EVALUATION OF THE EFFECTIVENESS OF XYZ COMPANY SAFETY TRAINING PROGRAM

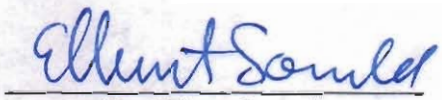
by

Pimrutai Monphongchai

A Research Paper
Submitted in Partial Fulfillment of the
Requirements for the
Master of Science Degree
in

Risk Control

Approved: 3 Semester Credits



Dr. Elbert Sorrell
Research Advisor

The Graduate School

University of Wisconsin-Stout

October, 2004

The Graduate School

University of Wisconsin Stout

Menomonie, WI 54751

Abstract

Monphongchai	Pimrutai	
(Writer) (Last Name)	(First Name)	(Middle Initial)

Evaluation of the Effectiveness of XYZ Company Safety Training Program

(Title)

Risk Control	Dr. Elbert Sorrell	October 2004	66
(Graduate Program)	(Research Advisor)	(Month/Year)	(# of Pages)

American Psychological Association, 5th edition

(Name of Style Manual Used in this Study)

The Occupational Safety and Health Administration (OHSA) requires employers to provide safety related training to their employees on regular basis. At XYZ Company, a training program was developed and mandated to all employees. The effectiveness of the XYZ Company safety training program had not been evaluated.

This study was purposed to evaluate the effectiveness of the XYZ Company safety training program, its organizational impact, and to provide feedback to the XYZ Company for further improvement. A questionnaire and historical safety records were used as tools to access employees' knowledge retention, overall achievement of the safety training program, and determine opportunities for improvement.

Results from the employee survey indicated that employees had significant loss ($p<.001$) of their safety knowledge in the first month after receiving the training. The

historical safety records emphasized needs for improvement of the XYZ Company safety training program.

Areas for improvement included reviewing training objective, developing a protocol to evaluate training activities, increasing the number of training attended employees, scheduling and retraining employees more frequently, and promoting other approaches for ultimate safety outcome.

Acknowledgments

This research could not be completed without assistance from many people. First of all, my heartfelt gratitude is to my research advisor, Dr. Elbert Sorrell, for his guidance, expertise, patience, and encouragement throughout this paper and my degree.

I am genuinely thankful to a safety manager and all volunteers from XYZ Company for permission to conduct this study. I would also like to thank Christine Ness, the Research and Statistical Consultant for her advice on data analysis. Special thanks are to Scott Marlette and Vicki Weber for proofreading and helping with paper format.

I appreciate Dr. Martin Ondrus and the entire Risk Control staffs including Dr. Brian Finder, Dr. Eugene Ruenger, Steve Senor and Lyle Koerner, for their valuable knowledge that I have acquired for this career.

Lastly, my cordial gratefulness is to my parents and friends for unlimited support and encouragements throughout my studies. I would not have done this much work without all of them.

Table of Contents

List of Tables

Page

List of Figures

Page

CHAPTER ONE: Introduction

In general, occupational and health hazards are present in all industries. Many workers are subject to injury or fatality from their occupations. The food manufacturing industry tends to have greater levels of exposure. According to the Occupational Safety and Health Administration, United States Department of Labor (2003), the food manufacturing industry was responsible for 64 cases of fatal occupational injuries and contributed 1.2% of all reported cases. Equipment presenting hazards within the food processing industry include: 1) processing equipment such as grinders and sifters, cooling tunnels, boilers, wrapping and packaging machines, 2) bulk material storage such as bins, tanks, and silos, 3) transportation systems such as forklifts. Also, chemicals used in the facility such as cleaning agents. In addition, workers have experienced injuries and/or illnesses from slipping and falling, highly repetitive tasks, lifting heavy objects, variable temperature conditions, noise exposure, and others.

