 1, 2, or 3) transformed into a "yes" and all neutral and negative agreements transformed into a "no" response. The analysis shows that a high percentage of those who had no intention of changing their workplace practice due the training they attended indicated the training has increased their knowledge (68%), improved their skills (61%), increased information (76%), do job better (59%), and reinforced knowledge and skills already in place (77%). These data are included in Table 25. Those that intended to make a change, not surprisingly, also had a high percent of those agreeing that the training made a difference in their workplace practice. These data are included in Table 26.

Table 25: Percent of respondents who had no intention to change their workplace practice who indicated that training impacted OSH (n=88)

	%
The training I attended increased my knowledge regarding an occupational safety and health issue	68
The training I attended increased my skills regarding an occupational safety and health issue	61
The training I attended provided useful information that is applicable to my job	76
The training I attended helped me do my job safer	59
The training I attended reinforced knowledge and skills already in place at my workplace	77

Table 26: Percent of respondents who had intention to change their workplace practice

who indicated that training impacted OSH (n=201)

	%
The training I attended increased my knowledge regarding an occupational safety and health issue	87
The training I attended increased my skills regarding an occupational safety and health issue	87
The training I attended provided useful information that is applicable to my job	88
The training I attended helped me do my job safer	81
The training I attended reinforced knowledge and skills already in place at my workplace	87

In an effort to identify how much the training is used at the workplace, one additional proxy was identified. This was how many times the students have referred to the training materials after they have participated in a class. The majority of participants (57%) have referred back to the training manual a few times, while 22% have referred to the materials many times. In all, 88% have referred back to the materials at least one time.

The national survey included questions about whether participants expected to make a change due to the training they received, as well as if they actually made that expected change. Seventy percent of the participants indicated that they intended to make a change to their workplace practices based on the knowledge or skills learned in the training course in which they completed. Of those that indicated a change was expected, 79 percent actually implemented the change they expected to make. These summary statistics are shown in Table 27.

Table 27: Percent of participants who indicated an intention to make change and actually made intended change due to knowledge and skills learned in the training course

	Intention to make change	Made intended change
No	30.4	21.4
Yes	69.6	78.6
Total	100	100
N	289	201

The means for each of the independent variables are displayed in Table 28.

A correlation analysis was performed between the experience variables (age, number of years OSH experience, and current job tenure). The correlation analysis was performed to determine the relationship between the three variables. A high correlation coefficient would indicate that the variables are related, and there would be errors in estimating the regression beta coefficients. There was moderate to low correlation for the variables, with a maximum correlation coefficient of 0.565. The other variables in the categories Region, Reason for Attending Course, and Job Classification are mutually exclusive.

Table 28: Means and conditional means of all independent variables

	Mean	Intended change		Changes made	
		N	Y	N	Y
STANDARD FEDERAL REGIONS					
Region 1 (CT, NH, MA, ME, RI, VT)	.01	1	.00	1	.01
Region 2 (NJ, NY, PR, USVI)	.19	31	.15	24	.15
Region 3 (DE, DC, MD, PA, VA, WV)	.02	4	.02	3	.02
Region 4 (AL, FL, GA, KY, MS, NC, SC, TN)	.17	35	.17	30	.19
Region 5 (IL, IN, MI, MN, OH, WI)	.12	21	.10	12	.08
Region 6 (AR, LA, NM, OK, TX)	.01	3	.01	3	.02
Region 7 (IA, KS, MO,NE)	.01	2	.01	2	.01
Region 8 (CO, MT, ND, SD, UT, WY)	.22	49	.24	44	.28
Region 9 (AZ, CA, HI, NV)	.13	31	.15	26	.16
Region 10 (AK, ID, OR, WA)	.04	7	.03	6	.04
TYPE OF CHANGE					
Engineering Control	.1315	36	.1791	32	.2025
Personal Protective Equipment	.1592	42	.2090	36	.2278
Policy	.2907	80	.3980	70	.4430
JOB CLASSIFICATION					
Occupational Safety	.3979	87	.4328	67	.4241
Industrial Hygienist	.1522	33	.1624	25	.1582
Occupational Health Nurse	.1315	28	.1393	23	.1456
Occupational Physician	.0138	3	.0149	3	.0190
Environmental Scientist	.0554	6	.0299	5	.0316
Environmental Technician	.0484	8	.0398	7	.0443
Trainer/Educator	.0277	6	.0299	5	.0316
Other Work Discipline	.1280	6	.0299	5	.0316
REASON FOR ATTENDING TRAINING					
Required	.3253	52	.2587	44	.2785
Beneficial to me	.1765	38	.1891	29	.1835
Beneficial to employer	.0450	7	.0348	5	.0316
Improves the safety of others	.1349	36	.1791	27	.1709
Reduces injuries and illnesses	.0277	5	.0249	4	.0253
Increases Knowledge	.1730	41	.2040	34	.2152
Increases Skills	.0588	13	.0647	9	.0570
EXPERIENCE					
OSH Work experience	13.19	169	13.09	138	13.61
Current job tenure	10.22	163	10.15	136	10.20
Age	45.62	184	45.98	150	46.25
Number of safety courses attended in past year	2.68	189	2.90	151	2.90
N	289	201		158	

The primary variables of interest are the type of change made at the participant's

work place due to the training they received and the primary reason for attending

training. The variable 'type of changes made' includes the three classifications within the

hierarchy of controls. These are personal protective equipment, administrative changes,

and engineering controls. The analysis of the data indicated that the administrative controls identified were policy changes, so the category included in the results is labeled policy. This is an important variable because it indicates the types of workplace changes that can be expected due to training. In practice, personal protective equipment is typically the first control implemented, as it is the easiest and least expensive control method. Engineering controls are typically the hardest to incorporate, as these require new control systems to be developed and can require a substantial investment of capital resources. Administrative changes may be easier and less costly to implement than engineering controls. Administrative controls require change in policy and commitment from corporate leadership.

The other variable of interest is the primary reason for attending the training course. Those that attend primarily because they are required by a law may have less interest in learning because they "must attend" the class. Employers may also gain less benefit from those attending because it is required as they are sending employees to a training course to meet a regulatory requirement, and not necessarily to increase the competency of their workforce. Another category within primary reason for attending training is self-improvement. This category includes the statements that training was attended to improve knowledge, improve skills, or that training was personally beneficial. These statements were incorporated into one category of self-improvement. Participants who are taking a course for self-improvement may be more highly motivated than others. Participants looking to improve their knowledge or skills may also be looking to improve their work conditions, and might be more willing to make a change in their workplace practice. Those who are participating in the course because it is beneficial to their

employer may also be more willing to make changes to their work conditions. Similarly those that have completed the course because training improves the safety of others may also be more willing to improve workplace practices. The final category is that training reduces injuries and illnesses. It would be the ideal situation if training could directly be attributed to a reduction in injuries and illnesses. However, it is difficult to link training to this type of reduction as there are many variables that influence the injury and illness rates.

