AN ABSTRACT OF THE DISSERTATION OF

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The management of hazardous materials is a rapidly expanding global concern and the need for Hazardous Materials Management Technicians is increasing to keep up with this demand.

During the late 1980's, community and technical colleges began responding to the needs of industry and started developing curriculum for a Hazardous Materials Management Technician program either as part of a certificate or as an associate degree.

To provide industry with well-trained technicians, the Department of Labor and Department of Education funded the development of 22 Voluntary Occupational Skills Standard projects. Hazardous Materials was one of the funded projects. After the development of the Skills Standard, community colleges that were part of the Partnership for Environmental Technology Education, (PETE) consortium that had hazardous materials programs

were surveyed to determine if their curriculum covered all of the skills listed in the standard.

The purpose of this research was to determine if the curriculum currently used by the three types of PETE schools, (certificate and degree, degree only, and certificate only) covers all of the identified areas in the newly developed national Hazardous Materials Management Technician Skills Standards.

When the results were reviewed, 95.4% of all the respondents indicated that the students would have at least a practical application level of understanding for all items listed in the Skills Standard.

Based on the results of this study, almost three-fourths (31 of 43 respondents or 72.1%) of the schools indicated that an overall mastery level of understanding was achieved by the graduates of the PETE hazmat programs. This indicates that when students complete a PETE hazmat curriculum program, their level of understanding is at the top level on the Likert scale for 72.1% of the skills listed in the Skills Standard. The combination certificate and degree program indicated the highest level of mastery at 77.8%, with the degree only programs indicating a 70.0% level of mastery. The certificate only programs indicated that 50% of the students would have accomplished the mastery level upon graduation.

The Status of Hazardous Materials Management Technology Skills Standard Competencies in Partnership for Environmental Technology Education at Community Colleges

by

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I understand that my dissertation will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my dissertation to any reader upon request.

Jean M. Drevdahl-Orchard, Author

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CHAPTER I

THE RESEARCH PROBLEM

Introduction

The management of hazard materials (hazmat) is a rapidly expanding global concern. As the need for professionals in this field increases, the emergence of the Hazardous Materials Management Technician (HMMT) is exponentially growing to keep up with the demand in this area (Center for Occupational Research and Development [CORD], 1992). In the late 1970's and early 1980's, trained HMM Technicians were few and far between. More often, individuals with a technical background and no previous hazardous materials experience were hired by companies and then trained in the safe handling of hazardous materials over the next six to nine months. Not only was this very time intensive for the companies, it was very expensive (George, 1994).

During the 1980's, community and technical colleges began responding to the needs of industry and started developing curriculum for a Hazardous Materials Management Technician either as a certificate or degree. As the programs expanded, there was a lack of consistency in the curriculum content; instead, the content of the curriculum depended on the geographical location of the college and the dominant industries in that region. Currently, there is a limited amount of information available regarding job functions of an HMMT in the literature.

Why is the area of hazardous materials growing so rapidly? As industries use more and more chemicals, hazardous substances are generated and they need to be disposed of properly. Additionally, medical waste provides a growing concern for hospitals and industrial facilities. The potential spread of communicable disease from this medium has drastically increased in the last ten years.

The universal generation of trash has grown. It has been estimated that every man, woman, and child generates approximately four pounds of trash each day (Rathke, 1991). As the population grows and more people are generating trash, the potential for adverse effect on human health and the environment increases. Vice-President Al Gore calls the 1990's the Environmental Decade; more emphasis is being placed on companies being environmentally conscious (Gore, 1992). As more wastes are generated by individuals and companies, more businesses are developing cost-effective ways to manage their waste.

Unfortunately, not all wastes are easily managed. Some wastes are so dangerous that extreme caution and only knowledgeable individuals can handle and dispose of it properly. In an article from Science Magazine in 1990, L. Roberts lists the top 10 environmental concerns as follows:

1. Active hazardous waste sites
2. Abandoned hazardous waste sites
3. Water pollution from industrial wastes
4. Occupational exposure to toxic chemicals
5. Oil spills
6. Destruction of the ozone layer
7. Nuclear power plant accidents
8. Industrial accidents releasing pollutants
9. Radiation from radioactive wastes
10. Air pollution from factories

As more individuals are needed to effectively deal with the environmental issues, technicians will serve a critical role in conquering this concern. As colleges develop programs to train technicians, several questions arise:

1. What skills does industry expect a graduate from a HazMat program to possess?
2. What are the components of a quality HazMat curriculum?
3. Since the HMMT Skills Standard was developed, how many schools are teaching the job functions and supporting knowledge and skills identified by the HMMT Skills Standard? In addition, to what level of mastery are these job functions and supporting skills taught?

This dissertation will focus on the questions that are part of number three in hopes of providing answers to these questions.

Statement of the Problem

The purpose of this study was to assess current Hazardous Materials curriculum for community colleges and four year institutions across the United States who are part of the Partnership for Environmental Technology Education (PETE) consortium. This research will determine if the curriculum currently used by the three types of PETE schools, (certificate and degree, degree only, and certificate only) covers all of the identified areas in the newly developed national Hazardous Materials Management Technician Skills Standard.

The Skills Standard consisted of 13 job functions which were the broad categories of job functions that an HMMT would be expected to perform. The 13 job functions were arbitrarily assigned a number from one to 13. Subsets of the job function were the supporting skills and knowledge areas. Each of the supporting skills and knowledge areas corresponded to a job function and were identified by the job function number and then an alphabet such as 1a. Therefore, the following objectives were developed for this study:

1) Determine if there is a common program title for the hazmat related programs at PETE colleges.
2) Determine if there is a difference in the type of student (full-time vs. part-time) that enrolls in each type of educational program.
3) Identify if the job functions are reported to be taught to at least an average level of understanding based on receiving a rating of three on a one to five Likert scale;
4) Compare the results for each of the three groups in the survey to determine if there is a difference in the level of understanding of the 13 job functions based on the type of program at the school.

The Null Hypotheses

Based on the stated objectives, the Null Hypotheses for this study were:

Ho1: There is a common program title for the hazmat related programs at PETE colleges.

Ho2: There is no significant difference in the student makeup (full-time vs. part-time) of the three types of educational programs.

Ho3: PETE schools teach all the job functions in the HMMT Skills Standard to at least a median level of understanding based on receiving a three on the Likert scale.

Ho4: There is no significant difference in reported level of understanding for the graduates of each type of educational program.

Limitations of the Study

1. The scope of this study is limited to Partnership for Environmental Technology Education, (PETE), member schools who confirm a certificate or an associate degree in the Hazardous Materials Technology discipline.
2. The list of PETE school members with hazmat programs was based on those schools who were members in December 1994.
3. Only one faculty member (the individual completing the survey) was used to obtain the data and serve as the spokesperson for the entire department.
4. The mailed surveys were completed by a single individual in the HazMat department. The researcher cannot validate the authenticity of the responses as they relate to the current curriculum at the school.

Definitions

For the purpose of this study the following terms are defined.

Beacon College: A college program that had demonstrated credibility and competence in a particular field of study that would serve as an example for new programs that were developed.

Chi Square: A nonparametric test used with frequency data to determine if the data from two or more mutually exclusive categories are similar.

CORD: The Center for Research and Development. This is a Waco, Texas based nonprofit research and development organization dedicated to developing a more productive, competitive workforce through the advancement of technical education and contextual learning (CORD, 1993).

Community: A region to be served and a climate to be created. (Building Communities, 1988).

Goals 2000: Puts into law the expectation of an effective national education system (Stevenson, 1995).

Goodman-Kruskal Gamma: A statistic that counts the number of concordant and discordance pairs making no allowance for ties.

Hazardous Materials Management Technician, HMMT: An individual who works in the field that deals with the safety and health issues associated with proper handling, storage, treatment, and disposal of hazardous materials. This could include, but is not limited to, products or by-products from manufacturing, health care, chemical manufacturing, construction, agricultural, biotechnical, or other industries.

HazMat or hazmat: An abbreviation for Hazardous Materials.

Job Function: A heading for a general statement of occupational requirements, skills, and knowledge (CORD, 1995).

Kruskal-Wallis: A generalization of the Mann-Whitney test that is used to determine if multiple populations are equal using nonparametric test.

Likert Scale: A survey instrument that asks individuals to respond to a set of questions based on ordinal data.

Logo Learning: An educational philosophy and an educational strategy that centers on enabling students to find meaningfulness in their education (Parnell, 1994).

Partnership for Environmental Technology Education, (PETE): This is a national coalition of community, technical, and four-year colleges with programs related to Hazardous Materials Management or Environmental Technology divided into six geographical regions within the United States.

P-Value: "The probability of obtaining a result as extreme as or more extreme than the one observed" (Dawson-Saunders, p. 93).

Skills Standard: A guideline that defines skills, attitudes, and knowledge that an individual must possess to successfully perform a particular job.

Supporting Skills and Knowledge: Are subtasks under a job function that an HMMT must possess to be able to accomplish the job function successfully.

Tech Prep: A set of principles that guide a process of curriculum reform leading to desired improvements in the educational system (Edling, 1994).

Summary

The development and application of occupational skills standards are a new concept in the United States that is being implemented to increase the quality of skills workers will be able to bring to their job. This study was an investigation of the curriculum components used at PETE related educational facilities that have a hazardous-materials academic program.

CHAPTER II

LITERATURE REVIEW

Introduction

Hazardous Materials Management Technology is a new and emerging specialty career in the environmental, safety, and health field. Historically, companies that employed HHMT hired individuals with a competent science background and trained them to perform the duties that needed to be done to comply with the environmental regulations. Each time an employee was hired, it cost the company a tremendous amount of money to train the technicians. It would take approximately six months to train a new technician how to perform the skills and tasks to comply with the safety, health, and environmental regulations (George, 1994). Ideally, a company would hire a person with the desired hazardous materials background, if these individuals existed; therefore saving the the employer the cost of providing training for the new employee.

To help meet the needs of industry by providing trained HMM Technicians, several community colleges started Hazardous Materials training programs. It has been difficult to track exactly how many schools have a hazmat-related program because there is no consistency in the title of the programs. Some colleges call a hazmat program

Environmental Technology, Environmental, Safety and Health; Hazardous Materials Management, or another related name. A report by the Commission on the Future of Community Colleges set the stage for the development of model schools across the nation for many different educational programs at community colleges. The theme of this report was *Building Communities: A Vision For A New Century*. This commission defined a community as "a climate to be created" (Burned, 1995). This is a major reason so many hazardous materials programs are at the community and technical college level because people are being trained to respond to emergencies in their own communities.

Due to the generosity of the W.K. Kellogg Foundation more than 250 community colleges participated in a program to identify "beacon" or exemplary colleges. A beacon was a program that had demonstrated great credibility and competency in the fields that were represented. Twenty-six colleges were selected to become beacons in their field because they were on the cutting edge of new fields and were willing to collaborate with other colleges to help develop programs similar to the program at the beacon college (PETE, 1994). Front Range Community College in Westminster, Colorado, was selected as the beacon college for Hazardous Materials Management Technology.

In the late 1980's and early 1990's, Front Range Community College responded to the need to provide Hazardous

Materials Technicians. At the beginning of the 1990's, it was estimated that there would be a demand for 300,000 to 1,500,000 HMMT and more than 500,000 professionals by the mid 1990's (Burned, 1995).

Front Range Community College teamed up with an outreach program through cooperation with the U.S. Department of Energy (DOE) and PETE. Due to the concerted effort of the DOE and PETE organizations, the community colleges across the nation were able to begin to meet the need for trained employees in the hazardous materials field.

The PETE organization began with the five western states of Arizona, California, Hawaii, Nevada, and Utah. From this pilot project, PETE has expanded to include six geographical regions in the United States, Puerto Rico and U.S. Territories (Partnership for Environmental Technology Education [PETE], 1994).

The mission of PETE is to "provide leadership in environmental education and training through community and technical college partnerships with business, industry, government, and other educational providers" (PETE, 1996 p. 4).

The goals of PETE are the following:

1. Create permanent regional public-private partnerships to support a national network of community colleges delivering quality environmental education and training.

2. Develop and support quality community and technical college programs targeting environmental technicians.
3. Establish quality articulated programs creating an environmental education ladder from high school through the post graduate level.
4. Meet the environmental technical workforce education, training, and retraining needs of the nation.
5. Stimulate economic development and international competitiveness through facilitating environment technology transfer among U.S. businesses, industry, and government.
6. Contribute to the improvement of global environmental quality through international programs and partnerships in environmental education and training. (Dickinson, 1994)

The focus of PETE is to assist in the development of environmental science and technology programs at community colleges throughout the nation. In addition, PETE wants to develop articulation agreements so students who want to complete a bachelor's degree will be able to do this without losing credits.

As the PETE organization grew, the focus expanded to help schools developing new environmental programs. One of the key areas of assistance for new schools was faculty development. To assist new faculty members, PETE sponsored regional conferences and summer internship programs. The regional conferences occurred twice a year where the faculties from many different colleges were able to network with each other and share ideas, successes, and experiences (PETE, February 1994).

One concern many faculty members had was the fact that their background was not in hazardous materials, but in a related scientific field. To help these faculty members gain more hazardous materials knowledge PETE began a summer internship program to provide faculty members with experience in industrial locations. This program focused on getting the faculty out into the "real-world" during their three-month hiatus in the summer. This experience would allow the faculty to integrate more "real-life" situations into their lectures and keep them on the cutting edge (Dickinson, 1994).