Both engineering and administrative control techniques are used within the food industry to reduce risks. Engineering control techniques such as redesigning work areas, using alternate chemicals, or installing machine guarding eliminate hazards at their origins. Administrative control techniques such as job rotation, implementing personal protective equipment, and employee training limit employee exposure. Employee training is commonly used to promote a culture of safety awareness and educate workers of proper performance. In addition, training of employees is regulated for the general industry, including food processing, by the Occupational Safety & Health Act (29 CRF 1910). For example, 29 CFR 1910.132 (f)(1) states that "the employer shall provide training to each employee who is required by this section to use personal protective

equipment." Recommended steps for developing training programs are: conducting need assessments, identifying goals and objectives, developing learning activities, conducting training, evaluating the effectiveness of programs, and improving programs (Roughton & Whiting, 2000). A successful training program incorporates management aspects with employee involvement. Top management must support the program. Employees also play an important role in a successful training program.

Company Background

The XYZ Company is a food production facility located in the midwest of the United States of America. The company employs approximately 370 people and operates 24 hours per day and seven days per week. There are six major plant areas: production, material handling, maintenance, quality control, sanitation, and a warehouse. Training is important for employees in order to ensure that they perform the job safely and effectively. Due to the variety of jobs performed within the company, a training program is mandated for all employees. The XYZ Company training program includes an orientation session for new or transferred employees, and follows with a refresher training session for all employees each month. The new employee orientation is conducted by a safety manager, and takes place over three days and covers several topics. The first day's topics include general safety, emergency response, plant orientation, key concepts of safety processes, incident reporting, company resource center, and hazard communications. On the second and third day, education and discussion panels cover safety training and compliance issues. Examples of those topics are forklifts, lock-out/tag-out (LOTO), process safety management principles, bloodborne pathogens (BBP), emergency eye wash/shower stations, proper ladder usage, fire prevention and

suppression principles, respiratory protection overview, hearing protection overview, personal protective equipment (PPE), machine guarding principles, heat stress, basic electrical principles, and confined space principles. The refresher training program is rotated every month and covers about 15 safety and compliance topics.

The training program is designed to protect employees and reduce accidents, injuries, and illness. Employers are required to provide some level of training to all employees. After the training classes are completed, trained employees should know how to perform their jobs safely. They should be able to recognize risks and protect themselves from those risks. Moreover, they should understand the importance of the training program for both employees and the organization. Accidents, injuries, and illnesses have a significant impact to the company. One accident can result in both direct and indirect costs. Injured employees suffer from pain, require medical care, and lose time at work. These circumstances result in decreased productivity, increased workers' compensation, and affect the company's reputation. It also requires company wide support. Training programs are a continuing improvement process. Evaluating the training program is necessary and will provide feedback for improvement.

At this time, overall aspects of the training program at XYZ Company are evaluated as one part of plant evaluation every three months. There is no standard procedure for the XYZ Company to use for measuring any improvement of the program. A company safety manager views that evaluating the effectiveness is important and should be done to improve the program.

Statement of the Problem

Currently a safety training program is developed and implemented at XYZ Company. It is questionable whether the XYZ Company training program is effective and minimizes injuries, illnesses, accidents, and associated cost.

Purpose of the Study

The purpose of this study was to evaluate the effectiveness of the XYZ Company safety training program, its organizational impact, and to provide feedback to the XYZ Company for further improvement.

Objectives of the Study

The objectives of this study were:

1) To determine the effectiveness of the XYZ Company safety training program,

2) To determine how well employees retain training information, and

3) To determine the opportunity to improve the safety training program.

Significance of the Study

The XYZ Company was the only company focused on in this study. The result of this study could provide a mechanism to improve safety training at XYZ Company. Improving the training program will benefit employees and the company. The employees will receive more effective training which will increase their awareness and knowledge of safety. As a result, the number of accidents, injuries and work-related illnesses should decrease. In addition, the benefit of improving the safety training program may reduce associated costs for training and workers' compensation. An effective training program may result in net saving to the organization.

Limitations of the Study

This study was limited to only the XYZ Company safety training program. Several factors were uncontrollable. These factors included:

1) Sample technique. The participants were voluntary current employees of XYZ Company. It was impossible to collect data from all employees.
2) Characteristics of subjects. The subjects were different in work experiences, background, and skills that could contribute limitations to this study.
3) Time. This study traced back the XYZ Company safety program for the past year. The post-safety knowledge of employees was measured for within the limited timeframe.

Definition of Terms

Effectiveness: "Producing or capable of producing a result" (Merriam-Webster, 1998, p. 367).