Other variables included in the regression analysis include the experience, job classification, and region of the US in which the participants work. Experience includes three variables: age, total years experience in OSH, and years in current job. The job classifications are: occupational safety, industrial hygienist, occupational health (which includes occupational health nurses and occupational medicine physicians), environmental technicians and specialists, and other job classifications. The primary emphasis of the NIOSH ERC training programs is on industrial hygienists, occupational safety professionals, occupational health nurses, and occupational medicine physicians. The participants of the National survey attended training at seven of the ERC CE programs. The target population for each of the ERCs is similar, and the types of courses offered are also similar.

An ordinary least squares regression was performed to identify the relationship between the dependent variable "expected to make a change in workplace practice" and a series of independent variables. The independent variables included region of US in which respondent is employed; the type of change made (PPE, Policy, or Engineering Control); primary reason for taking the training course; employment discipline (industrial

hygienist, occupational safety, occupational health, environmental scientist or technician, and other); number of years in OSH; number of years in current position; age; and number of courses taken in the last 12 months. A second regression was performed between the dependent variable "changes implemented that were intended at the conclusion of the training program." The same independent variables were used.

The regression is attempting to determine the key predictors that would cause training participants to expect to make changes in their workplace practice. The variables include type of change, reason for attending training, experience, and job classification. As stated above, region of the US was also included in the regression. The analysis includes four models. The first model includes the variables for type of change. In the second model, the variables primary reason for attending the training course were included. Additionally, the number of training course attended over the previous 12 months was included in the model. The third model includes experience and the fourth model includes job classification and regions. The variable for experience included the square of OSH work experience, square of current job tenure, and square of age. These are not reported in the table because there were no significant differences by adding these variables in the analysis. Regions are not reported in the table, although there was a statistically significant difference in regions seven and eight. The results of the first regression between the dependent variable "expected to make a change in workplace practice" and a series of independent variables are displayed in Table 29.

The first variable, type of change, looked to identify if trainees expected to make a change in the elements of the hierarchy of controls. These include changes in engineering controls, policy, and personal protective equipment. It would be expected

that personal protective equipment would have the highest positive difference, followed

by policy, and then engineering controls. The reason for this is that changes to PPE are

the easiest changes to make, and have lowest cost associated with the change. It also does

not take a lot of time to make changes to PPE. The most difficult a type of control to

make is engineering controls. These include changes to the facility (i.e., change of

ventilation systems) that may cost significant financial and time resources. The first

model included just the types of changes. The regression shows that those who responded

to making a change in policy have a difference of 30.5%, relative to those who did not

make any type of change, of expecting to make a work place change. This difference is

statistically significant at the 5 percent level and remains statistically significant in each

of the four models. It was expected that PPE would be the highest positive change. This

was not the case. A reason for policy being the most significant difference is that trainees

are reasonably experienced, with the average age of the participants being 45.6 years of

age, the average tenure in their current job is 10.2 years, and the average tenure in OSH is

13.19 years. The type of participant who typically attend NIOSH ERC courses are

managerial level, and have the ability to make changes to policies.

The second variable of interest was the primary reason for attending the training.

The responses included training is required, improves the safety of others, self-

improvement, beneficial to employer, and reduces injuries and illnesses. The regression

omitted the variable reduces injuries and illnesses. It would be expected that 'training is

required' would be the reason that made the largest negative difference in expectation to

make a change. The key informant interviews identified that people attend typically

participate in training because they are required to attend, not because they have a need or

want to learn new skills or knowledge. Those who are required to attend, have less interest to be at the course, and may be less motivated to make changes at the workplace. Those attending because they will gain a self-improvement (i.e., increase knowledge and skills) should have a positive difference in expectation to change workplace practice. Those who attend to improve the safety of others should have the largest difference in expectation to make a change. The reason for this is that they are motivated to help others, and a way to do that is by making changes that will make the workplace safer for all. The analysis confirms that those who selected improving the safety of others as the primary reason for attending training have a difference of 15.9%, relative to reducing injuries and illnesses, of expecting to make a change in the workplace. Those that selected training is required as the primary reason for attending training had a -12.6% difference, relative to reducing injuries and illnesses, of expecting to make a change in the workplace. Both of these are statistically significant at the 5 percent level. In models three and four, training is required remains statistically significant at the 1 percent level and improves the safety of others is not statistically significant.

The third variable, also included in the second model, was the number of training courses in which the respondent participated in the last 12 months. It would be expected that the more courses taken, the higher motivated that the individual is, so that it would be expected that as the number of courses increases, the change in expectation to make changes at the workplace would also increase. The analysis confirms that as the number of courses taken in the last year increased, the expectation to make a workplace change increases by 4.7%. This is statistically significant at the 5 percent level, and remains statistically significant in models three and four at the 1 percent level.

The fourth variable, experience, included number of years experience in OSH, number of years in current job, and age. The square of each of these values was also included. It is expected that the more experience the participant has, the less likely they would be expecting to make changes to their workplace practice. As participants are in their job for longer periods of time, they may feel that they have been operating a safe workplace, and are less likely to see the need for a change. These expectations are confirmed, as there is a negative difference between the experience variables and expectation to make changes in workplace practice. However, none of these variables were statistically significant. There was no statistical significance in any of the squared variables and they were not included in the table.

The fifth variable included the job classifications of the participants of the survey. It was anticipated that there would be no differences between the job classifications in terms of expected workplace changes. There were small differences between the job classifications, however, none were statistically significant.

The results of the second regression between the dependent variable "intended changes made due to knowledge and/or skills learned in the course" and the same series of independent variables. The analysis includes the same four models described above. The results are not included, as there was little or no explanatory value of the regression. A reason for this may be that there were not enough cases in the regression, or that there is no information on those that responded "no" to the question about intention to make change for those that actually made changes in their workplace practice.

Table 29: Regression models on intention to make changes to workplace practice based

on the knowledge and/or skills learned in the course (n=201)

Model	1		2		3		4	
	B	SE	B	SE	B	SE	B	SE
Type of Change								
Engineering Control	.130	.080	.098	.080	.116	.090	.081	.095
Personal Protective Equipment	.102	.074	.074	.073	.065	.085	.073	.088
Policy	.305**	.061	.284**	.061	.310**	.071	.333**	.075
Reason for attending training								
Training is required			-.126**	.058	-.137*	.070	-.126*	.073
Improves the safety of others			.159**	.081	.140	.101	.164	.104
Self improvement			-.100	.112	-.127	.138	-.103	.141
Beneficial to employer			-.068	.125	-.166	.142	-.224	.145
Number of training courses in last year			.047**	.015	.035*	.019	.033*	.020
Experience								
OSH Work experience					-.012	.013	-.009	.013
Current job tenure					-.0005	.014	-.006	.014
Age					-.035	.028	-.033	.028
Job classification								
Occupational Safety							-.063	.085
Industrial Hygienist							.048	.109
Environmental Scientist/Technician							-.146	.144
Occupational Medicine/Nursing							-.083	.121
Constant	.574**	.031	.499**	.056	1.409**	.616	1.321**	.635

* statistically significant at 1 percent level; ** statistically significant at 5 percent level.
The models exclude variables "reduces injuries and illness" within the category "reason
for attending training" and "other" in category "job classification.