History of Technicians

Over the last few decades, the makeup of the workforce has changed dramatically. The role of the professional and technical worker has increased exponentially. Between 1950 and 1988 there was a 94 percent growth in the entire workforce. During this same time the professional and technical areas grew 282 percent. Currently, almost 25 percent of the new jobs are professional or technical. Some estimates indicated that by the year 2000 the professionals and technicians will represent almost 20 percent of the U.S. workforce (Silvestri and Lukasiewicz, 1989). Most of these jobs will be filled by individuals who completed a general high school education. Currently, these individuals have not been targeted for the job market and have been deemed the "neglected majority" by Parnell (1985).

Historically technicians have been seen as "junior professionals" (Johnson, 1994, July) or individuals who do the basic work that a professional would not want to do. Recently, this image has been changing and technicians are being recognized as professionals in their own areas. The hazardous materials technician is a new type of technician that is emerging, but other technicians have been around for a long time period.

In the medical field many technicians are used. Some of the technicians include an emergency medical technician, x-ray technician, and electrocardiography (EKG) technicians. Each of these individuals has a very specialized level of knowledge and expertise that contribute to the overall professional medical team. These individuals are relied on for their expertise. A hospital "code and trauma team" is an example of technicians cohesively working with physicians to obtain a positive outcome for the patient. This group of highly trained individuals responds when there is a medical emergency such as a cardiac arrest, myocardial infarction, motor vehicle accident, or respiratory arrest. Each team member had a specific job to perform in hopes of having the patient survive. If there was a cardiac patient and the technicians were working on the patient, it was usual for the EKG technician to be reading out the type of arrhythmia so the physician could determine the proper treatment. Rarely, did physicians actually read the EKG themselves, instead, they relied on these highly trained technicians who often had more experience reading EKGs than the responding physician.

Unfortunately, often technicians state that their formal education was not useful or practical for their profession. One troubling report stated that "technicians with technical degrees also claim they use little of what they learned in school" (Barley, 1993, pg 10). What appears to be apparent is educators often view the theoretical aspect of a job as the foundation of learning, when the technician may view it differently. Technicians may believe that "practice provides the platform necessary for making sense of theory" (Barley, 1993, pg 11). Barley's paper discusses the philosophy of a Research Support Specialist who is responsible for teaching new technicians the proper way to culture cells. The philosophy that was stated is:

> First I let them observe me do it. Then I let them do it. Finally, I give them material to read. It's of little use to read about a process before you do it because the papers are too confusing. It works better if you see it first and then read...Reading becomes more helpful once you have an idea of what the words *really* mean (Barley and Back, 1993:37).

It has been found that a large portion of the population are kinesthetic learners (Drevdahl, 1995). This is especially true of technicians. These individuals learn better when they are able to experience what they are trying to learn. This can be in the context of any profession, but the importance is more significant for the technician since these individuals are often associated with performing the practical aspects of a job. Many technicians say that critical skills may be ignored or under-represented since the educators do not understand the importance of these tasks (Barley, 1993). One of the most important ways a technician can ensure that the critical components become integrated into an educational program is to be a part of the design, development, and evaluation of the program. Often, educational programs are developed by educators and professionals who *think* they know what a technician does instead of having the technician become an integral part of the entire process.

The Need for a Skills Standard

Former President Bush and the nation's Governors met in 1989 and determined ambitious educational goals were needed to set national educational standards for all students. Out of this meeting came the National Educational Goals which are the basis of the "Goals 2000: Educate America Act," the format President Clinton, then Governor Clinton, used for his educational initiative (United States Department of Education, [US DOE], 1994).

> The Goals included a pledge that by the year 2000, all American students would demonstrate competency in challenging subject matter. To provide direction, the Congressionally established, bipartisan National Council on Education Standards and Testing recommended the development of voluntary educational standards that would provide the needed focus for state and local efforts (p. 4).

It is only by having an educated population that we as a nation will be able tto continue to be a dominate force with the ensuring technological changes (CAL & Aguirre, May 1994). As part of the desire to have an educated country, the Labor's Commission on Achieving Necessary Skills (SCANS) determined that to be successful at a job you must have the job specific knowledge along with general knowledge. SCANS are generic competencies that span every area of the workplace beginning in school and transcending to the job (CORD, 1992). The ultimate goal is to provide high-performance employees for a rapidly changing technological society. To be able to work successfully with the new technology, the workers need basic literacy, computer skills, mathematical skills, problem solving skills, and people skills (US DOL, 1994, p. xiii).

In essence, SCANS provide the background knowledge that students must have before they are able to learn the job specific requirements. Recently, it has been suggested by the Secretary of Labor's SCANS Commission that workplace knowledge is the key to effective job performance (U.S. Department of Labor [US DOL], 1992).

As the global and national market becomes more competitive, individuals need to be more knowledgeable to ensure that they have marketable skills available. The United States of America is a well known global leader in many different areas, but unfortunately, the U.S. is the only industrialized nation that does not have Skill Standards (Bear, 1994).

In the report *What Work Requires of Schools,* a high-performance workplace requires:

> Workers who have a solid foundation in the basic literacy and computational skills, in the thinking skills necessary to put knowledge to work, and in the personal qualities that make workers dedicated and trustworthy. (US DOL, 1994, p. xiii)

Although SCANS will help prepare individuals for the common knowledge areas and skills that are needed for every job, they will not provide the job specific training for each particular occupation. The ultimate goal of SCANS is to provide high-performance employees for a rapidly changing technological society. A copy of the SCANS document identifying the common basic skills and knowledge areas is listed in Appendix A.

In essence, SCANS provide the background knowledge that students must have before they are able to learn the job specific requirements. The job specific requirements employees would need successfully to perform their job are identified in the Occupational Skills Standards. The specific occupational skills and knowledge areas that will be needed to work in a particular profession, such as an HMMT, will be defined by an HMMT occupational skill standard.

A primary educational focus of President Clinton's Administration is the development of Occupational Skills Standards. "A skill standard is a list of skills, knowledge, and level of ability that a person must possess to be successful in a given occupation" (Johnson, August, 1994, p. 1). This list usually includes a task list which is an in depth description of each task that is performed by the employee. After completing the task list, an analysis is conducted to identify the skills and knowledge required to successfully complete each task (Johnson, 1994). In the 1995 National Voluntary Skills Standard for HMMT, the term "job function" was defined as the major headings for general statements of occupationally related requirements, skills and knowledge. "Within each job function are supporting skills and knowledge that an HMMT must possess to be able to accomplish the job function successfully" (CORD, p.12).

Skill Standards are a new concept to the United States of America. The U.S. is the only industrialized nation that does not employ occupational skills standards (Pearlman, 1993). When skills standards are developed, a corporation should be able to hire someone who completed an educational program based on the Skills Standards with knowledge in an area allowing them to be ready to begin working on their first day of employment. Historically, the first six months were dedicated to training employees since they had basic knowledge, but not job specific knowledge (George, 1994).

In short, a skill standard defines the skills, attitudes, and knowledge that an individual must posses to successfully perform in a particular job. Under the Department of Education and the Department of Labor, 22 separate industries have been identified as the technologies of the future. These industries serve as the initial pilot group for the development of occupational specific Skills Standards. After the first 22 Skills Standards are developed and implemented, the goal is to have other occupations follow the pilot project's lead and develop their own specific Skills Standard (Kappner, 1994).

How will Skill Standards benefit industry? They will provide a minimum level of knowledge that students will have when they complete an educational or training program. In the area of Hazardous Materials Management Technology, the Skill Standard will be those competencies individuals will possess when they graduate from an accredited program and begin their career in hazardous materials.

In addition, the Skill Standards will change the focus of training and education. When the expected competencies are well defined and documented, the trainer or educator will be held accountable to meet these standards. Standards become very beneficial for the educators because they know what the student is expected to be able to do after completion of the program and can develop effective curriculum materials.

Students will receive a copy of the skills standard and know what skills and tasks they need to be able to perform when they graduate. Industry can look at the skills standards and determine if these are the tasks they need for a particular job. If they are the needed skills, the individual they hire should be ready to begin being productive shortly after being hired.

During the past 18 months, the Department of Education initiated a public-private partnership to develop skill standards for industries that have been identified as the industries for the future (US DOL & US DOE). Twenty-two projects were funded to develop occupational based industry specific skill standards. Although the standards will be voluntary at first, they will assist educators and administrators, to ensure that students learn what is needed to enter this particular profession. The Hazardous Materials Management Technician was one of the projects funded by the United States Department of Education. The focus of this project was to "determine and validate the tasks, skills, and level of ability that employees must possess to be successful in an entry-level position as a Hazardous Materials Management Technician" (US DOL & US DOE, p. 15). The standards will allow students to know exactly what is expected of them when they begin working as an HMMT.

The next step was to identify how many of the colleges that have an HMMT program actually teach each of the job functions and associated skills and knowledge areas identified in the standard. Unless the Skills Standard can be easily implemented and effectively monitored, it will not propel the HazMat profession forward.

Summary

This chapter presented an overview of the literature regarding the need and development of the Labor's Commission on Achieving Necessary Skills (SCANS) and the national voluntary occupational skills standard. The Department of Labor and Department of Education funded the development of 22 occupational skill standards as pilot-projects to serve as examples for future skill standards. "A skill standard is a list of skills, knowledge, and level of ability that a person must possess to be successful in a given occupation" (Johnson, August, 1994, p.1).

In addition, the history of technicians in other fields was discussed as a correlation between the new career field of hazardous materials technicians and how they will be able to assist the environmental profession.

CHAPTER III

METHODOLOGY

Introduction

This study was conducted to assess current Hazardous Materials Management Technology curriculum components for community colleges and four-year institutions across the United States who were part of the Partnership for Environmental Technology Education, (PETE) organization as of December, 1994. This research will determine if the PETE schools cover the components of the 1995 National Voluntary Occupational Skills Standards for Hazardous Materials Management Technicians in their curriculum. Therefore, the following objectives were developed for this study:

1) Determine the common program title for the hazmat related programs at PETE colleges.
2) Determine if there is a difference in the type of student (full-time vs. part-time) that enrolls in each type of educational program (certificate and degree, degree only, or certificate only).

3) Identify if the job functions are reported to be taught to at least a median level of understanding based on receiving a rating of three on a one to five Likert scale;

4) Compare the results for each of the three groups in the survey to determine if there is a difference in the level of understanding of the 13 job functions based on the type of program at the school.

The methodology for this study consisted of the development of (a) an educational survey instrument using a modified Delphi panel; (b) the educational survey validation process; (c) the survey process; and (d) the data analysis phase. After completion of this task, the null hypotheses failed to be rejected or were rejected.

The Survey Instrument Development

The recently developed Skills Standard for Hazardous Materials Management Technicians was developed over 18 months with input from regional focus groups and input at national hazmat related meetings.

At these meetings representatives from industry, large and small business, governmental agencies, and educational facilities participated in the development of the Skills Standard. A modified Delphi technique was used to gain group consensus and identify critical variances regarding the job functions of an HMMT by using industry-based focus groups. The focus groups were conducted around the nation to assist in identification of regional variances that may be part of an HMMT job requirements. Seven focus group meetings were held in conjunction with Hazardous Materials related organizational meetings. A draft of the Skills Standard was based on input from the focus group meetings.

A modified Delphi technique was used to validate the 13 identified areas of the Skills Standard. Validation participants were divided into groups that corresponded to the four major focus areas of the HMMT specialization: compliance, remediation, laboratory and analysis, and treatment, storage, and disposal (TSD). The participants selected the group they felt they were "expert" in and represented this discipline during the validation process. The groups reviewed the statement that described the job function and supporting job skills and knowledge areas. Each statement consisted of an action verb and a descriptive statement about the job. At the completion of this process the Skills Standard was formatted into the final format.

The developed Skills Standard was distributed in a survey format to 1150 individuals who were members of the professional hazardous materials organizations and currently worked in the hazmat field. The purpose of this survey was to determine if industry agreed that those items identified in the Skills Standard were the critical competencies an HMMT should be able to perform upon graduation from a certificate or degree program. Of the 1150 surveys mailed out, 20.9 percent were returned.

The results of the industry-based Skills Standard affirmed the areas identified in the Skills Standard as the key competencies an HMMT must be able to perform. The results from this survey were mailed out to companies, Departments of Education, individuals, trade and professional organizations, hazmat-related publications, and two- and four-year colleges.

The next step was to determine if schools with HMMT programs cover the identified job functions and related knowledge and skills areas identified in the Skills Standard in their current curriculum. To ascertain if the schools taught the components of the

Skills Standard, a survey instrument was developed based on the National Voluntary Skills Standards for Hazardous Materials Management Technology.

The purpose of this study was to assess current Hazardous Materials curriculum for community colleges and four-year institutions across the United States who are part of the PETE consortium.

The survey listed job functions and supporting tasks and knowledge areas. Each respondent rated these items on a Likert scale with a one (1) representing the students would have basic knowledge of this task, a three (3) representing the students would have a basic understanding of the task, to a five (5) representing the students mastered this particular skill or knowledge at the time of graduation from an HMMT program.

All of the components of the Skills Standard were divided into 13 major sections and 95 supporting skills and knowledge areas. Under each job function the range was from four to 13 supporting skills and knowledge areas. This gave a total of 108 questions specifically relating to the Skills Standard. In addition, there were 11 general questions regarding the school, name and title of individual completing the survey, and number of students enrolled in the program.

Although this totaled 119 responses, the HMMT Skills Standard advisory committee felt that individuals would be willing to complete the survey because the PETE national board and participating school members wanted the information so they could improve their curriculum and provide consistency at all PETE schools. The more consistent the core curriculum was for PETE schools, the easier it would be for students to transfer to a four-year school to complete a Bachelor's degree. The Department of Education wanted the information to serve as an example Skills Standard for other groups when additional Skills Standards will be developed in the future.