Exposure: "Condition that occurs when an employee is subjected to a toxic substance or harmful physical agent in the cause of employment through any route of entry, and that includes past exposure and potential exposure, but does not include situations in which the employer can demonstrate that the toxic substance or harmful physical agent is not present, used, handled, stored, or generated in the workplace in any manner different from typical non-occupational situations" (Confer and Confer, 1999, p.92-93).

Evaluation: "To determine the significance, worth, or condition of usually by careful appraisal and study" (Merriam-Webster, 1998, p. 400).

First Aid Rate: The rate is calculated by multiplied the number of first aid injuries with 200,000 and divided by the total number of hours worked.

Hazard: "A dangerous condition, potential or inherent, that can interrupt or interfere with the expected orderly progress of an activity" (Confer & Confer, 1999, p.116).

Incident: "An occurrence, happening, or energy transfer that results from either positive or negative influencing events and may be classified as an accident, mishap, near-miss, or none of them, depending on the level and degree of the negative or positive outcomes" (Vincoli, 2000, p. 507).

Injury: A result of an incident causing physical harm, damage to a person, or involving lost time or other than on-site medical treatment.

Lockout/Tagout: "A formal procedure for isolating equipment, machinery, or a process to prevent its unintentional operation during maintenance, servicing, or for any other reason. The equipment, etc., is put into an energy-isolated state, and each individual who will work on the device/equipment/machine/etc. places his/her lock and/or tag on the electrical switch or other start-up means in order to keep the device/machine/etc. in a zero-energy state until the work is completed by each individual who has affixed his/her lock and/or tag to it. The policy and procedure related to this practice is to clearly and specifically outline the purpose, responsibility, scope, authorization, rules, definitions, and measures to enforce compliance" (Confer & Confer, 1999, p. 148).

Occupational Safety and Health Administration (OSHA): "A federal agency within the United States Department of Labor responsible for establishing and enforcing standards for the exposure of workers to safety hazards or harmful materials that they

may encounter in the work environment, as well as other mattes that may affect the safety and health of worker" (Vincoli, 2000, p. 711).

OSHA Recordable Rate: The rate is calculated by multiplied the number of injuries and/or illness or lost workdays according to OSHA recordable cases with 200,000 and divided by the total number of hours worked.

Safety Training: "Any training associated with the safety aspects of the home, job, workplace, or other aspects of living or working, possibly specifically including any potential hazards and their relationships to a particular individual or group" (Vincoli, 2000, p. 878).

Total Incidence Rate: The rate of total injuries and/or illnesses or lost workdays and first aid cases

Training: "The act of providing or receiving instruction on certain tasks, requirements, specifications, or any combination of these to ensure adequate, safe, and/or proper performance" (Vincoli, 2000, p.1011).

Workers' Compensation: A type of insurance that employer purchase to cover payments to employees who are injured in accidents or/and in the course of their employment.

CHAPTER TWO: Literature Review

Occupational health and safety requirements have changed over the past decades. The occupational safety movement is driven by workers, government, and the private sector. According to OSHA (2003), "almost 6,000 Americans die from workplace injuries; perhaps as many as 50,000 workers die from illnesses in which workplace exposures were a contributing factor; nearly 6 million people suffer non-fatal workplace injuries; and the cost of occupational injuries and illnesses totals more than $170 billion" (p. 3). Employers today are more concerned about the safety of their employees, and attempt to prevent their employees from getting injured at work. However, hazards and substandard conditions are still present in the workplace. Safety training programs are recognized to be proactive ways in reducing hazards and risks associated with the workplace. In this chapter, literature related to the objective of this study is reviewed. Contents include food manufacturing hazards and risks, evaluation training programs, and OSHA regulations related to employees' safety training.