The data were collected with the potential answers to the questions being either, "yes", "no", or "no changes needed". The initial data analysis included "no changes needed" as "no", and is included in Table 29. The data were analyzed again, without including those answering "no changes needed". Those data were re-coded to be system missing. The results of these data are included in Table 30.

The results show that those who responded that they made a change in policy had a difference of 28.2% relative to those who did not make any change, of expecting to make a change in the workplace due to training. The difference is statistically significant at the 1 percent level and remains statistically significant in all four models. The same is true for those indicating a change in personal protective equipment. Those who changed their PPE use had a difference of 20.9% relative to those who did not make a change in PPE use, of expecting to make a change in workplace practice due to training. This difference is statistically significant at the 5 percent level, and remains statistically significant in all four models. Those who made a change to the engineering controls had a difference of 13.9% relative to those who did not make any change. This is not statistically significant.

The other models, which in addition to type of change include reason for attending training (model 2), experience (model 3), and job classification (model 4) are not different than the data presented in Table 29. The only statistically significant finding in the other models is that training being required has a negative effect on intention to make a change, relative to reduces injuries and illnesses.

The data show that those who make a change to their workplace practice, as measured by a change of their use of PPE, change of a workplace policy, or change of an engineering control, have a higher intention to change their workplace practice.

Table 30: Regression models on intention to make changes to workplace practice based on the knowledge and/or skills learned in the course, "no changes needed" excluded.

Model	1		2		3		4	
	B	SE	B	SE	B	SE	B	SE
Type of Change								
Engineering Control	.139	.107	.107	.107	.091	.116	.065	.122
Personal Protective Equipment	.209*	.094	.228*	.093	.251*	.105	.226*	.109
Policy	.282**	.093	.266**	.093	.358**	.106	.395**	.115
Reason for attending training								
Training is required			-.222*	.086	-.233*	.100	-.239*	.106
Improves the safety of others			.136	.125	.000	.158	-.011	.165
Self improvement			-.100	.157	-.101	.158	-.089	.162
Beneficial to employer			.354	.208	.324	.237	.288	.252
Number of training courses in last year			.017	.025	.020	.027	.031	.029
Experience								
OSH Work experience					-.004	.006	-.005	.007
Current job tenure					-.001	.006	-.002	.006
Age					.001	.006	.004	.007
Job classification								
Occupational Safety							-.148	.124
Industrial Hygienist							-.184	.152
Environmental Scientist/Technician							-.122	.312
Occupational Medicine/Nursing							-.241	.160
Constant	.547 *	.062	.515 *	.087	.447	.261	.451	.286

* statistically significant at 1 percent level; ** statistically significant at 5 percent level. The models exclude variables "reduces injuries and illness" within the category "reason for attending training" and "other" in category "job classification.

Demographics of study participants

The participants of the national survey were distributed across the United States. As noted above, other ERCs have provided email addresses of the participants of their training programs. Table 30 displays the geographical distribution of survey participants. The years of experience of the participants ranged from less than 1 year to more than 35 years of experience in occupational safety and health. The mean number of years experience in OSH is 13.72 years. Of the participants 33% had five years or less experience in OSH, and 53% had 10 years or less experience in OSH. Eighteen percent had over 25 years experience. Additionally, the participants reported the number of years they are in their current position. The range was from less than one year to more than 35 years experience in their current job. The mean number of years in their current job is 10.74 years. Fifty percent of the participants had five years or less of experience, and 64% had ten years or less experience in their current job. Eleven percent had over 25 years of experience in their current job.

The participants have attended a varying amount of training programs over the last year. The range is from one course attended to over 10 courses attended in the previous year. Thirty-one percent have taken only one training course, while 84% have taken four or fewer courses.

Table 31: Region in which participants are employed (N=268)

	N	%
Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont)	2	1
Region 2 (New Jersey, New York, Puerto Rico, US Virgin Islands)	55	21
Region 3 (Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, West Virginia)	7	3
Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee)	50	19
Region 5 (Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin)	35	13
Region 6 (Arkansas, Louisiana, New Mexico, Oklahoma, Texas)	4	1
Region 7 (Iowa, Kansas, Missouri, Nebraska)	2	1
Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming)	64	24
Region 9 (Arizona, California, Hawaii, Nevada)	37	14
Region 10 (Alaska, Idaho, Oregon, Washington)	12	4

The core disciplines in the NIOSH ERC training programs address industrial hygiene, occupational safety, occupational medicine, and occupational health nursing. Other non-core disciplines are also included in the ERCs. Analysis of the other category identified environmental scientists, environmental technicians, and trainers/educators as categories of others who have participated ERC training programs. The classifications of work discipline selected by the participants are displayed in Table 31.

Table 32: Classification of work discipline

	n	%
Occupational safety	115	42
Industrial hygiene	44	16
Occupational health nurse	38	14
Occupational physician	4	1
Environmental Scientist	16	6
Environmental Technician	14	5
Trainer/Educator	8	3
Other	37	13
Total	276	100

The age of the trainees who participated in the survey ranged from 23 to older than 70. The mean age was 28.71 years. The age distribution is displayed in Table 32.

Table 33: Age of trainees (N=264)

Age	%
21-25	4
26-30	7
31-35	11
36-40	13
41-45	9
46-50	17
51-55	17
56-60	16
61 and older	6

Chapter 5: Discussion

The research conducted utilized several methods to understand the effectiveness of training in OSH on workplace practice. The policies developed through the OSH Act in 1970 to create ERCs are effective in providing training programs that have a positive impact on workplace practices. The training provided by ERCs is effective in increasing knowledge, skills, and workplace practice.

This research sought to identify how the ERCs are meeting their policy mission to train OSH professionals, identify the impact they have on workplace practice, and what changes are needed to improve the ERCs. The ultimate objective was to link training courses to improved workplace outcomes, specifically a reduction in injury and illness. The research utilized four different types of data collection to understand the effectiveness of training provided by the ERCs. The types of data collection were a literature review, key informant interviews, pre/post training/follow-up assessment, and a post training assessment. The results of the different types of data collected indicate that the ERCs are important for OSH workforce development. Training provided by the ERCs is effective in producing changes in workplace behavior. The training programs provide an increase in knowledge and skills that are able to motivate workers to change their workplace practice. The change in workplace practice improves the safety conditions at the workplaces, and in turn, may reduce the injuries and illnesses that occur at workplaces.