A draft of the survey instrument was completed and pilot-tested during March and April of 1995. Pilot-test groups consisted of three PETE schools and members of the Skills Standards project team. The members of the pilot-test group are listed in Appendix B. Survey development included working with several researchers to ensure the survey was developed correctly. The goal was the survey would be easy for the recipient to complete. In addition, the survey needed to be easy to input into a spreadsheet and efficiently tabulate data. Those researchers providing input into the development of the survey included a Professor of Education who teaches statistics at Portland State University and a Ph.D. statistician from the Center for Occupational Research and Development in Waco, Texas. Both of these individuals possess a vast amount of experience and expertise in survey development and analysis. Critical feedback was obtained through the comprehensive review of the research staff at CORD. The research group along with the pilot-test group provided assistance ensuring that the formatted survey was presented in a logical manner that would be easily completed and analyzed.

The first survey draft was distributed to the regional contact individuals for the PETE organization and the technical experts working on the HMMT grant from the Department of Education. These individuals served as experts in a modified Delphi panel and are listed in Appendix C. Their comments and suggestions regarding the questionnaire were integrated into the next revision. A second revision was sent to the same individuals until there was consensus that the instrument collected the desired data. Then the instrument was prepared for general distribution to each of the PETE schools.

The Survey Process

After the draft survey instrument was completed, the following weeks were used to format, edit, and print the survey. A cover letter was developed to describe the goals of the survey and the importance of completing the survey.

The surveys were mailed out with a cover letter, the Skills Standard survey, and a copy of the National Voluntary Skills Standard for HMMT. The cover letter asked each recipient of the Skills Standard survey to mark the Likert scale with the level of understanding for each job function and supporting skills and knowledge areas their graduates would have at the completion of the HMMT program. A mark of one means the graduate would have basic awareness of the particular job function or supporting skills and knowledge. A mark of five on the scale means that the graduate would have mastery of that particular job function or supporting skills and knowledge. Therefore, the higher the job function median, the higher level of understanding and mastery the graduates should possess.

The surveys were mailed out to the 78 PETE schools that had actual HMMT programs. Other schools in the

PETE organization taught several individual classes in HMMT, but were not part of a curriculum leading to an associate degree or certificate.

The surveys were mailed out the last week in August 1995 with a return due date of September 30, 1995. This time was selected to correspond to the instructors being back in school. These surveys were mailed out by a Senior Research Associate at CORD.

A follow-up letter was sent to individuals who did not return their survey by the designated date of September 30, 1995. A follow-up phone call was made to individuals who did not respond to the follow-up letter to try to increase the response rate. When schools did not return the phone call, another phone call was placed to try to get the surveys returned. Many of the schools had voice mail, so a message was left on the voice mail to remind the participants to complete the survey or contact the researcher if they needed another copy of the survey. Twelve of the schools contacted requested another copy of the survey and these were mailed out with a return date of November 15, 1995.

As the surveys were returned, the results were manually input into a Microsoft Excel Spreadsheet. To analyze the data, the Excel Spreadsheet was loaded into the software program Statistical Processing for Social Sciences (SPSS).

Questionnaire Format

The questionnaire was divided into 13 sections corresponding to the 13 job functions identified in the National Skills Standard. Below each of the 13 questions, were additional questions about the supporting skills and knowledge needed to successfully perform the job functions. Each respondent was asked to mark the number on the Likert scale describing the level of understanding an individual would have about each of the job functions, skills, and knowledge areas upon completion of their school's program. A five-point Likert scale was used with the following numbers corresponding to the level of understanding:

1 Basic awareness of the concept,

3 Ability to use concept in a practical situation,

5 A thorough understanding and ability to apply a concept in a variety of situations or mastery of the concept.

The numbers two and four were used as transition points between the other numerical representations. Nonparametric statistical tests do not require the response population to be normally distributed. The data provided by the Likert scale are ordinal in nature; therefore nonparametric methods were applied.

Each of the 13 job functions and supporting skills and knowledge areas were identified across the top of the spreadsheet and each school's answers were listed in rows. The skills and knowledge that were part of these categories were assigned a corresponding number and letter to indicate which job function and subtask the answers were related to on the survey. An example would be the code 1B. The number represents the first job function listed on the questionnaire and the letter B represents the second supporting skill and knowledge under job function one. The computer program would not accept the code of A; therefore the code X was used to represent A.

The responses from those individuals who completed the survey were entered into an Excel Spreadsheet and then imported into SPSS.

Methods Used to Analyze the Hypothesis

The hypotheses were analyzed using different statistical methods appropriate to the response from each question. The following paragraphs describe each the hypotheses and the methods of analysis.

Ho1: There is a common program title for the hazmat related programs at PETE colleges.

Hypothesis one was analyzed using counts. The respondents were asked to indicate the title of their hazmat related educational program on the survey form. The titles were tallied and grouped together to form similar categories of program titles to aid in the identification of the most common program title.

Ho2: There is no significant difference in the student makeup (full-time vs. part-time) of the three types of educational programs: certificate and degree, degree only, and certificate only.

Hypothesis two was analyzed using counts since respondents were asked to check a box that indicated the enrollment categories that most accurately represented the student base at their school. Comparison between full-time and part-time students will be discussed using the descriptive statistical techniques using the mode and median.

Ho3: PETE schools teach all the job functions in the HMMT Skills standard to at least a median level of understanding based on receiving a rating of three on a Likert scale.

A median was identified for each of the 13 job functions to determine if the overall level of understanding corresponds to a level greater than 3.0 on the Likert scale. The medians were used to determine the order of response based on student understanding.

The reported median and calculated median were also compared. The reported median is the median that was reported on the survey by each of the respondents. The calculated median was determined by taking each of the subtasks under the 13 major job functions and determining the median for each. The assumption was that the reported median should be similar to the calculated median.

Ho4: There is no significant difference in reported level of understanding for the graduates of each type of educational program.

Hypothesis four compares the results for each of the three groups to determine if there is a difference in the level of understanding for the 13 job functions based on the type of educational program at the school.

Some of the individuals completing the survey completed all of the questions which included the 13 job functions and the associated supporting skills and knowledge areas. Unfortunately, some respondents only answered the supporting skills and knowledge questions. To maximize the use of all the data, imputations were performed to obtain data for the unanswered job functions.

The imputation process consists of determining each job function mode based on the associated supporting skills and knowledge responses. The mode is the most frequently occurring observation. The next step was to take the determined mode and impute it into the spreadsheet when the response for the 13 job functions was missing. To substantiate the claim that there is a strong association between the imputation of the mode and the supporting skills and knowledge areas a Goodman-Kruskal gamma statistic was calculated on the relationship between modes of the supporting skills and the available reported job function scores. The Goodman-Kruskal gamma is a statistic that counts the number of concordant and discordance pairs making no allowance for ties.

Ordinal data is often analyzed by comparing pairs of observations. These pairs are termed concordant or discordant. A pair is concordant (P) if the value for each of the variables is larger in the second observation. A pair is discordant (Q) if the value for one pair is larger in the first observation and smaller in the second observation. If the observations are identical, they are considered to be a tied pair.

If the majority of the pairs are concordant, the association is positive. If the majority of the pairs are discordant, the association is negative. The Goodman-Kruskal gamma statistic is the number of concordances and discordances between row and column classifications with no allowance for ties (Spent, 233).

Gamma is used in this study to give a measure of the concordance between the data reported for each job function and the mode of the supporting skills. Gamma can range from -1 for a negative association to +1 for a positive association. The closer to one, the stronger the association. All of the Gammas were at least .56 with 85% of them being above a .70. This shows a very strong correlation between the reported job function score and the mode of the supporting skills for each job function. The values of the Gammas are listed in Table 1.

Table 1

Comparison of Gamma Associated with Job Function and Mode

Job Function	Gamma of Job Function & Mode
1	.8
2	.8
3	.74
4	.72
5	.8
6	.78
7	.88
8	.82
9	.98
10	.9
11	.71
12	.61
13	.56

Range of gamma is from -1 to +1

Due to the strength of the imputed data, these data was used to calculate the rest of the statistics for testing Ho4. To determine if the three groups had the same level of understanding a Chi-Square statistic was used. Chi-Square is a nonparametric test used with frequency data to determine whether the data from two or more mutually exclusive categories are similar.

Certain theoretical assumptions must be considered when applying the Chi-Square test. To be effective, Chi-Square must be sufficiently large based on the Pearson Chi-Square distribution. This is defined as having no expected frequency counts less than one and not more than 20% of the expected frequencies should be less than five. If an expected frequency is less than five, data should be collapsed to combine categories so the expected frequencies meet the minimum criteria stated previously.

A Chi-Square was run on each job function against each type of program. When analyzing the data, several of the job functions violated the minimum numbers required in the expected range. To ensure expected numbers were large enough, response categories were combined. Many of the responses in the lower and upper ranges were so small the responses from the category of one and two on the Likert scale were combined. In addition, the responses from the four and five categories were also combined. The result was a three by three comparison table. Although some of the expected frequencies were still below five, if more collapsing was performed the data would be nonspecific and not useful.

The alpha level for analysis was established at .05. Alpha is the probability of a Type I error or rejecting the null hypothesis when Ho is actually true. The Null Hypothesis will be rejected, if the Chi-Square is larger than the table value. The p-value is listed at the bottom of each of the tables. The p-value is "the probability of obtaining a result as extreme as or more extreme than the one observed" (Dawson-Saunders, p. 93).

The Chi-Square and Kruskal-Wallis were used to determine if there was a difference in the level of understanding for the three types of educational programs.

The Kruskal-Wallis is a nonparametric test analogous to the parametric ANOVA. It is also a generalization of the Mann-Whitney test used to determine if multiple populations are equal. To identify which of the populations were different, the following comparisons were made:

- Certificate and degree programs were compared to degree programs,
- Certificate and degree programs were compared to certificate only programs,

- Certificate only and degree only programs were compared to each other.

An alpha level of .05 was used to test this hypothesis. The null hypothesis is rejected, if the calculated Kruskal-Wallis value is larger than the table value. The corresponding p-value was reported.

Summary

This chapter described the methods used in this study. Discussion related to the study objectives, development of the survey instrument, implementation of the survey process, and the statistical methods used to analyze the data from each of the hypothesized questions.

CHAPTER 4

DATA TREATMENT AND ANALYSIS

Introduction

This chapter will examine the analysis of data obtained from the Hazardous Materials Management Technology Skill Standard survey. A copy of the survey is included in Appendix D.

Survey Results

Data analysis was dependent on the results from a self-reporting questionnaire sent to all schools who were members of the PETE organization as of December 1994. An assumption was only one faculty member, the individual completing the survey who was listed as the key contact, would serve as spokesperson for the entire department.

The demographic information obtained from the survey was descriptive and provided background data about the various Hazardous Materials Management Technology, HMMT, programs available at PETE schools. This demographic information included the following:

- Institution's name,
- Respondent's name,
- Respondent's title,
- Address of the school,
- Telephone number,
- Fax number,
- Internet address,
- Type of certificate or degree offered,
- Names of certificate or degree offered,
- Number of full-time and part-time students.

The name of the person completing the survey, location of the school, and name of the responding college have been removed from the results listed at the end of the dissertation. The removal of this information was to ensure anonymity to those who responded to the questionnaire as stated in the cover-letter that accompanied the questionnaire.

The remainder of the HMMT Skills Standard questionnaire was analyzed with various nonparametric methods because the results were frequency counts obtained from a modified Likert scale.

Eighty-four PETE schools received a copy of the survey with 48 of the departments responding representing 42 schools. Six schools copied the survey and provided information on several related safety and health programs offered at their school. The response of 42 schools represented 50 percent of the institutions who were mailed a survey. Three of the schools stated they had removed the HMMT program from their curriculum due to low enrollment. Seven schools stated they did not have an HMMT program at all. Two respondents provide continuing education short courses, not certificate or degree related programs; therefore, their results were not included in this research. One school provided surveys on other related programs: Industrial Health and Safety and Health Physics. The Industrial Health and Safety responses were included in the data for this research project. The Health Physics responses were not included in the data because this research was specific to the Hazardous Materials area and the author felt the Hazardous Materials and Industrial Health and Safety were more representative of the research area.

After removing the twelve schools that did not have a program from the responses, 36 schools were left out of a possible 72 respondents. This response rate was 50%. Twenty of the 36 schools confer a certificate and an associate degree in the HMMT area. Ten schools offer only an associate degree, while six schools offer only a certificate.

Findings Related to Major Hypotheses

In the following section, each of the hypotheses will be discussed.

Hypothesis 1: Educational Program Titles

Ho1: There is a common program title for the hazmat related programs at PETE colleges.

The most common certificate or degree name was Environmental Technology related. Twenty programs offered a certificate or degree in one of the following areas: Environmental Technology, Environmental Science, Environmental Technician, or Environmental Management Technology. Thirteen of the programs had certificates or degrees entitled: Hazardous Materials Technology, Hazardous Materials Technician, Hazardous Materials Handling Technician, and Hazardous Materials Management. Five schools had programs called Environmental Hazardous Materials Technology or Environmental Hazardous Materials. Five responses did not indicate the name of the certificate or degree. Two programs had titles that were not previously stated; Hazardous Waste Management and Industrial Health and Safety.

Table 2 summarizes the responses of PETE school program titles and their distribution for types of program titles used in their hazardous materials curriculum.

Table 2

Program Titles for PETE School Hazmat-Related Program

# of Responses	Program Titles
20 Respondents	Environmental Technology Environmental Science Environmental Technician Environmental Management Technology
13 Respondents	Hazardous Materials Technology Hazardous Materials Technician Hazardous Materials Handling Technician Hazardous Materials Management
5 Respondents	Environmental Hazardous Materials Technology Environmental Hazardous Materials
7 respondents	Program Title Not Listed Hazardous Waste Management Industrial Health and Safety

Hypothesis 2: Program Enrollment

Ho2: There is no difference in the student makeup of the three types of educational programs.