Food Manufacturing Industry

Food manufacturing covers a broad number of industries involved with preparing, processing, preserving, and packing food commodities. Those activities are aimed at extending shelf life of perishable foods, increasing nutritional value of the product, and offering conveniences for consumers. The categories of food manufacturing are diverse depending on types of food and processes such as bakery, beverage and brewing, candy and confectionery, dairy, fruit and vegetable, grain and oilseed, meat and poultry, seafood industries, and so on. General methods of food processing and preservation are acidification, and thermal processing including canning, ultrahigh temperature (UHT)

treatment, and pasteurization. Methods also include concentration by evaporation, dehydration, refrigeration or chilled storage, freezing, salting, sugaring, curing, smoking, chemical preservatives, irradiation, and ultraviolet (UV) light (Sancho-Madriz, 2003, and Ensminger et al, 1994). Employment statistics in food manufacturing from the Bureau of Labor Statistic, United States Department of Labor (2004) are presented in Table 1. Workers totaling 1,525,200 were employed within the food manufacturing industry. The highest employment industry was animal slaughtering and processing. According to Table 1, seafood product preparation and packaging employed the least number of workers.

Table 1

Employment in Food Manufacturing by Industry Segment in 2002

Industry Segment	**Employment (in thousands)**	**Percent**
Animal slaughtering and processing	520.3	34.11
Bakery and tortilla manufacturing	294.6	19.32
Fruit and vegetable preserving and specialty food manufacturing	181.6	11.91
Other food manufacturing	151.6	9.94
Dairy product manufacturing	136.9	8.98
Sugar and confectionary product manufacturing	83.1	5.45
Grain and oilseed milling	61.9	4.06
Animal food manufacturing	51.5	3.38
Seafood product preparation and packaging	43.7	2.87
Total employment	1,525.2	100.00

Source: Bureau of Labor Statistic, U.S. Department of Labor (2004)

Similar to other industries, food manufacturing companies hire several types of employees. The majority of employees are food production workers who have direct

contact with food during the production phase. Supervisors oversee line workers and report to managers. Top management directs and organizes all aspects of the company.

Working Conditions and Exposure to Hazards

Working conditions in food manufacturing varies depending upon the type and size of the industry. Major production lines in food manufacturing are preparation, processing, filling, and packing. In the preparation area, workers check raw materials for color, shape, size, and appearance. Their duties also include sorting, grading, washing, peeling, and slicing the raw material. Some tasks are done manually and others are completed mechanically. The line employees handle a variety of tools and equipment such as knives and cutting machines. In addition, they also work in wet areas and a variety of temperatures ranging from hot to cold. Food processing employees lift and carry food in bulk containers as well as at high temperatures. They operate equipment such as cookers, retorts, ovens, driers, and evaporators. The foods are filled and packed manually or automatically in various containers such as glass bottles, cans, plastic bags, or boxes. The workers examine the quality of the product and label the product prior to storage and warehousing. These processes create many safety related hazards.

A hazard as defined by Goetsch (2005) is "a condition with the potential of causing injury to personnel, damage to equipment or structures, loss of material, or lessening of the ability to perform a prescribed function" (p. 851). Hazards within food manufacturing vary with different types of processing. Malagie et al. (1998) categorized hazards in the food processing industry into physical injuries and health risks. However, hazards can be grouped as physical, chemical, and biological.

Physical Hazards

Physical hazards involve machinery, hazardous energy, workplace condition, environmental issues, and ergonomics. According to Malagie et al. (1998), employees are injured by using hand tools, operation of machinery, collisions with moving or stationary objects, falls or slips, and burns. In meat processing plants, workers cut the carcasses into wholesale cuts or smaller cuts for retail business. Some meat processing plants also prepare meat products such as sausage and hamburger. The slaughterers use sharp knives, cleavers, and other dangerous tools to cut the meat. Improper usage of sharp tools such as knives, cleavers, or power tools cause injuries (Bureau of Labor Statistics, 2004).

One major machine widely used in food manufacturing is the conveyor which easily becomes stuck with objects. Employees could be injured from clearing obstacles out of the conveyors. Moving objects from one area to another are common practices in food manufacturing industries. Employees may get injured from collision if there is inefficient light or existing barrier such as curtains in the area.

In addition, fleet accidents can be caused from operating powered industrial trucks. Injuries from slips, trips, and falls frequently happen in wet and slippery areas especially in washing rooms. Hazardous energy produced from electricity, steam pressure and explosive materials is another concern. Most machines are operated by high voltage and pressure. Employees may get electrical shock from improper usage.