The results of the key informant interviews indicated that ERCs are valuable entities that provide training and education to the occupational health and safety workforce. The ERCs provide quality training programs that include essential safety and

health information. The ERC CE programs provide valuable knowledge and skills that can be applied at the workplace. The information learned by course participants contributes to the reduction in injuries and illnesses seen at the workplace. However, barriers exist at workplaces that limit the impact that training has on workplace practice. The culture of the workplace has an effect on how trainees can make positive changes in workplace practice. There must be a culture that is accepting of change, and that supervisors and management are open to reviewing their safety practices. Additional barriers include budget and time. It was reported that some companies do not have the financial ability to purchase new equipment, and will continue working with the equipment they currently have. Additionally, some employers need to complete a job in a short period of time, and do not include the safety functions necessary to provide for the safety of their employees.

The key informants also felt that regulation was the primary reason that organizations send their employees to OSH training courses. It was reported that some employees want to "do the right thing", and ensure that their employees are trained appropriately. Similarly, the key informants reported that individuals attend training to comply with regulations. Individuals are also motivated to attend to increase their knowledge and skills.

The three-part survey conducted in Phase 3 included a pre-course readiness assessment, post-course assessment, and 3-month follow-up assessment. The pre-course readiness assessment identified that training was effective in increasing OSH knowledge and skills. This is confirmed by the post-course assessment where trainees felt that the courses increased their OSH knowledge and skills, the course motivated trainees to

identify changes at their workplace, helped them identify that areas for improvement, and that trainees expected to make changes at their workplace. The 3-month follow-up survey showed that many trainees did make changes based on the information that was learned in the training courses.

The results of the national survey of ERC participants identified that the primary reason for attendance at OSH training courses is that they are required by regulation. Although the requirement by regulation was the primary reason participants attend training, they had also selected other reasons for attending the training. These are similar to the ones identified by the key informants, including increasing safety and health knowledge and skills, reducing injuries or illnesses, and that the course provides a benefit to the trainee. It is interesting to note that when ranking how much a participant agreed with specific reasons for attending training, "required by regulation" was the lowest ranked. However, when asked specifically their primary reason for attendance at the training program, required by regulation was the highest rated response.

Utilizing the Theory of Planned Behavior is an appropriate way to identify the types of changes made that have a directly attribution to the training provided. At the conclusion of the training, each trainee can identify the types of changes they expected to make when returning to the workplace based on what knowledge and skills were learned in the training. A follow-up at some point after the training will identify if any of the changes were made. By having the participants identify the changes they intend to make based on what was learned in the training, a more direct link between training and changes made in workplace practice may be made. There are barriers and encouragements at the workplace that effect the way that employees are able to

implement intended changes. The barriers and encouragements range from supervisor support to financial issues to time required to implement changes. Many of the barriers and encouragements are not in the control of the employee, and will have an impact on whether the intended changes will be made.

RESEARCH QUESTION 1

How have the ERCs met the policy mission of "providing education and training in OSH, increasing the number of trained professionals in occupational medicine, occupational health nursing, industrial hygiene, and occupational safety?

The ERCs have been effective in providing education and training to these worker populations. The mission of the ERCs is to provide graduate level training to increase the number of professionals in the core disciplines, and to provide continuing education to these professionals so that they retain or increase their knowledge in their professional practice. The ERCs have provided graduate education to 16,628 between 1977 and 2010. The 17 ERC continuing education programs, on average, provide over 1,350 courses to over 36,000 OSH professionals each year. A continuing demand for OSH professionals is reported by the US Bureau of Labor Statistics, and the programs offered through the ERCs is one way of meeting that projected demand. The ERCs are also one of the few training entities that provide cross-training in the core OSH disciplines. Interdisciplinary training is a requirement of ERCs, and provides the opportunity for occupational medicine residents to interact with industrial hygiene faculty and students in training and research. The ERCs address OSH training and research in a cross cutting and integrated manner, intended to result in cross fertilization among the various disciplines and impact safety and health practice and research. The interdisciplinary education provided to ERC

students in OSH training programs is an essential element for a well-rounded education.

RESEARCH QUESTION 2

What effect does training provided by the ERCs have on the practice of OSH in the United States?

This research has demonstrated that training provided by the ERCs has a positive effect on the practice of OSH in the US. All three phases of the research identified the value of the ERCs. The key informants identified that ERCs have faculty that are highly educated, leaders in the OSH field, and generate knowledge for the OSH system. The two-tiered approach of ERCs for safety and health training is important to effectively teach OSH. The CE that ERCs provide is effective in producing changes in the workplace. Participants in the research identified that the training courses provided them with new OSH knowledge and skills, and they are motivated to identify changes in their work. The participants in the ERC CE courses expect to make changes at their workplace about OSH issues after they have taken the training through the CE programs of the ERCs. The changes that were expected ranged from implementing new policies and procedures, communicating effectively with others at their workplace, and better understanding hazards associated with their work. The three-month follow-up survey identified that 75% of the respondents made the changes they reported they would make at the end of the training program. An additional 47% made other changes, they we not expected at the end of the training. These improvements in workplace practice should have a positive effect on the health and safety of the workers in these facilities.

The national survey identified five themes in which participants in the CE program intended to make changes. These themes were awareness, policy, procedure,

training and management. The types of changes made that are attributable to the training include that workers are better prepared to discuss safety and health issues with their supervisors, are better prepared to improve safety and health issues at the workplace, and make better safety and health decisions. Participants also felt they have the ability to correct safety and health issues at their workplace and make changes to a workplace safety and health policy. The ability to act on information learned in the training courses will have a significant impact on workplace practices. If the course participants feel empowered to make changes at their workplace, there is a better chance that these changes will actually be made. And if changes are made that improve safety and health work practices, then the risk of injury and illness to workers will be reduced.

RESEARCH QUESTION 3

Have the ERC trainings kept up-to-date with improvements in technology and changes in OSH legislation? If not, what changes need to be made for the ERCs to fulfill the intended policy goals set out for workplace safety and health?

A problem the ERCs face to keep up with technology is the lack of funding to maintain existing or purchase new equipment, or to invest in new technologies to provide OSH training. Several ERC CE programs have initiated the development of online training for several courses. However, the lack of funding has hampered the efforts to develop robust distance learning courses. The lack of expertise at ERCs in distance learning course development may also be a limiting factor. A third issue with distance learning as a modality for OSH training is that many courses have hands-on skills-building components, and distance learning is not the appropriate method for teaching these skills.

The ERCs are effective in teaching new legislation, and developing courses that enable workers to comply with new regulations. An example given by one of the key informants was that the ERCs were leaders in providing information to the automobile industry to make changes to their ergonomic programs. Additionally, ERC faculty were leaders in development of training courses in hazardous waste, asbestos, lead and other safety and health issues.

The ERCs are a market driven entity, especially for the delivery of CE courses. In order for the CE program to be effective, they must understand what the OSH profession needs to learn, and how to effectively present the information that will encourage changes to occur in the workplace. The CE programs must keep current with legislative and regulatory changes in in order to keep the training programs current with appropriate information. Additionally, the CE programs must be aware of the types of training needed in order to continually meet the changing needs of the OSH market.