School enrollment was evaluated to determine the number of full-time and part-time HMMT students at participating PETE schools. The categories included those listed in Table 3.

Table 3

Student Enrollment Options Listed on the Questionnaire

Full-Time	Part-Time
Less than 10	Less than 20
10 - 20	21 - 40
21 - 40	41 - 60
Over 40	Over 60

The enrollment of the schools ranged from the minimum category range of less than 10 full-time students, to the maximum category range of over 40 full-time students. The part-time students ranged from the minimum category range of less than 20, to more than 60 students in the program.

When comparing the three types of educational programs, the evidence indicates a difference in student make up with respect to full-time and part-time students. In the colleges that offered a degree and certificate program the minimum student enrollment was less than 10, with the maximum enrollment over 40 for full-time students. For part-time students the smallest category was less than 20 and the largest category was more than 60 students. The mode enrollment for full-time students was the range from 21-40 students. The mode enrollment for part-time students was less than 20 students. The median for full-time students was 10 - 20, while the median for part-time students was 21 - 40.

When analyzing degree only programs, the minimum student enrollment was the range of 10-20 full-time students and less than 20 part-time students. The maximum student enrollment was over 40 for the full-time students, to over 60 for the part-time students. The mode and median of this group were 21-40 full-time students and less than 20 part-time students. This indicates that schools that have a degree program have more full-time students enrolled in the program than part-time students.

When analyzing the certificate only programs, the minimum student enrollment was 10-20 full-time students and less than 20 part-time students. The maximum student enrollment was between 10-20 for full-time students and more than 60 part-time students. The mode and median of this group were 10-20 full-time students and more than 60 part-time students. This indicates that a certificate program is geared toward those individuals who are not full-time students, but working to complete their certificate on a part-time basis. The enrollment distribution for full-time and part-time students is listed in Table 4and 5

Table 4

Enrollment Distribution for Full-Time Students

Program Type	**>10**	**10 - 20**	**21 - 40**	**Over 40**
Cert & Degree	4	7	9	2
Degree		2	4	4
Cert		2		1

Table 5

Enrollment Distribution for Part-Time Students

Program Type	**>20**	**21 - 40**	**41 - 60**	**Over 60**
Cert & Degree	6	6	5	5
Degree	4	1	1	1
Cert	1			3

Hypothesis 3: Level of Job Function Understanding

Ho3: PETE schools teach all the job functions in the HMMT Skills Standard to at least a median level of understanding based on receiving a three on the Likert scale.

The responding schools were asked to rate each of the thirteen job functions that were part of the Skills Standard. In addition, each respondent was asked to evaluate the supporting skills and knowledge that were subcomponents of the job function. To determine whether the corresponding job function answers matched the responses of the supporting skills and knowledge, a comparison of the mean for each group was undertaken. The median was determined for each of the individual responses for the 13 major job functions. Then, a calculated median was determined by combining the supporting skills and knowledge under each of the thirteen job functions and a median was determined for the supporting skills and knowledge. The hypothesis was that the reported value for each of the job functions should be similar to the calculated median. Table 6 displays the comparison of the reported and calculated job function medians.

The results of reviewing the medians indicate that the reported median was the same as the calculated median with the exception of two job functions which were job function 10 and job function 11. Job function 10 states "Select and use appropriate personal protective equipment and respiratory protection" which had a reported median of 4.5 while the calculated job function median was 4. Job function 11 which states "Collect, prepare, document, and ship samples for analysis" had a reported median of 4 while the calculated job function median was 3.

Therefore, it can be concluded that the reported level of understanding for each job function is consistent with the supporting skills and knowledge subcategories.

Table 6

Comparison of Reported Median and Calculated Median for the 13 Job Functions.

Job Function	Reported Median	Calculated Median
1	3	3
2	4	4
3	4	4
4	3	3
5	5	5
6	3	3
7	4	4
8	4	4
9	4	4
10	4.5	4
11	4	3
12	4	4
13	4	4

Table 7 depicts how the schools responded to the survey. The median for each of the ratings on the job functions was determined with the highest median being the job function that was listed as first, or the job function that was deemed to have the greatest level of understanding by the graduates.

All medians were above the hypothesized level of a three on the Likert scale. Therefore, the hypothesis was accepted; concluding that the PETE schools reported to teach the job functions to at least an average level of understanding based on receiving an average rating of three on the Likert scale.

Table 7

Rank of Most Important Job Functions Based on All Responses by PETE Schools

Rank	Med	Description of Job Function
1	5.0	Identify and label hazardous-materials and hazardous-waste in accordance with regulatory requirements.
2	4.5	Select and use appropriate personal protective equipment and respiratory protection.
6.5 Tie	4.0	Respond to hazardous-materials and hazardous-waste emergency situations in accordance with regulatory requirements.
6.5 Tie	4.0	Implement procedures to comply with appropriate regulations
6.5 Tie	4.0	Implement applicable safety regulations and procedures.
6.5 Tie	4.0	Collect, prepare, document, and ship samples for analysis.
6.5 Tie	4.0	Safely handle hazardous-materials and hazardous-waste.
6.5 Tie	4.0	Transport and store hazardous-materials and hazardous-waste in accordance with applicable regulations.
6.5 Tie	4.0	Compile, record, and maintain required documents for hazardous-materials and hazardous-waste management activities.
6.5 Tie	4.0	Operate hazardous-materials and hazardous-waste treatment and disposal systems.
12 Tie	3.0	Calibrate, operate, and maintain instrumentation.
12 Tie	3.0	Evaluate hazardous-materials and hazardous-waste sample data.
12 Tie	3.0	Operate equipment related to hazardous-materials and hazardous-waste operations.

Hypothesis 4: Level of Understanding Based on Type of Program

Ho4: There is no significant difference in reported level of understanding for the graduates of each type of education program.

Hypothesis four compared the results for each of the three groups to determine if the presence of any differences in the level of understanding for the 13 job functions was based on the type of educational program at the school. To evaluate if the three groups had the same level of understanding, Chi-Square and Kruskal-Wallis statistics were used.

The results for each of the 13 job functions are followed by a brief discussion of the findings for each section. The descriptive statistics in this section reflect three categories: certificate and degree programs, degree only programs; and certificate only programs. The respondents indicated the expected level of understanding that the students would achieve upon completion of an HMMT program on a Likert scale.

Table 8 displays the summary information for the 13 job functions and their associated Chi-Square and p-values. Using the Chi-Square statistic, data indicates there are minor differences among the three types of educational programs with respect to the level of understanding for job function five.

Table 8

Summary of Test Results for Chi-Square on Ranks for All Job Functions (alpha level = .05)

Job Function	Chi-Square	Probability Level	Decision
1	3.91	0.419	Fail To Reject Ho
2	1.58	0.812	Fail To Reject Ho
3	8.95	0.062	Fail To Reject Ho
4	2.37	0.668	Fail To Reject Ho
5	11.9	0.018*	Reject Ho
6	1.01	0.909	Fail To Reject Ho
7	8.37	0.079	Fail To Reject Ho
8	8.84	0.065	Fail To Reject Ho
9	1.99	0.736	Fail To Reject Ho
10	1.62	0.445	Fail To Reject Ho
11	6.19	0.186	Fail To Reject Ho
12	9.06	0.060	Fail To Reject Ho
13	4.99	0.289	Fail To Reject Ho
All	3.63	0.458	Fail To Reject Ho

* Significant Level at .05 Alpha Level

Table 9 displays the summary information for the 13 job functions and their associated Kruskal-Wallis test statistics and p-values. Using the Kruskal-Wallis One Way ANOVA, there appears to be a difference in the level of understanding expected by the students at the three types of educational programs with respect to job functions three, five, and seven. Differences in job functions three and seven were not identified using the

Chi-Square method which could be partly due to the greater strength of the Kruskal-Wallis test statistic. The supporting data for job functions three, five, and seven will be discussed during the general discussion of the associated job function. The supporting data for the job functions where the null hypothesis was accepted are listed in Appendix F.

Table 9

Summary of Test Results for Kruskal-Wallis One-Way ANOVA on Ranks for All Job Functions (Corrected for ties, alpha level = .05)

Job Function	Chi-Square	Probability Level	Decision
1	3.03	0.220	Fail To Reject Ho
2	1.17	0.558	Fail To Reject Ho
3	8.16	0.017*	Reject Ho
4	2.14	0.342	Fail To Reject Ho
5	7.25	0.026*	Reject Ho
6	0.51	0.773	Fail To Reject Ho
7	6.48	0.039*	Reject Ho
8	5.40	0.067	Fail To Reject Ho
9	0.72	0.699	Fail To Reject Ho
10	1.58	0.454	Fail To Reject Ho
11	4.24	0.120	Fail To Reject Ho
12	5.55	0.062	Fail To Reject Ho
13	4.17	0.124	Fail To Reject Ho
All	2.13	0.345	Fail To Reject Ho

* Significant Level at .05 Alpha Level

The following section will discuss the results from each of the 13 job functions.

Job Function 1:

Evaluate hazardous-materials and hazardous-waste sample data.

The results from Table 10 shows the highest percentage (18 or 42.9%) of total respondents indicated this job function was to be performed at a masterly level of understanding. The combined certificate and degree programs suggest an emphasis on the practical application (9 or 34.6%) and mastery (10 or 38.5%) of this job function. The majority of the degree only programs (6 or 60.0%) and the certificate only programs (2 or 33.3%) indicated this job function required a mastery level of understanding.

When the job function summary data are presented in tables for job functions 1 - 13, the following abbreviations have been used in the table: Basic Know means basic knowledge and Practic Applica means practical application of the skill.

Table 10

Job Function 1 Summary Data for the Three Types of Educational Programs (alpha level = .05)

Degree Type	Data	Basic Know	Practic Applica	Mastery	Total
C & D	Counts	7	9	10	26
	Row %	26.9	34.6	38.5	100
Degree	Counts	0	4	6	10
	Row %	0	40	60	100
Cert	Counts	2	2	2	6
	Row %	33.3	33.3	33.3	100
Total	Counts	9	15	18	42
	Row %	21.4	35.7	42.9	100

Chi-Square = 3.91
p = .419

Kruskal-Wallis = 3.03
p = .220

Job Function 2:

Safely handle hazardous-materials and hazardous-wastes.

The highest percentage (31 or 72.1%) of total respondents indicated this job function was to be performed at a masterly level of understanding based on the data from Table 11. The majority of all categorical programs also indicated that this skill level should be understood at the mastery level as shown in the following table.

Table 11

Job Function 2 Summary Data for the Three Types of Educational Programs (alpha level = .05)

Degree Type	Data	Basic Know	Practic Applica	Mastery	Total
C & D	Counts	4	5	18	27
	Row %	14.8	18.5	66.7	100.0
Degree	Counts	1	1	8	10
	Row %	10.0	10.0	80.0	100.0
Cert	Counts	0	1	5	6
	Row %	0.0	16.7	83.3	100.0
Total	Counts	5	7	31	43
	Row %	11.6	16.3	72.1	100.0

Chi-Square = 1.58
p = .812

Kruskal-Wallis = 1.17
p = 0.558

Job Function 3:

Respond to hazardous-materials and hazardous-waste emergency situations in accordance with regulatory requirements.

The majority of respondents (26 or 61.9%) indicated this job function was to be performed at a mastery level of understanding as indicated by the data in Table 12. The combined certificate and degree programs (12 or 46.2%) and the majority of the degree only (8 or 80.0%) indicated a preference for the mastery level of understanding. All of the certificate only programs (6 or 100%) specified a mastery level of understanding.

Table 12

Job Function 3 Summary Data for the Three Types of Educational Programs (alpha level = .05)

Degree Type	Data	Basic Know	Practic Applica	Mastery	Total
C & D	Counts	7	7	12	26
	Row %	26.9	26.9	46.2	100.0
Degree	Counts	0	2	8	10
	Row %	0.0	20.0	80.0	100.0
Cert	Counts	0	0	6	6
	Row %	0.0	0.0	100.0	100.0
Total	Counts	7	9	26	42
	Row %	16.7	21.4	61.9	100.0

Chi-Square = 8.95
p = .062

Kruskal-Wallis = 8.16
p = 0.017

Since the Kruskal-Wallis summary table indicated that all three educational programs were not identical with respect to job function 3, additional tests were run.

Table 13 shows the Kruskal-Wallis multiple comparison Z-test values for the three types of programs. Based on the results listed in this table, it appears that there is a difference between the combined certificate and degree program and the degree only programs along with a difference between the combined certificate and degree programs and the certificate only programs because the associated Z-values are above the cut off for an alpha level of .05.

Table 13

Kruskal-Wallis Multiple Comparison Z-Value Test

Program Type	Z-Value
Cert & Degree vs Degree	2.04*
Cert & Degree vs. Certificate	2.41*
Degree vs. Cert	.639

*P < .05

Job Function 4:

Operate equipment related to hazardous-materials and hazardous-waste operations.

In Table 14, the highest percentage (41.5% or 17 respondents) specified a mastery level of understanding of this job function upon graduation. The highest number of respondents in a combination degree and certificate program indicated a practical application level of understanding was needed for the graduates (10 or 40.0%). The degree only programs felt more strongly about achieving the mastery level with the majority of these respondents (6 or 60.0%) choosing the mastery level. Yet, the certificate only programs specified an equal emphasis with each level of understanding receiving 33.3% of the responses.