Workers are subjected to burns from high temperature equipment such as ovens in the bakery industry, roasters in cocoa manufacturing, and retorts in canning facilities. Moreover, breakages of hot steam pipes or hoses are hazardous. Steam and hot water are mainly used in food processing for blanching vegetables and washing and sanitizing

equipment. Employees need to be aware of possible burn injuries. In grain and cereal manufacturing, fire explosions are major concerns at this facility due to usage of a silo to store raw material.

Workplace conditions are very important as well. Damp conditions are common in food processing. Several steps using water for washing raw materials, draining waste water, and cleaning equipment and tools are common in the production lines. Employees may experience respiratory disease from working in areas containing organic dust. In addition, employees require ample space to perform their jobs safely. Tools and equipment need to be kept in proper places. Adequate housekeeping needs to be addressed.

Environmental issues also create hazardous exposure to employees. In some processes such as roasting, baking, candy making, or steam cooking, employees work in hot conditions, while other processes such as meat cutting or seafood preparation, they work in cold conditions. Employees may suffer from cold exposure and results in impairment if proper protective equipment is not supplied. In addition, they may experience heat stroke from working in hot areas when the ventilation system is inefficient. Hearing loss from noise exposure is another issue in canning, or other manufacturing.

Lastly, from an ergonomic standpoint, cumulative trauma disorder is caused from repetitive motions, extreme posture, and force load tasks such as manually filling product, and lifting heavy ingredients. In the cheese making process, workers need to add ingredients such as enzymes, bacteria culture and salt into the milk and cheese curd. This

step is done by hand using a shovel-like tool, and requires employees to mix ingredients together well. This may cause physical stress due to the mass of the cheese product.

Chemical Hazards

Chemical hazards can enter the body via inhalation, ingestion, injection, and skin absorption. Chemicals can be in forms of mist, fume, vapor, gas, liquid, or solid. Chemicals added in food processing are considered to be safe for human consumption. However, employees can be exposed to chemical substances such as cleaning agents, detergents, or pesticides. Without wearing proper protective equipment such as gloves, employees may experience skin irritation. Report from National Institute for Occupational Safety and Health (2003) indicated that breathing certain chemical flavoring used in microwave popcorn can lead to lung disease in workers. In quality control or research and development laboratories, many chemical substances are stored and used for experiments. Appropriate labeling of chemicals and handling chemical waste are essential. Ammonia used in cooling areas is also a hazardous chemical. Liquid nitrogen, used in the frozen food industry, can cause cold burns and skin damage. Compressed gas tanks used for food processing are other things to be considered as hazardous material.

Biological Hazards

Infections from microorganisms which are spread by animals and insects cause biological hazards. Exposure from microorganisms such as hepatitis B virus (HBV), human immunodeficiency virus (HIV), and so on is possible when fluid transmission occurs. Since the nature of working conditions in food manufacturing is wet and damp, mold growth in the building can be present and may create an issue. Animals such as

mites and rodents can spread infection. Current biological hazards in food are anthrax from *Bacillus anthracis* and mad cow disease from bovine spongiform encephalopathy, which can infect food workers if precautions are not taken.

Education and Training Program

Food processing companies typically hire high school graduates with or without experience. Training varies from type of food manufacturing due to different tasks performed. According to Occupation Information Network (2004), three main tasks for agricultural product graders and sorters are 1) to grade and sort products, 2) to segregate products on a conveyor belt or table, and 3) to estimate weight of product visually and by feel. Food cooking machine operators' and tenders' tasks are 1) to collect and examine product samples during production to test quality, 2) to record production and test data such as batch numbers, cooking time and temperature. Food batchmakers set up, operate, and tend equipment that cooks, mixes, blends, or processes ingredients in the manufacturing of food products, according to formulas or recipes.

Some basic skills such as cutting, operating machines, or packing products require short-term training, however, employees require time and experience to become familiar with processes and to be able to perform them safely (Bureau of Labor Statistics, Career Guide to Industries, 2004).

Safety Training Program

As mentioned earlier, there are many hazards and risks associated within the food processing industry. Education and training programs play an important part in reducing employee exposure. However, training programs are not engineering controls and do not

minimize hazards at their origin. It is a proactive way to increase awareness of safety for workers, and prevent accidents and injuries.