An issue with the ERC CE programs is the lack of effective distance education programs. The cost to develop an effective program is high, and the ERCs have very little flexibility in their budgets to develop these types of programs.

The training provided by the ERCs effectively leads to changes in workplace practice. Training increases knowledge and improves skills of participants, and encourages participants to assess the health and safety conditions at their workplace. Training provides knowledge and skills so that participants can identify specific changes needed in their workplace. Additionally, training provides the skills so that participants are able to implement workplace changes. Training makes a difference in participants who indicated they did not expect to make changes to their workplace practice. Twenty-

five percent of those participants did change the way they address safety and health

hazards at the workplace. In addition, participants who indicated they did not expect to

make a change state that training has increased their knowledge and skills, provided

useful information that is applicable to their job, assists in making their job safer, and

reinforces knowledge and skills already in place. Participants who did expect to make a

change also indicated that training has increased their knowledge and skills, provided

useful information that is applicable to their job, assists in making their job safer, and

reinforces knowledge and skills already in place. The percent for those that expected to

make a change are higher than those that did not expect to make a change.

Training is a key element of any safety and health program. The research

conducted shows that training makes a difference in the way that workers address safety

and health issues at their workplace. Because training increases knowledge and skills,

improves awareness of hazards, and changes the way that workers address safety and

health issues at their workplace, training should have an impact on lowering injury and

illness rates, thereby making the workplace a safer place for all workers.

FUTURE RESEARCH

The impact of training programs on worker safety and health should continue to

be a focus of research. The federal government provides funding to universities, unions,

and other organizations to provide OSH training programs to various worker populations.

It is important to identify how the programs impact worker safety and health. Identifying

a link between training and reduction of workplace injuries, illness, and fatalities is a

difficult link to make without conducting follow-up surveys of workers at their

workplace. Follow-up surveys can provide evidence of the impact training programs have

on workplace safety. They can identify whether workers have implemented knowledge and skills learned in training programs. Long-term workplace follow-up surveys can identify if cohorts of trainees have made an impact on injury and illness rates. This would be possible only if many employees from the same organization participated in the same training programs.

Research should also identify what types of training is needed to ensure that competencies of the OSH workforce are met. NIOSH recently completed a National Assessment of the Occupational Safety and Health Workforce that assessed the current and future demand of OSH professionals, and determined the desired professional competencies required for the next five years (NIOSH 2011). The assessment identified that the workforce would expect to hire 25,000 OSH professionals over the next five years. Many of these professionals will be required to attend continuing education courses to maintain their license or certification. Identifying the types of training needed is important to understand how OSH programs can continue to be effective in protecting workers. The NIOSH assessment identified that OSH employers have the need for employees to learn leadership and communication skills. Continuing education programs developed in these content areas may help meet the needs identified in the survey. Follow-up studies should also be developed to identify if increased training in leadership and communication impacts safety and health of the workers.

Additional research areas should focus on the effectiveness of various teaching methodologies. This research identified several types of training that are offered by the ERCs. Participants in the surveys have indicated that hands-on training is the most effective type of training. Specific follow-up surveys can be conducted to identify if

training methodology had an impact on the way workers implement OSH training in the workplace.

Other areas of research include identification of economic benefits of providing workplace safety and health training. Conducting a cost-benefit analysis of training for an organization can include many of the factors previously mentioned. The cost-benefit analysis can include the costs associated with training, including time away from the workplace, lost production due to training, cost of training, and others versus the benefits of training, including potential new skills and knowledge that can improve workplace safety, reduction of workers compensation costs, and others.

Further research will include identifying a strong link between OSH training and workplace practice. This research will survey cohorts of trainees from one organization, and following them in their workplace to determine how the training has impacted workplace practice. The types of surveys to be completed will be similar to the ones completed in this research. Starting with a survey that identifies workplace readiness for change before training takes place, followed by a post course evaluation to identify what changes are expected to be implemented, followed by follow-up surveys to identify how training has impacted their workplace practice. Since this survey will be conducted with a cohort that attended training from one organization, the follow-up will be conducted over a longer period of time to identify if the training will have long term effectiveness. The research completed only followed-up at three months to identify if the changes that were expected to be made were implemented. A longer term follow-up will identify what impacts changes that were made had on workplace injury and illness rates, workers compensation rates, and other metrics. In addition, in-depth interviews can be conducted

with those that participated in the training to identify what changes have occurred over time, and how changes made have made a difference in the workplace. These types of surveys are important to identify the cost-benefit of training, and show that training does have a positive effect of the individual workers and on workplaces.

Appendix 1: Key Informant Interview Questions

1. What motivation do firms have to send workers to training?

2. What benefits do firms have when workers receive training?

3. What benefits do individuals have when receiving training?

4. How do you identify workplace changes that are related to the training workers have received?

5. How much of the training has been implemented? How do you know?

6. Do you think training is effective in changing workplace behavior?

7. Do you think training helps reduce injuries and illness? How and why?

8. Some training programs are intended to provide skills to workers that do not have formal education in a particular discipline. For example, workers may be conducting industrial hygiene duties without being formally trained as an industrial hygienist. How do you ensure they receive the IH skills to conduct their duties effectively?

9. How do you evaluate the training that workers have received?

10. What are the elements of effective training?

11. How do you measure the transfer of training to the workplace?

12. How have the (Education and Research Centers (ERCs) met the policy mission of "providing education and training in occupational safety and health, increasing the number of trained professionals in occupational medicine, occupational health nursing, industrial hygiene, and occupational safety"?

13. What measures do ERCs use to assure that they have met the standards of the federal requirements?

14. What effect does training provided by the ERCs have on the practice of occupational safety and health in the United States?

15. Have ERC trainings kept up-to-date with improvements in technology and changes in occupational safety and health legislation? If not, what changes need to be made for the ERCs to fulfill the intended policy goals set out for workplace health and safety?

16. What questions should be asked of those who have completed training to identify the effectiveness of the training they received?