Table 14

Job Function 4 Summary Data for the Three Types of Educational Programs (alpha level = .05)

Degree Type	Data	Basic Know	Practic Applica	Mastery	Total
C & D	Counts	6	10	9	25
	Row %	24.0	40.0	36.0	100.0
Degree	Counts	1	3	6	10
	Row %	10.0	30.0	60.0	100.0
Cert	Counts	2	2	2	6
	Row %	33.3	33.3	33.3	100.0
Total	Counts	9	15	17	41
	Row %	22.0	36.6	41.5	100.0

Chi-Square = 2.37
p = .668

Kruskal-Wallis = 2.14
p = 0.342

Job Function 5:

Identify and label hazardous-materials and hazardous-waste in accordance with regulatory requirements.

The majority of respondents (37 or 86.0%) selected the mastery level of understanding based on the data in Table 15. Most of the combination certificate and degree programs (26 or 96.3%) and the degree only (6 or 60.0%) and certificate programs (5 or 83.3%) designated a mastery level of understanding. Interestingly, 40 percent of the respondents in the degree only programs choose a practical application emphasis.

Table 15

Job Function 5 Summary Data for the Three Types of Educational Programs (alpha level = .05)

Degree Type	Data	Basic Know	Practic Applica	Mastery	Total
C & D	Counts	1	0	26	27
	Row %	3.7	0.0	96.3	100.0
Degree	Counts	0	4	6	10
	Row %	0.0	40.0	60.0	100.0
Cert	Counts	0	1	5	6
	Row %	0.0	16.7	83.3	100.0
Total	Counts	1	5	37	43
	Row %	2.3	11.6	86.0	100.0

Chi-Square = 11.9
p = .018

Kruskal-Wallis = 7.25
p = .027

Since the null hypothesis of job function 5 was rejected based on a Chi-Square, it was concluded differences exist in the expected level of understanding upon graduation from the three different types of programs.

A Kruskal-Wallis one-way ANOVA based on ranks concurred with the Chi-Square indicating there was a difference in the three types of programs at an alpha level of .05 and an associated p-value was .027.

Table 16 shows the Kruskal-Wallis multiple comparison Z-test values for the three program types.

Additional tests were performed to determine where the differences occurred. This was done by comparing the certificate and degree program with the degree only programs. Then the degree only programs were compared to the certificate only programs. Finally, the certificate only programs were compared to the combined certificate and degree program.

The noted differences occurred between the combined certificate and degree program with the degree only programs are identified in Table 16. The other two program types (degree only compared to certificate only and combined certificate and degree compared to the certificate only) had the hypothesis accepted, therefore indicating that there are no differences in these two types of programs.

Table 16

Kruskal-Wallis Multiple Comparison Z-Value Test

Program Type	Z-Value
Cert & Degree vs Degree	2.69*
Cert & Degree vs. Certificate	0.77
Degree vs. Cert	1.26

*P < .05

Job Function 6:

Calibrate, operate, and maintain instrumentation.

Overall, the mastery level of understanding had the highest response rate (18 or 42.9%) as indicated by the data in Table 17. The highest number of respondents (10 or 38.5%) for the combination certificate and degree program indicated a mastery level of understanding.

Table 17

Job Function 6 Summary Data for the Three Types of Educational Programs (alpha level = .05)

Degree Type	**Data**	**Basic Know**	**Practic Applica**	**Mastery**	**Total**
C & D	Counts	8	8	10	26
	Row %	30.8	30.8	38.5	100.0
Degree	Counts	2	3	5	10
	Row %	20.0	30.0	50.0	100.0
Cert	Counts	2	1	3	6
	Row %	33.3	16.7	50.0	100.0
Total	Counts	12	12	18	42
	Row %	28.6	28.6	42.9	100.0

Chi-Square = 1.01
p = .909

Kruskal-Wallis = .514
p = .773

Job Function 7:

Compile, record, and maintain required documents for hazardous-materials and hazardous-waste management activities.

In Table 18, the majority of respondents (30 or 71.4%) indicated a masterly level of competence was needed to perform this particular job function. For the combination certificate and degree program, almost 85 percent of the respondents supported the mastery level of understanding. The degree only programs had a closer distribution between mastery and 50 practical application, 40% and 50%, respectively. The certificate only programs had a preference for the mastery level (4 or 66.7%), while the knowledge and practical application accounted for only 16.7% of the responses each. Based on the responses, this job function should be performed at the practical application level with mastery level preferred. This preference may be due to the regulatory requirements for record keeping and the potential for financial fines for failure to maintain accurate records.

Table 18

Job Function 7 Summary Data for the Three Types of Educational Programs (alpha level = .05)

Degree Type	Data	Basic Know	Practic Applica	Mastery	Total
C & D	Counts	1	3	22	26
	Row %	3.8	11.5	84.6	100.0
Degree	Counts	1	5	4	10
	Row %	10.0	50.0	40.0	100.0
Cert	Counts	1	1	4	6
	Row %	16.7	16.7	66.7	100.0
Total	Counts	3	9	30	42
	Row %	7.1	21.4	71.4	100.0

Chi-Square = 8.37
p = .079

Kruskal-Wallis = 6.48
p = .039

Since the Kruskal-Wallis summary table indicated a difference between the three educational programs were not identical with respect to job function 7, additional tests were run to identify where the differences occurred (these differences were not identified by the Chi-Square statistic).

Table 19 shows the Kruskal-Wallis multiple comparison Z-test values for the three types of programs. Based on the results listed in this table, there is evidence of a difference between the combined certificate and degree programs and the degree only programs.

Table 19

Kruskal-Wallis Multiple Comparison Z-Value Test

Program Type	Z-Value
Cert & Degree vs Degree	2.52*
Cert & Degree vs. Certificate	0.97
Degree vs. Cert	0.96

*P < .05

Job Function 8:

Implement procedures to comply with appropriate regulations.

The majority of the respondents listed in Table 20 (29 or 69.0%) felt the mastery level was needed for this job function. At least 70 percent of the respondents in the combined certificate and degree programs and degree only programs indicated a mastery level as the most important. The combined certificate and degree program felt strongest about this with 76.9% of the respondents choosing mastery. The degree only programs had the next highest response with 70.0% of the respondents choosing mastery as the preferred level of understanding. While the certificate only groups had a 33.3% response rate of mastery for this job function.

Only three respondents (7.1%) indicated that a knowledge level was adequate to perform this function.

Table 20

Job Function 8 Summary Data for the Three Types of Educational Programs (alpha level = .05)

Degree Type	Data	Basic Know	Practic Applica	Mastery	Total
C & D	Counts	1	5	20	26
	Row %	3.8	19.2	76.9	100.0
Degree	Counts	0	3	7	10
	Row %	0.0	30.0	70.0	100.0
Cert	Counts	2	2	2	6
	Row %	33.3	33.3	33.3	100.0
Total	Counts	3	10	29	42
	Row %	7.1	23.8	69.0	100.0

Chi-Square = 8.83
p = .065

Kruskal-Wallis = 5.40
p = .067

Job Function 9:

Implement applicable safety regulations and procedures.

Table 21 shows the majority of respondents (29 or 69.0%) indicated mastery was the level of understanding needed to successfully perform this job function. At least two-thirds of all categorical groups choose mastery as the level of understanding needed. The combined certificate and degree programs and certificate only programs indicated a 66.7 percent of the respondents chose mastery as the level of understanding. The highest percentage was indicated by the degree only programs which had 77.8 percent of the respondents (7 or 77.8%) indicating mastery needed.

Only 6 of the 42 respondents (14.3%) indicated a basic knowledge level of understanding was adequate to successfully perform this job function. This consisted of five responses from the combined certificate and degree programs and one response from the certificate only programs.

Table 21

Job Function 9 Summary Data for the Three Types of Educational Programs (alpha level = .05)

Degree Type	Data	Basic Know	Practic Applica	Mastery	Total
C & D	Counts	5	4	18	27
	Row %	18.5	14.8	66.7	100.0
Degree	Counts	0	2	7	9
	Row %	0.0	22.2	77.8	100.0
Cert	Counts	1	1	4	6
	Row %	16.7	16.7	66.7	100.0
Total	Counts	6	7	29	42
	Row %	14.3	16.7	69.0	100.0

Chi-Square = 1.20
p = .736

Kruskal-Wallis = .717
p = .699

Job Function 10:

Select and use appropriate personal protective equipment and respiratory protection.

More than 81 percent of the respondents (35 or 81.4%) choose mastery as the level of understanding required for this job function as indicated in Table 22. The combined certificate and degree program had the lowest level of respondents indicating mastery level would be needed (9 or 77.8 percent of the respondents). The degree only programs had an 80.0 percent response rate (8 or 80.0%) of the respondents choosing mastery. The certificate only programs had 100 percent (6 or 100%) of the respondents choosing mastery as the preferred level of understanding.

Less than 20 percent (8 or 18.6%) of the respondents chose a practical knowledge level as adequate for this job function. Of this group, six of the responses or 75 percent came from the combined certificate and degree programs. No one selected a basic knowledge level on this job function as adequate preparation.

Table 22

Job Function 10 Summary Data for the Three Types of Educational Programs (alpha level = .05)

Degree Type	Data	Basic Know	Practic Applica	Mastery	Total
C & D	Counts	0	6	21	27
	Row %	0.0	22.2	77.8	100.0
Degree	Counts	0	2	8	10
	Row %	0.0	20.0	80.0	100.0
Cert	Counts	0	0	6	6
	Row %	0.0	0.0	100.0	100.0
Total	Counts	0	8	35	43
	Row %	0.0	18.6	81.4	100.0

Chi-Square = 1.62
p = .445

Kruskal-Wallis = 1.58
p = .454

Job Function 11:

Collect, prepare, document, and ship samples for analysis.

Overall, the respondents to this question indicated a moderate level of mastery needed successfully to perform this job (23 or 54.8%) based on the data in Table 23. The combined certificate and degree programs had eight of the respondents (8 or 30.8%) indicate a practical level of understanding was attained upon graduation. Fifty percent (13 or 50.0%) of the combined certificate and degree programs choose mastery as the level of knowledge. The degree only programs felt more strongly about graduates having a mastery of this job function as indicated by 80 percent (8 or 80.0%) of the respondents indicating this level. The certificate only programs indicated a 33 percent level of mastery for this job function. The certificate only programs had the highest level of basic knowledge needed to perform this job function at 50 percent (3 or 50.0%).

Table 23

Job Function 11 Summary Data for the Three Types of Educational Programs (alpha level = .05)

Degree Type	Data	Basic Know	Practic Applica	Mastery	Total
C & D	Counts	5	8	13	26
	Row %	19.2	30.8	50.0	100.0
Degree	Counts	1	1	8	10
	Row %	10.0	10.0	80.0	100.0
Cert	Counts	3.0	1	2	6
	Row %	50.0	16.7	33.3	100.0
Total	Counts	9	10	23	42
	Row %	21.4	23.8	54.8	100.0

Chi-Square = 6.19
p = .186

Kruskal-Wallis = 4.24
p = .120

Job Function 12

Transport and store hazardous-materials and hazardous-waste in accordance with applicable regulations.

Table 24 shows that the majority (25 or 58.1%) of the respondents indicated the mastery level was needed for this job function. The combined certificate and degree program had the highest response rates (19 or 70.4%) indicating a preference for the mastery level. For the degree only programs, 50 percent indicated the mastery level was needed, while 30 percent of the respondents indicated a basic knowledge level as adequate. The certificate only programs indicated the greatest level of understanding for graduates was at the practical level (4 or 66.7%).

Table 24

Job Function 12 Summary Data for the Three Types of Educational Programs (alpha level = .05)

Degree Type	Data	Basic Know	Practic Applica	Mastery	Total
C & D	Counts	2	6	19	27
	Row %	7.4	22.2	70.4	100.0
Degree	Counts	3	2	5	10
	Row %	30.0	20.0	50.0	100.0
Cert	Counts	1	4	1	6
	Row %	16.7	66.7	16.7	100.0
Total	Counts	6	12	25	43
	Row %	14.0	27.9	58.1	100.0

Chi-Square = 9.06
p = .060

Kruskal-Wallis = 5.55
p = .062

Job Function 13:

Operate hazardous-materials and hazardous-waste treatment and disposal systems.

Over 87 percent of all the respondents (38 or 88.4%) determined at least a practical level or mastery level was necessary to perform this job function. Almost one-half of the respondents (20 or 46.5%) indicate that a mastery level was needed for this job function. This information is identified in Table 25.

The high level of understanding needed for this job function may be due to the regulatory requirements for operating a treatment, storage, and disposal system

(TSD). A TSD facility has very stringent regulatory requirements which must be complied with to minimize citations.

Table 25

Job Function 13 Summary Data for the Three Types of Educational Programs (alpha level = .05)

Degree Type	Data	Basic Know	Practic Applica	Mastery	Total
C & D	Counts	2	10	15	27
	Row %	7.4	37.0	55.6	100.0
Degree	Counts	1	5	4	10
	Row %	10.0	50.0	40.0	100.0
Cert	Counts	2	3	1	6
	Row %	33.3	50.0	16.7	100.0
Total	Counts	5	18	20	43
	Row %	11.6	41.9	46.5	100.0

Chi-Square = 4.99
p = .289

Kruskal-Wallis = 4.170
p = .124

Summary Data of All Job Functions:

Table 26 provides an overview of the response for all 13 job functions in their entirety. Based on this information, almost three-fourths (31 of 43 or 72.1%) of the respondents indicated that the mastery level of understanding was achieved by the graduates of the PETE hazmat programs. This indicates that when students complete a PETE hazmat curriculum program, their level of understanding is at the top level for 72.1% of the skills and knowledge areas listed in the Skills Standard. The combination certificate and degree program indicated the highest level of mastery at 77.8%, with the degree only programs indicating a 70.0% level of mastery. The certificate only programs indicated that 50% of the students would have accomplished the mastery level upon graduation.