Training defined by Vincoli (2000), is " the act of providing or receiving instruction on certain tasks, requirements, specifications, or any combination of these to ensure adequate, safe, and/or proper performance" (p.1011).

Safety training is "any training associated with the safety aspects of the home, job, workplace, or other aspects of living or working, possibly specifically including any potential hazards and their relationships to a particular individual or group" (Vincoli, 2000, p. 879).

Training Program for New and Transferred Employees

Accidents tend to occur more than usual on the first days of work for new employees because of confusion and stress (Goetsch, 2005). Newly hired employees in food manufacturing industries are not required to have experience. Training in these industries varies from business types and tasks. Experience is not needed for some positions such as food preparation-cutting, trimming and washing. Employees can learn within a few days. Whereas other complicated tasks such as slaughtering and cheese making require more time. Highly skilled butchers take about one to two years to develop their skill (Bureau of Labor Statistics, 2004).

An orientation for new and transferred employees is important to reduce stress to those employees. Employees will be given instructions on how to perform their jobs safely and how to reduce any exposure to hazards. In addition, they will be familiarized with the company's rules and policies. In the safety and health management program suggested by OSHA for a small business, which employs less than 100 workers, training

is indicated as one part of the whole program. Two hours of orientation are given to new employees. On the first day, the new employee only observes an assigned partner performing the job and reads the job safety procedures to be familiar with the job function. The new worker performs the job under observation from the partner on the second day and is restricted in that work area for a period of six months.

Importance of Safety Training Program

The safety training program is important to industries for many reasons. Hecker (1998) indicated that "the overall rationale for training and education is to improve awareness of safety and health hazards, to expand knowledge of the causes of occupational illness and injury, and to promote the implementation of effective preventive measures" (p.18.2). Increasing safety knowledge and awareness is believed to decrease accidents and injuries within the organization. Decreases in accidents and injuries are beneficial for the company because of increased productivity, less absenteeism, and reduced costs for medical and workers' compensation premiums.

In addition, safety training is regulated for general industries by OSHA in Title 29, Code of Federal Regulations Part 1910. Employers are required to provide training as regulated in the OSHA standards. Non-compliance issues can create tremendous difficulties to the organization. The company may receive citations and penalties from OSHA for various violations. Violations are categorized from willful, serious, other-than-serious, failure to abate, and repeat (OSHA, 2003). Publication indicated that fines vary from $5,000-70,000 depending on types of violation and circumstances. Fines for criminal penalties may be as much as $250,000, but if the penalized organization is a

corporation, the fine may be up to $500,000. For this reason, companies need to ensure that OHSA standards are followed.

OSHA Standards requiring training programs are subpart E-means of egress, subpart F- powered platforms, manlifts, and vehicle-mounted work platforms, subpart G-occupational health and environmental control, subpart H-hazardous materials, subpart I-personal protective equipment, subpart I- general environmental controls, subpart J-medical services and first aid, subpart L- fire protection, subpart N- materials handling and storage, subpart O- machinery and machine guarding, subpart Q- welding, cutting, and brazing, subpart R- special industries such as grain handling facilities, subpart S-electrical safety-related work practices, and subpart Z- toxic and hazardous substances (OSHA, 1998). Contents of each standard can be found in Code of Federal Regulations, Title 29, Parts 1900-1999.

Developing Training Program

The educational training program requires company-wide support. It needs commitment from upper management and involvement from employees. A successful training program is driven from clear objectives and must be delivered to the right people with appropriate technique.

According to Goetsch (2005) safety and health training should be performed following principles of learning. The principles are as follows; people learn best by hands-on experience and in practical performing step-by-step manner and when ready to learn; they learn more easily when the topic relates to what they already know; people will remember and understand better when they use what they learn often (p.657). Also,

successful learning will motivate additional learning, and people need immediate feedback from their gained knowledge.