Appendix 2: Survey Instruments

SURVEYS OF NATIONAL ERC STUDENTS

z o o m e r a n g

Occupational Safety and Health Training

Created: May 31 2011, 8:10 AM
Last Modified: July 18 2011, 8:05 AM
Design Theme: Basic Blue
Language: English
Button Options: Labels
Disable Browser "Back" Button: False

Occupational Safety and Health Training

Page 1 - Heading

As part of my dissertation, I appreciate being able to ask you questions about training, evaluation of training programs, and specifically about the NIOSH Education and Research Center training programs. Your answers will help me understand the effectiveness of the training programs, and how they may be improved to help ensure worker safety. If you are willing to participate in this interview, it will take less than 15 minutes. You may choose not to answer any questions that make you uncomfortable and you may withdraw from this study at any time. It will be conducted entirely through a web based survey instrument. This survey is confidential. Your name and anything that can identify you will be kept secret. Your answers will be summarized with those of other workers. I will not talk to anyone about what you said or let anyone know that you said what you said in any report. Your participation is voluntary. It is totally up to you whether to participate in this survey. I am unable to provide material benefits or money for your participation. If you have any questions about the study, please contact: Mitchel Rosen at 732-235-9452 or mrosen@umdnj.edu. My mailing address is UMDNJ-School of Public Health, 683 Hoes Lane West, Piscataway, NJ 08854. If you have any questions about your rights as a research subject, you may contact the Sponsored Programs Administrator at Rutgers University at: Rutgers University Institutional Review Board for the Protection of Human SubjectsOffice of Research and Sponsored Programs3 Rutgers PlazaNew Brunswick, NJ 08901-8559Tel: 732-932-0150 ext. 2104Email: humansubjects@orsp.rutgers.edu

Page 1 - Heading

This informed consent form was approved by the Rutgers University Institutional Review Board for the Protection of Human Subjects on 9/18/2010; approval of this form expires on 5/16/2012.

Page 1 - Heading

Please print a copy of this page for your records.

Page 1 - Question 1 - Yes or No   [Mandatory]

I agree to participate in this survey

    ○ Yes [Skip to 2]
    ○ No [Skip to End]

Page 2 - Heading

Please rate the following items related to reasons why you attend occupational safety and health training courses.
1=Strongly AGREE, 7=Strongly DISAGREE

Page 2 - Question 2 - Rating Scale - Matrix

I attend training because

	Strongly AGREE	2	3	4	5	6	Strongly DISAGREE
Training is required by regulation	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7
Training is beneficial to me	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7
Training is beneficial to my employer	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7

Training will help me improve the safety of others	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7
Training helps reduce injuries and illnesses	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7
Training increases my safety and health knowledge	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7
Training increases my safety and health skills	○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7

Page 2 - Question 3 - Choice - One Answer (Bullets)

Of the following, please choose your primary reason for attending training

- ○ Training is required by regulation
- ○ Training is beneficial to me
- ○ Training is beneficial to my employer
- ○ Training will help me improve the safety of others
- ○ Training helps reduce injuries and illnesses
- ○ Training increases my safety and health knowledge
- ○ Training increases my safety and health skills
- ○ Other, please specify

....

Page 3 - Question 4 - Yes or No   [Mandatory]

At the conclusion of the training program, did you intend to make changes to your workplace practice based on the knowledge and/or skills learned in the course?

- ○ Yes [Skip to 4]
- ○ No [Skip to 5]

Page 4 - Question 5 - Open Ended - Comments Box

What changes did you intend to make?

....
....
....
....

Page 4 - Question 6 - Yes or No

Did you implement the change(s) you intended at the conclusion of the training program?

- ○ Yes
- ○ No

Page 5 - Question 7 - Rating Scale - One Answer (Horizontal)

I am able to implement knowledge and skills that I learned in training at my workplace

Strongly AGREE	2	3	4	5	6	Strongly DISAGREE
○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7

Page 5 - Heading

Please rate the following items related to the occupational safety and health training course(s) you attended.
1=Strongly AGREE, 7=Strongly DISAGREE

Page 5 - Question 8 - Rating Scale - Matrix

Due to the training I received

	Strongly AGREE	2	3	4
I am better prepared to discuss safety and health issues with my supervisor	○ 1	○ 2	○ 3	○
I am better prepared to improve safety and health issues at my work site	○ 1	○ 2	○ 3	○
I am able to make better safety and health decisions	○ 1	○ 2	○ 3	○
I am able to identify a safety or health issue that may have caused an injury or illness	○ 1	○ 2	○ 3	○
I am able to correct a safety or health issue that may have caused an injury or illness	○ 1	○ 2	○ 3	○
I am able to change a workplace safety and health policy	○ 1	○ 2	○ 3	○

Page 5 - Question 9 - Yes or No   [Mandatory]

Did the training change the way you address safety and health hazards at the workplace?

- ○ Yes [Skip to 6]
- ○ No [Skip to 7]

Page 6 - Question 10 - Open Ended - Comments Box

Please give a specific example of what you learned in the training that changed the way you address safety and health hazards.

....
....
....
....

Page 7 - Question 11 - Yes or No   [Mandatory]

Do you typically talk to co-workers about safety and health issues?

- ○ Yes
- ○ No [Skip to 9]

Page 8 - Question 12 - Choice - Multiple Answers (Bullets)

Which co-workers do you typically talk to about safety and health issues?(Select all that apply)

- ☐ Co-worker with similar job title
- ☐ Subordinate
- ☐ Supervisor
- ☐ Manager
- ☐ Director
- ☐ Senior Management
- ☐ Other, please specify

....

Page 9 - Question 13 - Choice - One Answer (Bullets)

After attending the training course, did you make a change in a safety and health engineering control?

- ○ Yes
- ○ No
- ○ No changes were needed

Page 9 - Question 14 - Choice - One Answer (Bullets)

After attending the training course, did you make a change in personal protective equipment (PPE) provided to you or others at your worksite?

○ Yes
○ No
○ No changes were needed

Page 9 - Question 15 - Choice - One Answer (Bullets)

After attending the training course, did you make a change in workplace safety and health procedures or policies?

○ Yes
○ No
○ No changes were needed

Page 9 - Question 16 - Choice - One Answer (Bullets)

After attending the training course, did you use information from the training to educate others at your worksite?

○ Yes
○ No

Page 10 - Question 17 - Yes or No   [Mandatory]

Do you experience any barriers at the workplace that impede your ability to implement what you have learned in your training course?

○ Yes [Skip to 11]
○ No [Skip to 12]

Page 11 - Question 18 - Open Ended - Comments Box

Please list all the barriers to implementing change in occupational safety and health that exist at your work place.

....
....
....
....

Page 11 - Question 19 - Yes or No

Did these barriers to implementing what you learned have an affect on your safety and health?

○ Yes
○ No

Page 11 - Question 20 - Rating Scale - One Answer (Horizontal)   [Mandatory]

The training I received provided me with knowledge and skills to overcome those barriers

Strongly agree	2	3	4	5	6	Strongly disagree
○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7

[Skip Unconditionally to 13]

Page 12 - Question 21 - Open Ended - Comments Box

Please list all the work place conditions that enabled you to implement changes in occupational safety and health at your work place.

....
....
....
....
....