If the overall expectation is reviewed, 95.4% of all the respondents indicated that the students would have at least a practical application level of understanding upon graduation of all job functions and supporting skill and knowledge areas listed in the Skills Standard.

Table 26

Job Function Summary Data for the Three Types of Educational Programs for all Job Functions (alpha level = .05)

Degree Type	Data	Basic Know	Practic Applica	Mastery	Total
C & D	Counts	1	5	21	27
	Row %	3.7	18.5	77.8	100.0
Degree	Counts	0	3	7	10
	Row %	0.0	30.0	70.0	100.0
Cert	Counts	1	2	3	6
	Row %	16.7	33.3	50.0	100.0
Total	Counts	2	10	31	43
	Row %	4.7	23.3	72.1	100.0

Chi-Square = 3.63
p = .458

Kruskal-Wallis = 2.13
p = .334

Summary

This chapter provided a description of the various demographic variables in the study. Findings related to the four major hypotheses were discussed. Those hypothesis that had statistical data support were discussed. In addition, all hypothesis that were rejected were discussed.

CONCLUSIONS

Introduction

The purpose of this study was to determine if Partnership for Environmental Technology Education (PETE) schools incorporate into their curriculum all the job functions, supporting skills and knowledge areas identified in the national voluntary HMMT Skills Standard that was developed in 1994. The goal of integrating the Skills Standard into a hazmat curriculum was to provide consistency in the training of hazmat technicians. The analysis was conducted to determine if there was a significant difference in the level of understanding the graduates acquired from the three types of educational programs offered at PETE schools.

Summary

The management of hazardous materials is a rapidly expanding global concern. As the need for more professionals in the environmental field increases, the emergence of the Hazardous Materials Management Technician is exponentially growing. Technicians play a cost-effective roll in helping to maintain the environment. Since the hazardous materials field is new, few people have specific academic training in this area. Instead, most of the Hazardous Materials Technicians acquired the skills they need to perform their job while they were working in the field. This need provides a new opportunity for community colleges to develop and implement a hazardous materials curriculum in their area.

During the past few years, the Department of Education and Department of Labor funded 22 projects to assist the development of voluntary occupational Skills Standards for the "professions of the future." One of the projects that was funded was the development of the Hazardous Materials Management Technician Skills Standard. Skills Standards identify the specific job functions skills, and knowledge areas that students need to be able to perform to be successful in their job. "A skill standard is a list of skills, knowledge, and level of ability that a person must possess to be successful in a given occupation" (Johnson, August, 1994, p. 1).

The Skills Standard was developed with input from industry, large and small businesses, governmental agencies, academic institutions, and consultants. The Skills Standard identified 13 major areas that are part of the job a hazmat technician would perform. In addition to the 13 job functions, additional supporting skills and knowledge areas were identified as components that a hazmat technician would need to be able to perform successful work in the environmental field.

Once the Hazardous Materials Management Technician Skills Standard was developed, the next step was to identify how many of the PETE colleges that offer a hazardous materials program teach all of the components listed in the Skills Standard. The focus of this research was to determine if the PETE schools teach all of the components of the skills standard.

Analyzing the results from Ho1 indicated that the most common certificate or degree name was related to Environmental Technology. It was expected that there would be a common title, but I expected it to have the them hazardous-materials in the program title.

The results from Ho2 indicated that there is a difference in the student make up with respect to the number of full-time and part-time students in degree or certificate programs. In colleges that offered a degree program more full-time students were enrolled in the program than part-time students. Certificate programs had a larger number of students working to complete their certificate on a part-time basis. When I taught an Environmental, Safety, and Hazardous Materials certificate program at a community college in the Pacific Northwest, I found that all of my students were attending class on a part-time basis while being fully employed. This provides a tremendous opportunity to be able to integrate practical knowledge and experience into the class because of the diverse experiences the students bring to class.

Results of data from Ho3 indicate that all 13 job functions were taught above the hypothesized level of three on a Likert scale. A level of three corresponded to the students having practical knowledge of all components of the Skills Standard.

Data analysis on Ho4 indicated that overall, there is no difference in the level of understanding that a graduate of a PETE hazmat program would have at the completion of their program regardless of the type of program they attended (certificate and degree, degree only, or certificate only). Chi-Square and Kruskal-Wallis statistics were used to determine if graduates of the three types of educational programs acquired the same level of understanding for each of the components of the Skills Standard.

Based on the Chi-Square, one of the 13 job functions was rejected at an alpha level of .05. When the Kruskal-Wallis was run, it was concluded that there were differences in the expected level of understanding upon graduation from the three types of programs. The difference in the programs occurred between the combined certificate and degree program with the degree only programs.

The data from Ho4 were not as expected. I had expected there to be a statistically significant difference in the level of understanding students would have when they graduate based on the type of educational program they attended. Instead, it appears that there is no difference in the level of understanding for all 13 job functions. This indicates that the core components of a hazmat program are covered in a certificate program. The additional courses that are required for an associate degree appear to be unrelated to the hazmat major, but would be more general education.

It appears that the graduates of the PETE hazardous materials curriculums are well prepared to accomplish the items identified in the National Voluntary Occupational Hazardous Materials Management Technician Skills Standard.

A potential limitation to the ability to generalize the results of this study was the response rate. A moderate response rate could limit the study's application to other HMMT programs. Because only 50% of the respondents chose to return their completed survey even with four and five follow-up inquiries by the researcher, nonrespondent HMMT programs may differ from those programs where someone completed the survey. Other researchers have found that the nonrespondents often choose not to complete surveys for a variety of reasons which could include: concern about the inadequacy of confidentiality; apprehension about providing information; and neglecting to allocate time to complete the survey (Knudson, 1996). These findings are representative of only the schools that chose to complete the survey and may not represent curriculums at other PETE schools or technical schools that have HMMT programs.

Another limitation was the lack of a response on the questionnaire indicating that a particular skill or knowledge was not taught in the HMMT program. It was assumed that if a skill or knowledge was not taught the space would be left blank although a blank could be where the respondent forgot to mark an answer.

Recommendations for Future Research

This study presented data regarding the new Hazardous Materials Management Technician National Voluntary Skills Standard. When the Skills Standard was developed, resources were put into place to allow the standard to be updated in three to five years. When the standard is updated, it would be beneficial to repeat the survey and determine if the PETE schools have updated their curriculum to correspond to changes in the Skills Standard.

This study focused on the PETE schools that have hazardous materials related programs. This survey could be expanded to include all schools, not just PETE schools, that teach a hazardous materials curriculum. In follow up surveys, it would be useful to determine if the students felt their education prepared them for the hazmat field.

In addition, this study could serve as a pilot for other Skills Standards. Other projects that were funded at the same time as the hazmat study could use a similar format to determine if the schools that teach the topics covered in their standard do so to an acceptable level of understanding.

As more professions develop Skills Standards, the research in these fields will expand exponentially.

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APPENDICES

Appendix A

The Basic Foundation Skills

Reading	Locates, understands, and interprets written information in prose and documents--including manuals, graphs, and schedules--to perform tasks; learns from text by determining the main idea or essential message; identifies relevant details, facts, and specifications; infers or locates the meaning of unknown or technical vocabulary; and judges the accuracy, appropriateness, style, and plausibility of reports, proposals, or theories of other writers.
Writing	Communicates thoughts, ideas, information, and messages in writing; records information completely and accurately; composes and creates documents such as letters, directions, manuals, reports, proposals graphs, and flow charts with the language, style, organization, and format appropriate to the subject matter, purpose, and audience; includes, where appropriate, supporting documentation, and attends t level of detail; and checks edits, and revises for correct information, appropriate emphasis, form, grammar, spelling, and punctuation.
Arithmetic	Performs basic computation; uses basic numerical concepts such as whole numbers and percentages in practical situations; makes reasonable estimates of arithmetic results without a calculator; and uses tables, graphs, diagrams, and charts to obtain or convey quantitative information.
Mathematics	Approaches practical problems by choosing appropriately from a variety of mathematical techniques; uses quantitative data to construct logical explanations for real world situations; expresses mathematical ideas and concepts orally and in writing; and understands the role of chance in the occurrence and prediction of events.
Listening	Receives, attends to, interprets, and responds to verbal messages and other clues such as body language in ways that are appropriate to the purpose--for example, to comprehend, learn, critically evaluate, appreciate, or support the speaker.

Reading	Locates, understands, and interprets written information in prose and documents--including manuals, graphs, and schedules--to perform tasks; learns from text by determining the main idea or essential message; identifies relevant details, facts, and specifications; infers or locates the meaning of unknown or technical vocabulary; and judges the accuracy, appropriateness, style, and plausibility of reports, proposals, or theories of other writers.
Speaking	Organizes ideas and communicates oral messages appropriate to listeners and situations; participates in conversations, discussion, and group presentations; selects an appropriate medium for conveying a message; uses verbal language and other cues such as body language in a way appropriate in style, tone, and level of complexity to the audience and occasion; speaks clearly and communicates a message; understands and responds to listener feedback; and asks questions when needed.

Thinking Skills

Creative Thinking	Generates new ideas by making nonlinear or unusual connections, changing or reshaping goals, and imagining new possibilities; and uses imagination freely, combining ideas or information in new ways, making connections between seemingly unrelated ideas, and reshaping goals in ways that reveal new possibilities.
Decision Making	Specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternatives.
Problem Solving	Recognizes that a problem exists (i.e., that there is a discrepancy between what is and what should be); identifies possible reasons for the discrepancy, and devises and implements a plan of action to resolve it; and evaluates and monitors progress, revising the plan as indicated by findings.
Mental Visualization	Sees things in the mind's eye by organizing and processing symbols, pictures, graphs, objects, or other information--for example, sees a building from a blueprint, a system's operation from schematics, the flow of work activities from narrative descriptions, or the taste of food from reading a recipe.
Knowing How to Learn	Recognizes and can use leaning techniques to apply and adapt existing and new knowledge and skills in both familiar and changing situations; and is aware of learning tools such as personal learning styles (visual, aural, etc.), formal learning strategies (note taking or clustering items that share some characteristics), and informal learning strategies (awareness of unidentified false assumptions that may lead to faulty conclusions).
Reasoning	Discovers a rule or principle underlying the relationship between two or more objects and applies it in solving a problem--for example, uses logic to draw conclusions from available information, extracts rules or principles from a set of objects or a written text, or applies rules and principles to a new situation (or determines which conclusions are correct when given a set of facts and conclusions).

Responsibility	Exerts a high level of effort and perseverance toward goal attainment; works hard to become excellent at doing tasks by setting high standards, paying attention to details, working well even when assigned an unpleasant task, and displaying a high level of concentration; and displays high standards of attendance, punctuality, enthusiasm, vitality, and optimism in approaching and completing tasks.
Self-Esteem	Believes in own self-worth and maintains a positive view of self, demonstrates knowledge of own skills and abilities, is aware of one's impression on others, and knows own emotional capacity and needs and how to address them.
Sociability	Demonstrates understanding, friendliness, adaptability, empathy, and politeness in new and ongoing group settings; asserts self in familiar and unfamiliar social situations; relates well to others; response appropriately as the situation requires; and takes an interest in what others say and do.
Self-Management	Accurately assesses own knowledge, skills, and abilities; sets well-defined and realistic personal goals; monitors progress toward goal attainment and motivates self through goal achievement; and exhibits self-control and responds to feedback unemotionally and nondefensively.
Integrity and Honesty	Recognizes when being faced with making a decision or exhibiting behavior that may break with commonly held personal or societal values; understands the effects of violating these beliefs and codes on an organization, oneself, and others; and chooses an ethical course of action.

Appendix B

Members of Pilot-Test Survey Group

Robert Bear
Facilities & Environmental Consultants, Inc.
Longwood, FL

Doug Feil
Hazardous Materials Training and Research Institute
Cedar Rapids, IA

David Gardner
Adjunct Faculty
Sr. Planning and Control Engineer
West Valley Nuclear Services Company, Inc.
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Lois George
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Gayle Haecker
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Waco, TX

Jim Johnson
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C. Daniel McGrew
Hazardous Materials Control Resources Institute
Rockville, MD

Charles Richardson
National Environmental Training Association
Phoenix, AZ

Susan Drew Thomas
National Association of Environmental Professionals
Washington, DC

Appendix C

Members of the Delphi Panel

Robert Bear
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Hazardous Materials Control Resources Institute
Rockville, MD

Charles Richardson
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Phoenix, AZ

Susan Drew Thomas
National Association of Environmental Professionals
Washington, DC

Appendix D

Hazardous Materials Management Technology Survey

This questionnaire should be completed by the individual most familiar with the Hazardous-Material Management Technician Program at your campus.

Educational Institution: ____________________

Respondent's Name: ____________________

Title: ____________________

Address: ____________________

____

City/State/Zip: ____________________

Telephone: ____________________ **FAX:** ____________________

Internet Address: ____________________

Please check the answer that best describes your current program

What type of Hazardous-Materials Management degree or certificate do you offer? (mark all that apply)

- ❑ Certificate
- ❑ Associate Degree

If you offer both certificate and degree programs, please duplicate this questionnaire so that responses can be independently evaluated.

1. List the name(s) of your certificates or degrees related to Hazardous-materials Management.

____

____

____

2. What is the total enrollment of students in the HazMat certificate or degree program?

Full Time	Part Time
❑ less than 10	❑ less than 20
❑ 10 - 20	❑ 21 - 40
❑ 21 - 40	❑ 41 -60
❑ over 40	❑ over 60

INSTRUCTIONS

The following set of questions refers to your HazMat certificate or degree program curriculum. This questionnaire has been divided into thirteen sections based on job functions. Below each job function is a list of supporting skills and knowledge. For each job function, mark the box that best describes the level of understanding an individual would have at the completion of your program.