Page 13 - Question 22 - Rating Scale - One Answer (Horizontal)

I learn more in training programs that are highly interactive

Strongly agree	2	3	4	5	6	Strongly disagree
◐ 1	◯ 2	◯ 3	◯ 4	◯ 5	◯ 6	◯ 7

Page 14 - Heading

In the training courses in which you participated, several teaching methods were utilized. In thinking about those methods, please rate how much you agree with the following statements:
1=Strongly AGREE, 7=Strongly DISAGREE

Page 14 - Question 23 - Rating Scale - Matrix

	Strongly AGREE	2	3	4	5	6	Str
Hands-on training is effective in teaching safety and health	◐ 1	◯ 2	◯ 3	◯ 4	◯ 5	◯ 6	
Small group discussions are effective in teaching safety and health	◯ 1	◯ 2	◯ 3	◯ 4	◯ 5	◯ 6	
Lectures are effective in teaching safety and health	◯ 1	◯ 2	◯ 3	◯ 4	◯ 5	◯ 6	
Demonstrations are effective in teaching safety and health	◯ 1	◯ 2	◯ 3	◯ 4	◯ 5	◯ 6	

Page 14 - Question 24 - Choice - One Answer (Bullets)

When thinking about the training you received, which method was most effective for you to retain the information?

- ◯ Hands-on training
- ◯ Small group discussions
- ◯ Lectures
- ◯ Demonstrations
- ◯ Other, please specify

....

Page 15 - Question 25 - Yes or No   [Mandatory]

Is Personal Protective Equipment (PPE) needed for the type of work you do?

- ◯ Yes [Skip to 16]
- ◯ No [Skip to 17]

Page 16 - Question 26 - Yes or No

Do you have the proper PPE available to you at your workplace?

- ◯ Yes
- ◯ No

Page 16 - Question 27 - Yes or No

Did the training make you aware of PPE needed in the workplace?

○ Yes
○ No

Page 16 - Question 28 - Yes or No

Did the training provide additional information on PPE that will change the way you use PPE?

○ Yes
○ No

Page 17 - Question 29 - Rating Scale - Matrix

Please rate the following items related to the occupational safety and health training course(s) you attended.

1=Strongly AGREE, 7=Strongly DISAGREE

The training I attended

	Strongly AGREE	2	3	4	5	
Increased my knowledge regarding an occupational safety and health issue	● 1	○ 2	○ 3	○ 4	○ 5	
Increased my skills regarding an occupational safety and health issue	○ 1	○ 2	○ 3	○ 4	○ 5	
Provided useful information that is applicable to my job	○ 1	○ 2	○ 3	○ 4	○ 5	
Helped me do my job better	○ 1	○ 2	○ 3	○ 4	○ 5	
Reinforced knowledge and skills already in place at my workplace	○ 1	○ 2	○ 3	○ 4	○ 5	

Page 17 - Question 30 - Choice - One Answer (Bullets)

How often have you referred back to the materials you received in the training course?

○ Never
○ Once
○ A few times
○ Many times

Page 18 - Question 31 - Choice - One Answer (Drop Down)

Please select your primary work region

○ Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont)
○ Region 2 (New Jersey, New York, Puerto Rico, US Virgin Islands)
○ Region 3 (Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, West Virginia)
○ Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee)
○ Region 5 (Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin)
○ Region 6 (Arkansas, Louisiana, New Mexico, Oklahoma, Texas)
○ Region 7 (Iowa, Kansas, Missouri, Nebraska)
○ Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming)
○ Region 9 (Arizona, California, Hawaii, Nevada)
○ Region 10 (Alaska, Idaho, Oregon, Washington)

Page 18 - Question 32 - Choice - One Answer (Drop Down)

How many years of work experience do you have in occupational safety and health?

- ○ Less than 1
- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ 7
- ○ 8
- ○ 9
- ○ 10
- ○ 11
- ○ 12
- ○ 13
- ○ 14
- ○ 15
- ○ 16
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- ○ 26
- ○ 27
- ○ 28
- ○ 29
- ○ 30
- ○ 31
- ○ 32
- ○ 33
- ○ 34
- ○ 35
- ○ More than 35

Page 18 - Question 33 - Choice - One Answer (Drop Down)

How many years have you been employed in your current job?

- ○ Less than 1
- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ 7
- ○ 8
- ○ 9
- ○ 10
- ○ 11

○ 12
○ 13
○ 14
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○ 16
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○ 26
○ 27
○ 28
○ 29
○ 30
○ 31
○ 32
○ 33
○ 34
○ 35
○ More than 35

Page 18 - Question 34 - Choice - One Answer (Drop Down)

How many safety and health training courses have you attended in the last year?

○ 1
○ 2
○ 3
○ 4
○ 5
○ 6
○ 7
○ 8
○ 9
○ 10
○ More than 10

Page 18 - Question 35 - Choice - One Answer (Bullets)

Which of the following classifications best describes your work discipline?

○ Industrial hygiene
○ Occupational safety
○ Occupational physician
○ Occupational health nurse
○ Other, please specify

What is your age?

- ○ 18
- ○ 19
- ○ 20
- ○ 21
- ○ 22
- ○ 23
- ○ 24
- ○ 25
- ○ 26
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- ○ 57
- ○ 58
- ○ 59
- ○ 60
- ○ 61
- ○ 62
- ○ 63
- ○ 64
- ○ 65
- ○ 66
- ○ 67
- ○ 68

- ○ 69
- ○ 70
- ○ Older than 70

Thank You Page

Thank you for participating in this survey.

Mitchel A. Rosen

Screen Out Page

Standard

Over Quota Page

Standard

Survey Closed Page

Standard

SURVEYS – PRE-TRAINING, POST-TRAINING, FOLLOW-UP

Pre-course evaluation: Readiness for training

Question 1

Occupational safety and health training is beneficial to me

Strongly agree	2	3	4	5	6	Strongly disagree
○	○	○	○	○	○	○

Question 2

I value training as a way to improve my safety and health

Strongly agree	2	3	4	5	6	Strongly disagree
○	○	○	○	○	○	○

Question 3

Providing training to employees is beneficial to my work employer

Strongly agree	2	3	4	5	6	Strongly disagree
○	○	○	○	○	○	○

Question 4

My employer values training as a way to improve employee safety and health

Strongly agree	2	3	4	5	6	Strongly disagree
○	○	○	○	○	○	○

Question 5

Training is important to improve safety and health within an organization

Strongly agree	2	3	4	5	6	Strongly disagree
○	○	○	○	○	○	○

Question 6

Training helps me make decisions that effect my safety

Strongly agree	2	3	4	5	6	Strongly disagree
○	○	○	○	○	○	○

Question 7

Training helps me make decisions that effect the safety of co-workers

Strongly agree	2	3	4	5	6	Strongly disagree
○	○	○	○	○	○	○

Question 8

I will be more effective at my job as a direct result of the training I receive

Strongly agree	2	3	4	5	6	Strongly disagree
○	○	○	○	○	○	○

Question 9

Training will help me approach the way I work more safely

Strongly agree	2	3	4	5	6	Strongly disagree
○	○	○	○	○	○	○

Question 10

Training is an effective way to improve my safety and health knowledge

Strongly agree	2	3	4	5	6	Strongly disagree
○	○	○	○	○	○	○

Question 11

Training is an effective way to improve my safety and health skills

Strongly agree	2	3	4	5	6	Strongly disagree
○	○	○	○	○	○	○

Question 12

Training is an effective way to improve my attitude about the importance of safety and health

Strongly agree	2	3	4	5	6	Strongly disagree
○	○	○	○	○	○	○

Heading

Please rate the following items related to reasons why you attend occupational safety and health training courses.

Question 13

I attend training because it is required by regulation

Strongly agree	2	3	4	5	6	Strongly disagree
○	○	○	○	○	○	○

Question 14

I attend training because it is beneficial to me

Strongly agree	2	3	4	5	6	Strongly disagree
○	○	○	○	○	○	○

Question 15

I attend training because it is beneficial to my employer

Strongly agree	2	3	4	5	6	Strongly disagree
○	○	○	○	○	○	○

Question 16

I attend training because it will help me improve the safety of others

Strongly agree	2	3	4	5	6	Strongly disagree
○	○	○	○	○	○	○

Question 17

I attend training because it helps reduce injuries and illnesses

Strongly agree	2	3	4	5	6	Strongly disagree
○	○	○	○	○	○	○

Question 18

I attend training because it helps me reduce workplace accidents

Strongly agree	2	3	4	5	6	Strongly disagree
○	○	○	○	○	○	○

Question 19

I attend training because it will increase my safety and health knowledge

Strongly agree	2	3	4	5	6	Strongly disagree
○	○	○	○	○	○	○

Question 20

I attend training because it will increase my safety and health skills

Strongly agree	2	3	4	5	6	Strongly disagree
○	○	○	○	○	○	○

Question 21

Of the reasons listed, which is the primary reason you are attending this course?

❑ I attend training because it is required by regulation
❑ I attend training because it is beneficial to me
❑ I attend training because it is beneficial to my employer
❑ I attend training because it will help me improve the safety of others
❑ I attend training because it helps reduce injuries and illnesses
❑ I attend training because it helps me reduce workplace accidents
❑ I attend training because it will increase my safety and health knowledge
❑ I attend training because it will increase my safety and health skills

Question 22

My employer values safety and health

Strongly agree	2	3	4	5	6	Strongly disagree
○	○	○	○	○	○	○

Question 23

My employer provides opportunities for me to review safety and health concerns

Strongly agree	2	3	4	5	6	Strongly disagree
○	○	○	○	○	○	○

Question 24

I am comfortable approaching my employer when a safety issue is identified

Strongly agree	2	3	4	5	6	Strongly disagree
○	○	○	○	○	○	○

Question 25

If I point out safety issues to my employer, I feel he/she will make address those issues

Strongly agree	2	3	4	5	6	Strongly disagree
○	○	○	○	○	○	○

Question 26

I have pointed out safety issues to my employer

Strongly agree	2	3	4	5	6	Strongly disagree
○	○	○	○	○	○	○

Question 27

Please provide any other comments on the safety culture at your workplace.

Post course evaluation survey

Number: _____

This course provided me with new occupational safety and health knowledge	Yes
	No
This course provided me with new occupational safety and health skills	Yes
	No
This course motivated me to identify changes in my work	Yes
	No
Due to this course, I see areas of improvement needed at my work	Yes
	No
I expect to make changes to occupational health and safety at my work	Yes
	No

Please list any changes that you expect to make that effects safety to at your work place due to the training you received. (Please be specific)

3-month follow up survey

Page 1 - Heading

Thank you for participating in the 40-hour Hazardous Waste course at the UMDNJ-School of Public Health in March. As part of our evaluation process, we discussed that I would contact you three months after the course to identify if any of the changes you intended to make were implemented. The following questions refer back to the answers you provided at the conclusion of the training course.

Page 1 - Question 1 - Yes or No

At the conclusion of the course, you indicated that you expected to make changes to occupational safety and health at your work site. Specifically, you wrote that you would use the tools and skills I learned in class to be better prepared in the field. For example I will make sure I'm wearing correct PPE and make sure I am very alert to what is going on at a hazardous waste site prior to taking action. Did you make any of these changes?

○ Yes
○ No

Page 1 - Question 2 - Yes or No

Did you implement any other changes due to the information you learned in the course?

○ Yes [Skip to 2]
○ No [Skip to 3]

Page 2 - Question 3 - Open Ended - Comments Box

Please list the changes that you made due to the training you received.

Page 3 - Question 4 - Yes or No

Did you experience any barriers at the workplace that impeded your ability to implement the change you expected to make?

○ Yes [Skip to 4]
○ No [Skip to 5]

Page 4 - Question 5 - Open Ended - Comments Box

Please list the barriers to implementing change in occupational safety and health that you encountered at your work place.

Page 4 - Question 6 - Yes or No

Did these barriers to implementing what you learned have an affect on your safety and health?

○ Yes
○ No

Page 5 - Question 7 - Open Ended - Comments Box

Please list all the work place conditions that enabled you to implement the changes in occupational safety and health at your work place. If no changes were made, please write "NA'.

Thank You Page

Thank you for participating in this evaluation of the training we provide. Please visit our website, ophp.umdnj.edu, for more information on other training opportunities.

Appendix 3: Alphabetical List of Key Informant Interviewees

Name	Location
Mark Catlin	Washington, DC *
Connie Crandall	Salt Lake City, Utah [+]
Steven Hecker	Seattle, Washington [+]
John Howard	Washington, DC *
Joseph Hughes	Research Triangle Park, North Carolina *
Judy Jarrell	Cincinnati, Ohio [+]
Laura Kenny	New York, New York
Elizabeth Maples	Birmingham, Alabama [+]
David Newman	New York, New York
Kenneth Oldfield	Birmingham, Alabama
Randy Rabourn	Ann Arbor, Michigan [+]
Phil Taylor	New York, New York
Deborah Weinstock	Washington, DC *
Joseph Zanoni	Chicago, Illinois [+]

* Oversees programs with a national focus.

[+] ERC CE Director.

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Curriculum Vitae

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Education

May 2012	PhD – Public Policy	Rutgers University, New Brunswick, NJ
May 1989	MS – Public Health Education	University of Massachusetts, Amherst, MA
May 1987	BA – Biology	University of Rhode Island, Kingston, RI

Appointments at the UMDNJ-School of Public Health

2010-present Principal Investigator
NJ Public Health Training Center (funded by HRSA)
2003-2006 Co-Director
New Jersey Center for Public Health Preparedness (funded by ASPH)
2002-present Instructor
Department of Health Education and Behavioral Science
1999-present Director
Office of Public Health Practice (Acting Director, 1999-2002)
1999-2010 Principal Investigator (Project manager 1999-2005)
NY and NJ Public Health Training Center (funded by HRSA)
1995- present Principal Investigator (Project manager, 1999-2006)
Continuing Education for the NY/NJ Education and Research Center
Three programs, Continuing Education, Hazardous Substance Training, and NORA (funded by NIOSH)
1988-present Center Manager
NJ/NY Hazardous Materials Worker Training Center (funded by NIEHS)

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