A scale of 1 - 5 is being used. The following definitions are provided for clarification.

1	Knowledge	Basic awareness of the concept
3		Ability to use concept in a practical situation
5	Mastery	A thorough understanding and ability to apply a concept in a variety of situations

Then check the information that is part of your curriculum and meet this job function.

Knowledge				Mastery	
1	2	3	4	5	**1. Evaluate hazardous-materials and hazardous-waste sample data.**
					Please mark all the following supporting information included in your curriculum to meet this job function
1	2	3	4	5	A Perform mathematical calculations following existing formulas and reference materials
1	2	3	4	5	B Read and interpret blueprints, charts, curves, graphs, maps, plans, and spreadsheets from plotted and tabulated data
1	2	3	4	5	C Collect, tabulate, and assist in the evaluation of data, using appropriate techniques and technology such as: calculators, computers, databases, graphics, and spreadsheets
1	2	3	4	5	D Check laboratory and/or field sample analyses by comparing to regulatory limits

Knowledge				Mastery	
1	2	3	4	5	**2. Safely handle hazardous-materials and hazardous-wastes.**
					Please mark all the following supporting information included in your curriculum to meet this job function
1	2	3	4	5	A Use chemical reference materials to obtain information on proper chemical handling
1	2	3	4	5	B Recognize, apply, and respond appropriately to chemical-hazard information
1	2	3	4	5	C Direct personnel in the proper handling and control of hazardous-materials and hazardous-wastes
1	2	3	4	5	D *Identify and implement safe ergonomic controls and procedures*
1	2	3	4	5	E Demonstrate safe handling procedures for chemical containers such as: bulk containers, drums, portable and stationary tanks
1	2	3	4	5	F Identify and respond to emergencies, alarms, and abnormal situations in accordance with written procedures
1	2	3	4	5	G Identify and implement safe chemical-handling procedures such as: bonding, fire control, grounding, storage, vapor control, and ventilation
1	2	3	4	5	H Provide on-the-job training as required

Knowledge				Mastery	
1	2	3	4	5	**3. Respond to hazardous-materials and hazardous-waste emergency situations in accordance with regulatory requirements.**
					Please mark all the following supporting information included in your curriculum to meet this job function
1	2	3	4	5	A Perform as a team member on an emergency-response team
1	2	3	4	5	B Ensure that adequate spill-control equipment and supplies are available at all times
1	2	3	4	5	C Develop and implement an emergency-response program
1	2	3	4	5	D Demonstrate competency and maintain certification in first aid and cardio-pulmonary resuscitation
1	2	3	4	5	E Follow guidelines for controlling leaks from containers
1	2	3	4	5	F Consider environmental consequences of emergency situations and respond appropriately

Knowledge				Mastery	
1	2	3	4	5	**4. Operate equipment related to hazardous-materials and hazardous-waste operations.**
					Please mark all the following supporting information included in your curriculum to meet this job function
1	2	3	4	5	A Identify and describe the safe and proper use of equipment such as: drum crushers, hand tools, heavy equipment, monitoring and sampling equipment and instrumentation, motorized lifting devises, power tools, pumps, valves, and meters
1	2	3	4	5	B Identify, describe, and use appropriate equipment-decontamination procedures
1	2	3	4	5	C Identify, describe, and use appropriate operations and maintenance procedures, plans, and manuals
1	2	3	4	5	D Identify, describe, and use appropriate health and safety equipment such as: communication systems, eyewash and safety showers, fire extinguishers, vehicles, equipment, first aid

Knowledge				Mastery	
					5. Identify and label hazardous-materials and hazardous waste in accordance with regulatory requirements.
					Please mark all the following supporting information included in your curriculum to meet this job function
1	2	3	4	5	A Identify, characterize, and label hazardous-materials by chemical and physical properties, such as: color,corrosivity, density, flammability, reactivity, specific gravity, toxicity, and viscosity
1	2	3	4	5	B Identify and characterize hazardous-wastes according to regulatory standards such as: acute toxicity, corrosivity, ignitability, reactivity, and toxic characteristic leachate procedure (TCLP)
1	2	3	4	5	C Provide proper labeling for hazardous-wastes
1	2	3	4	5	D Use chemical reference materials to obtain identification and labeling information
1	2	3	4	5	E Check for correct labels and Material Safety Data Sheets (MSDSs) when shipment is required
1	2	3	4	5	F Label containers of repackaged materials with appropriate warnings and expiration information
1	2	3	4	5	G Direct personnel in the proper identification and labeling of hazardous-materials

Knowledge				Mastery	
1	2	3	4	5	**6. Calibrate, operate, and maintain instrumentation.**
					Please mark all the following supporting information included in your curriculum to meet this job function
1	2	3	4	5	A Operate, record, and evaluate meter- and gauge-reading trends and implement appropriate actions
1	2	3	4	5	B Perform routine maintenance of equipment and instrumentation
1	2	3	4	5	C Operate gauges, meters, and monitoring and sampling instrumentation
1	2	3	4	5	D Calibrate and operate field and laboratory instrumentation such as: air-monitoring instrumentation, groundwater-monitoring instrumentation, soil-monitoring instrumentation, solid-waste-monitoring instrumentation, and surface-water-monitoring instrumentation
1	2	3	4	5	E Identify the need for and comply with factory calibration
1	2	3	4	5	F Describe the difference between fluid and factory calibration and demonstrate their appropriate use

Knowledge				Mastery	
1	2	3	4	5	**7. Compile, record, and maintain required documents for hazardous-materials and hazardous-waste management activities.** *Please mark all the following supporting information included in your curriculum to meet this job function*
1	2	3	4	5	A Compile and maintain a hazardous-materials inventory
1	2	3	4	5	B Compile and maintain documentation of hazardous-materials, such as: chain of custody, equipment calibration and maintenance, exception reports, field notebooks, incident documentation, laboratory data, manifests, MSDS, purchase orders, shipping documents, and vendor invoices
1	2	3	4	5	C Compile and maintain records to prepare compliance reports
1	2	3	4	5	D Ensure current MSDSs are available in the workplace
1	2	3	4	5	E Operate and maintain auditable record-keeping systems in accordance with regulatory requirements
1	2	3	4	5	F Conduct and maintain a hazardous-waste inventory
1	2	3	4	5	G Communicate with suppliers to obtain product identification and labeling
1	2	3	4	5	H Identify and maintain an inventory of empty and full containers
1	2	3	4	5	I Compile and maintain personal health and safety records
1	2	3	4	5	J Read and interpret blueprints, flow diagrams, and schematics

Knowledge				Mastery	
1	2	3	4	5	**8. Implement procedures to comply with appropriate regulations.** *Please mark all the following supporting information included in your curriculum to meet this job function*
1	2	3	4	5	A Read and apply regulatory standards to ensure compliance in operations
1	2	3	4	5	B Obtain hazardous-materials and hazardous-waste permits and/or approvals
1	2	3	4	5	C Describe the regulatory process, from the introduction of a bill to the promulgation of a regulation
1	2	3	4	5	D Identify and describe the penalties for noncompliance
1	2	3	4	5	E Differentiate between federal, state, and local hazardous-materials and hazardous-waste regulations and identify appropriate regulatory agencies
1	2	3	4	5	F Identify regulatory changes and the impact they have on an operation
1	2	3	4	5	G Comply with federal, state, and local hazardous-materials regulations
1	2	3	4	5	H Conduct audits and inspections to ensure hazardous-waste management activities are in compliance with federal, state, and local regulations
1	2	3	4	5	I Follow written, company-standard operating procedures
1	2	3	4	5	J Comply with federal, state, and local health and safety regulations
1	2	3	4	5	K Identify sources of current or timely regulatory information

Knowledge				Mastery	
1	2	3	4	5	**9. Implement applicable safety regulations and procedures.** *Please mark all the following supporting information included in your curriculum to meet this job function*
1	2	3	4	5	A Demonstrate safe health and work habits
1	2	3	4	5	B Read and implement other regulatory standards and guidance relative to worker safety and health such as: blood-borne pathogens, confined space, emergency egress, fire safety, hearing conservation, and lockout/tagout
1	2	3	4	5	C Identify and describe unsafe workplace and job conditions and implement corrective actions

Knowledge				Mastery	
1	2	3	4	5	**10. Select and use appropriate personal protective equipment and respiratory protection.** *Please mark all the following supporting information included in your curriculum to meet this job function*
1	2	3	4	5	A Use and interpret chemical reference materials in the selection of appropriate personal protective equipment (PPE) and respirators
1	2	3	4	5	B Communicate with suppliers and manufacturers to obtain personal protective and respiratory equipment information
1	2	3	4	5	C Identify, describe, and use PPE appropriate to the work conditions
1	2	3	4	5	D Identify and describe the elements of respiratory protection and PPE plans
1	2	3	4	5	E Identify, describe, and use respiratory protection appropriate to the work conditions
1	2	3	4	5	F Identify and describe hazards associated with the use and limitations of PPE and respiratory protection
1	2	3	4	5	G Maintain and inspect PPE and respiratory protection systems according to regulations

Knowledge				Mastery	
1	2	3	4	5	**11. Collect, prepare, document, and ship samples for analysis.** *Please mark all the following supporting information included in your curriculum to meet this job function*
1	2	3	4	5	A Perform and document sampling for hazardous-waste characterization purposes
1	2	3	4	5	B Perform field tests according to instructions and procedures
1	2	3	4	5	C Calibrate and operate, as required, field-test equipment such as: air-monitoring equipment, bailers, hand augers, organic-vapor analyzers, pumps, radioactivity measuring equipment, and split spoons
1	2	3	4	5	D In accordance with instructions and/or procedure, collect samples such as: air and soil, bulk materials, groundwater, solid wastes, and surface water
1	2	3	4	5	E Identify and demonstrate an ability to adjust procedures appropriately for potential sample interferences
1	2	3	4	5	F Decontaminate equipment in accordance with quality-control/quality-assurance procedures
1	2	3	4	5	G Identify and describe the appropriate use, limitations, and applications of sampling equipment such as: colorimetric indicator, combustible-gas indicator, and organic-vapor analyzer
1	2	3	4	5	H Perform personnel-exposure monitoring in accordance with appropriate standards such as: noise monitoring, oxygen monitoring, radiation dosimetry, temperature extremes, and Threshold Limit Value & Biological Exposure Indices
1	2	3	4	5	I Prepare and ship samples to laboratory

Knowledge				Mastery		
1	2	3	4	5		**12. Transport and store hazardous-materials and hazardous waste in accordance with applicable regulations.**
						Please mark all the following supporting information included in your curriculum to meet this job function
1	2	3	4	5	A	Monitor documentation related to the shipment of hazardous-materials and hazardous-wastes
1	2	3	4	5	B	Identify incompatible combinations of chemicals that could result in dangerous situations
1	2	3	4	5	C	Label containers with appropriate identification and expiration information
1	2	3	4	5	D	Safely package, load, document, and ship hazardous-materials and hazardous-wastes in compliance with appropriate regulations
1	2	3	4	5	E	Inspect hazardous-waste storage areas for compliance with appropriate rules and regulations
1	2	3	4	5	F	Properly segregate and store incompatible hazardous-materials and hazardous-wastes

Knowledge				Mastery		
1	2	3	4	5		**13. Operate hazardous-materials and hazardous-waste treatment and disposal systems.**
						Please mark all the following supporting information included in your curriculum to meet this job function
1	2	3	4	5	A	Record and maintain documentation of operations activities
1	2	3	4	5	B	Follow appropriate plans such as: assessment plan, health and safety plan, initial sampling plan, remediation plan, risk-assessment plan, site-closure plan, standard operating procedures, waste-minimization plan
1	2	3	4	5	C	Assist and contribute to the development and revision of plans and reports such as: assessment plan, health and safety plan, initial sampling plan, remediation plan, risk-assessment plan, site-closure plan, standard operating procedures, waste-minimization plan
1	2	3	4	5	D	Prepare and maintain hazardous-waste manifests and associated documents for inspection
1	2	3	4	5	E	Select appropriate drums and containers
1	2	3	4	5	F	Implement good housekeeping practices in the workplace
1	2	3	4	5	G	Check and document activities of hazardous-waste treatment and disposal contractors
1	2	3	4	5	H	Working individually or with others, develop improvements in the reduction, reuse, recycling, or disposal of waste streams
1	2	3	4	5	I	Coordinate collection and disposal of empty containers
1	2	3	4	5	J	Prepare accumulated hazardous waste for proper disposal
1	2	3	4	5	K	Identify and describe treatment, removal, and disposal systems such as: bio-remediation, chemical and physical, deep-well injection, incineration, vitrification, volatile organic compounds
1	2	3	4	5	L	Identify and describe hazards associated with abatement of materials such as:asbestos, fiberglass, lead, and others
1	2	3	4	5	M	Identify and describe hazards associated with treatment, removal, and disposal systems and operations
1	2	3	4	5	N	Provide on-the-job training as required

Appendix E

Survey Results

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS
1	Cert	Deg	Names of C	Full time	Part time	1	1X	1B	1C	1D	2	2X	2B	2C	2D	2E	2F	2G	2H	3	3X	3B	3C	3D	3E	3F	4	4x	4B	4C	4D	5	5X	5B	5C	5D	5E	5F	5G	5	5X	5B	5C	5D	5E
2																																													
3		As	Hazardous I	3	1		3	3	3	2		4	4	2	1	5	4	4	1		5	4	4	5	4	4		4	5	4	4		5	3	5	4	5	4	4		5	5	5	5	5
4		AS Ag	Environmen	3	2	3	4	4	4	5	4	4	4	4	2	2	4	3	3	4	4	3	2	2	3	4	4	2	2	3	3	3	4	4	4	4	4	2	3	4	4	4	4	4	4
5	c	as	Environmen	2	2	3	2	3	3	3	4	5	5	4	4	5	4	4	4	2	3	3	3	1	2	2	3	2	4	3	4	5	5	5	5	5	5	5	5	3	4	3	3	2	2
6	C	AS	Environmen	2	1	5	5	4	5	5	5	5	5	5	4	4	4	5	5	4	5	5	4	1	5	5	4	1	3	4	5	5	4	4	5	5	5	5	5	3	3	3	3	1	3
7	C	AS	Environmer	2	2	4	3	3	3	4	3	5	3	3	2	2	4	1	2	3	3	5	4	1	2	3	1	1	2	3	1	5	5	5	5	5	5	3	5	2	1	1	2	3	2
8	C	AS	Environmr	2	3		5	3	5	5		5	5	3	3	3	5	3	5		5	3	3	5	5	3		1	5	3	5		5	5	5	5	5	5	5		3	3	3	3	3
9	C	AS	Environmer	3	4	3	2	3	3	3	4	4	4	4	3	3	4	3	4	4	4	4	4	1	4	4	3	2	4	4	4	4	4	4	4	4	4	4	4	3	3	2	3	2	2
10	C		HM Technician		4	1	1	1	1	1	3	3	3	3	2	3	4	3	1	4	4	4	4	1	4	4	2	1	3	1	1	4	4	4	4	3	4	1	1	2	4	1	4	1	1
11	C	AS	Environmer	1	4		5	5	3	3		4	5	3	3	2	3	2	2		2	2	4	2	2	2		1	4	3	4		4	5	5	5	5	5	5		2	2	1	1	2
12		AS	AS Environ	4	4	5	3	3		3	5	33	3	3		3		3		4	3	3	3		3	3	5	3	3	3	3	5	3	3	3	3	3			3	3	3	3	3	3
13		AS		4	1	5	5	5	5	5	5	5	5	5		5	5	5		5	5	5	5		5	5	4	5	5		5	3	5	5		5				4	5	5	5	5	5
14	c		Environmental Technology																																										
15		AS	Environmer	2	2		3	4	5	5	5	5	4	2	4	4	4	4	5		5	4	4	3	4	4	4	4	3	4	4	5	5	5	4	4	3	4			3	3	4	4	4
16	C	AS	HW Mgmt	4	2	3	3	3	3	4		4	3	2	1	3	3	3	2	6	3	3	2	3	3	3		3	3	3	3		4	4	3	4	4	4	2		2	1	3	3	4
17	c		Certificate of achievement Environmental Technology																																										
18		AS	Environmer	1	3		3	1	2	3		4	3	3	2	3	3	4	3		3	3	5	1	4	3		2	2.5	3	4		5	5	5	5	4	5	4		2	1	2	1	3
19	C		Environmental Technok		4		3	3	5	5		5	5	3	3	5	4	3	5		5	5	3	5	5	5		3	4	4	5		5	5	5	5	5	5	3		4	3	5	4	4
20	C		HM Tech		4	4	4	3	4	4	5	5	5	4	3	5	5	4	3	4	5	5	3	3	4	4	2	2	2	3	5	5	5	5	5	5	5	5	5	4	4	4	4	4	4
21		AS	HM	2		3	4	3	3	4	4	5	5	4	5	5	5	5	5	4	4	5	5	3	5	5	4	4	5	4	4	5	5	4	5	5	5	5	5	2	2	2	3	3	3
22	C	Ind. H & S			2	5	4	5	1	2	1	3	2	2	2	3	5	3	4	3	3	2	3	1	4	5	3	2	1	5	1	2	1	1	2	5	1	1	3	5	1	1	1	4	5
23	C		Hazardous	3	3		4	3	4	4		4	4	4	3	3	3	3	4		2	2	4	1	3	3		1	2	3	2		3	4	4	4	5	5	4		2	1	2	1	2
24		AAS	Hazardous	3	3		4	3	4	4		4	4	4	3	3	3	3	4		2	2	4	1	3	3		3	3	3	3		3	4	4	4	5	5	4		4	3	4	4	4
25	C		Hazardous Materials Technology				4	3	4	4		4	4	4	3	3	3	3	4		2	2	4	1	3	3		1	2	3	2		3	4	4	4	5	5	4		2	1	2	1	2
26		AS	Hazardous		1		4	3	4	4		4	4	4	3	3	3	3	4		2	2	4	1	3	3		3	3	3	3		3	4	4	4	5	5	4		4	3	4	4	4
27	C		Environmer	1	1		2	1	1	2		3	3	3	3	3	3	3	3		3	3	3	3	2	3		1	2	3	4		4	4	4	4	5	5	5		2	3	3	3	3
28		AS	Environmen	1	1		5	3	3	4		4	3	3	3	3	4	4	4		3	3	3	3	4	3		1	3	3	4		4	4	4	4	5	5	5		2	4	4	3	4
29	C	AA	non listed		3	3	3	3	3	4	4	4	4	4	3	4	4	4	3	4	4	4	3	3	4	4	4	4	4	4	5	5	5	5	5	5	5	5	5	3	3	4	4	3	3
30	c		Environmen	3		2				2	2	2	2	3	2				1		3	5				2	2		2			4	4	4	4	4	4	4	3						
31	c		Environmer	3		2	2	2	2	2	2	2	3	3		2	3	1	1	3	3	5	1			1	3	2	2	4	4	4	4	4	4	4	4	4	3	1			2	1	
32		AS	Environmer	3		2	2	2	2	2	2	2	3	3		1	2	1	1	2	2	5				2	3	2	2	4	4	4	4	4	4	4	4	4	3	1			2	1	
33	C		HazMat Certificate of C		1		4	1	1	3		5	5	5	3	3	5	4	4		4	4	4	2	5	4		1	2	3	3		3	3	4	5	5	4	3		1	1	1	1	1
34		AAS		3		4	5	4	5	4	3	5	4	2	1	4	4	3	1	3	4	2	1	4	4	3	3	4	3	3	4	3	3	3	4	4	3	4	1	4	4	4	4	4	4
35		AD	Environmer	2	1	3	4	3	4	3	4	5	5	5	1	4	5	3	4	4	3	3	5	2	3	4	3	3	3	4	4	5	5	5	5	5	5	5	5	3	4	2	3	4	5
36		AD	Environmer	4			3	3	3	3		3	3	3	1	1	1	1	1		3	3	3		3	3		1	3	3	1		3	3	3	3	3	3	3		1	1	1	1	3
37	c	AD	Hazardous	2	4		1	2	2	3		5	5	5	5	5	5	5	5		5	5	5	2	5	5		2	5	5	5		5	5	5	5	5	5	5		4	4	5	5	5
38		AD	Hazardous I	4	1	4	3	3	4	5	4	5	5	4	2	3	3	3	4	4	5	3	3	2	4	3	3	2	5	4	4	5	5	5	4	5	4	3	3	4	3	3	4	4	3
39		AD	Environmer	3	1	5	5	5	5	5	5	5	5	5	5	5	5	5	3	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	3	3	5	5	5	5	5	5
40	C		EHMT Cert	2			3	3	4	3		4	4	4	2	4	4	3	3		5	5	4	3	3	3		3	4	3	5		5	5	5	5	5	5	5		3	2	3	3	2
41	C	AD	Envirotmental Technolo		4	2	2	2	4	4	4	4	4	2	2	4	4	4	4	4	5	4	4	2	4	5	2	2	4	3	3	5	5	5	5	5	5	5	5	3	3	2	4	2	3
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47		AS	Environmer	3	3	4	4	3	4	4	5	5	5	5	4	5	5	4	5	5	4	5	5	5	5	5	4	3	4	4	4	5	4	5	5	5	5	5	5	3	3	3	3	2	3
48	C	AD		4			5	2	3	4		5	5	5	3	4	5	5	5		3	4	5	1	3	5		5	5	5	4		3	3	5	5	5	5	5		5	4	5	5	5
49		AS	Environmer	2	2	4	2	2	2	2	4	5	5	4	3	5	5	5	3	5	5	5	4	5	5	5	4	4	5	3	5	5	5	5	5	5	5	5	5	4	4	4	4	4	5
50	C		Hazardous Materials Te		2	3	3	2	3	4	4	5	5	4	3	3	5	3	2	4	3	4	5	1	3	5	3	2	3	5	3	4	4	4	4	5	5	3	4	2	1	1	2	2	1
51	c	As		1	1	4	4	3	3	3		5	4	4	1	4	4	3	4	4	4	2	4	1	1	4	1	1	1	1	1	4	4	4	4	3	5	4	4	1	1	1	1	1	1
52		AS	Environmer	2		3	1	1	3	4	4	5	5	4	3	3	4	3	3	4	4	4	4	1	4	5	4	1	4	4	5	5	5	5	5	5	5	5	4	4	5	3	5	5	4
53	C	AS	AS - Occup	1	4		2	2	3	4		5	5	5	4	5	5	5	4		4	5	4	1	4	3		3	4	4	5		4	4	5	5	5	5	4		4	3	3	3	3
54			C - Achievement in Occupational Safety & Health																																										
55	C		Environmental Hazardo		4		3	1	1	3		5	5	4	2	5	5	3	3		5	4	3	1	5	5		5	5	5	5		4	5	5	5	5	5	5		3	4	3	3	2
56		AS	Environmer	1	1	3	3	3	4	4	4	3	3	3	3	4	4	4	4	4	4	4	4	3	4	4	4	4	4	4	4	4	4	4	5	4	5	4	4	4	4	4	4	4	4
57			8 & 24 Hour courses only																																										
58	C	AS	Environmer	2	4	4	3	4	4	3	4	4	3	3	4	4	4	4	3	3	4	2	3	3	3	3	3	3	3	4	3	4	4	4	4	4	4	3	3	3	3	3	3	3	2
59		AS	Environmental Technology																																										
60	C		Environmer	2	1	4	4	4	4	4	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1		2	1	1	1		3	2	2		3	2	1		3	3	3	3	3
61		AS	Environmer	1	1	3	3	3	4	4	4	3	3	3	3	4	4	4	4	4	4	4	4	3	4	4	4	4	4	4	4	4	4	4	5	4	5	4	4	4	4	4	4	4	4
62	C	AS		2	4		3		4	3		5	5	4	4	5	4	5	5		5	5	4	4	4	5		4	5	4	5		3	3	4	5	5	4	3		3	2	4	1	2
63	C	AA	Environmer	2	1	3	3	3	3	3		4	4	3	3	2	3	2	2														4	4	4	4	4	4	4						
64	C	AS	OSH		4	3	3	2	3	5	3	5	4	2	4	4	3	4	2	4	4	3	3	5	4	3	4	3	4	3	4	4	4	4	4	4	5	4	2	3	4	2	3	3	2
65	C	AS	Occ Envirar	1	4		3	3	3	3		5	5	5	4	5	5	4	4		3	3	3	1	3	3		2	3	3	5		4	4	4	5	5	4	4		4	4	4	4	5
66	C	H & S for Hazardous Waste Operations Training Program																																											
67		AS	Environmer	3	2	4	4	3	3	5	5	5	5	5	4	5	5	4	5	5	5	4	5	5	5	4	3	1	3	3	4	5	4	4	5	5	5	5	5	5	4	3	5	5	5
68		AS	Environmen	1	1	2	4	3	3	3	3	5	3	3	1	1	1	2	1	1	1	1	1	1	1	1	3	3	4	4	4	3	3	3	3	3	3	3	3	5	5	5	5	5	5
69	c		Environmen	1	1	2	4	3	3	3	3	5	3	3	1	1	1	2	1	1	1	1	1	1	1	1	3	3	4	4	4	3	3	3	3	3	3	3	3	5	5	5	5	5	5
70	C	AS	Not given	1	3	4	5	5	4	5	5	5	5	5	3	5	5	5	4	5	5	5	4	2	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
71	C	AS	Environmer	1	2		3	3	3	2		5	4	4	2	4	4	4	4		4	5	4		4	5		2	3	3	4		5	5	5	5	4	3	5		1	1	2	1	3

1	AT 6F	AU 7	AV 7X	AW 7B	AX 7C	AY 7D	AZ 7E	BA 7F	BB 7G	BC 7H	BD 7I	BE 7J	BF 8	BG 8X	BH 8B	BI 8C	BJ 8D	BK 8E	BL 8F	BM 8G	BN 8H	BO 8I	BP 8J	BQ 8K	BR 9	BS 9X	BT 9B	BU 9C	BV 10	BW 10X	BX 10B	BY 10C	BZ 10D	CA 10E	CB 10F	CC 10G	CD 11	CE 11X	CF 11B	CG 11C	CH 11D	CI 11E	CJ 11F	CK 11G	CL 11H	CM 11I	CN 12	CO 12X
2																																																
3	4													4	2	2	4	3	3	3	2	4	3	3		5	4	4		5	5	5	5	5	5	5		4	4	4	4	3	3	3	2	1		1
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13		2				5							5												5	5	5	5	5	5	5	5	5	5	5	5	4	5		5	5		5	5	5		2	5
14																																																
15	3		4	4	4	5	4	4	4	5	4	4	4	4	4	4	5	5	5	4	4	5		4		3	4	3		4	4	3	3	3	3	3		4	5	4	5	3	3	4	3	4		4
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17																																																
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Appendix F

Computer Disk of Supporting Data