Adult learning is different in many ways from the way children learn. Factors, which influence learning in adults, are motivation, seeing and hearing, and the physical environment (Atherley & Robertson, 1998). Unlike children who must go to school, adults learn voluntarily. However, they must follow the company's policy. In order to gain participation from adults, motivation is necessary. Adults can be motivated to learn based on individual interests. Audio and visual conditions in adults can present obstacles for learning. They may not see and hear well. For this reason, presenters need to provide accommodations such as using microphone and visual aids. Facility and equipment are customized for learners. For example, pair discussion and small groups will support learning in adults.

Evaluating the effectiveness of a training program is one step in the training program. The training program requires steps as following:

- Identifying training needs
- Setting goals and objectives
- Generating training plan
- Implementing the training program
- Evaluating effectiveness of the training program
- Following up and improving the program.

Evaluating the Training Program

According to Mayo (1987), evaluation is a broader term of validation that encompasses a wide range of activities that provide information from which judgments can be made in order to achieve the stated objective.

Phillip (1997) defined "evaluation is a systematic process to determine the worth, value, or meaning of an activity or process" (p.36), and listed ten evaluation purposes as:

1. To determine success in accomplishing program objectives
2. To identify the strengths and weaknesses in the training process
3. To compare the costs to the benefits of a training program
4. To decide who participate in future programs
5. To test the clarity and validity of tests, cases and exercises
6. To identify which participants were the most successful with program
7. To reinforce major points made to the participant
8. To gather data to assist in marketing future program
9. To determine if the program was the appropriate solution for the specific need
10. To establish a database that can assist management in making decision

Effective safety training programs are believed to reduce accidents and injury rate, decrease absenteeism of employees, and lessen workers' compensation costs. Evaluating training programs is important and necessary. It measures any success or failures of the program and provides an opportunity for improving future training programs. In addition, the trainers receive feedback on quality of contents, materials, and the presentation.

In the training program, evaluation activities can take place in four stages which are 1) during the initial planning, 2) while implementing the training, 3) at the end of the training program, and 4) a post-training program after a certain period (Miller, 1994)

Training evaluation can be summative or formative. Summative evaluation focuses on the final outcome or impact of the program, but formative evaluation aims to assist decision making in the revision of a program (Hawthorne, 1987).

Two types of data measurements are subjective and objective as defined by William (1992) as followed:

- "Subjective measures are those that are based on beliefs, opinions, or judgments"
- "Objective measures are those that are readily observable and require minimal inference." (p.58)

Evaluation input can be obtained either from participants or third parties such as consultants (William, 1992).

Levels of Evaluation and Model

Several types of data can be collected to evaluate the training program. Table 2 summarizes several levels of evaluation models and its components.

In general, each model contains a similar component. For example, Mayo's Four Categories are very familiar with The Kirkpatrick Four-Level. The Phillips Five-Levels of Evaluation and Kaufman's Five Levels of Evaluation are modified from the Kirkpatrick Four-Level. Details of The Kirkpatrick Four-Level, The Phillips Five-Levels of Evaluation, and The CIPP Model will be discussed.

Table 2

Summary of Level of Training Evaluation Model

Model	Level of Evaluation
The Kirkpatrick Four-Level (Kirkpatrick, 1994)	1. Reaction 2. Learning 3. Behavior 4. Results
Mayo's Four Categories of Training Criteria (Mayo, 1987)	1. Acceptance by trainees 2. Gain in skill or knowledge 3. Improvement in job performance 4. Better results of operations.
The Phillips Five-Levels of Evaluation (Phillips, 1996)	1. Reaction & Planned Action 2. Learning 3. Job Applications 4. Business Results 5. Return on Investment
Kaufman's Five Levels of Evaluation (Phillips, 1997)	1. Societal Outcomes 2. Organizational Output 3. Application 4. Acquisition 5. 1) Reaction 2) Enabling
CIPP Model (Galvin, 1983)	Context Evaluation Input Evaluation Process Evaluation Product Evaluation
The CIRO Approach (Phillips, 1997)	Context Evaluation Input Evaluation Reaction Evaluation Outcome Evaluation

The Kirkpatrick Four-Level Model

A four-level of evaluation model created by Donald Kirkpatrick is well known and accepted for four decades. Kirkpatrick's model defined four levels for measurement training outcomes as reaction, learning, behavior, and results.

1. Reaction. Measuring reaction can be accomplished by evaluating how trainees react to the program such as their interests in the program, or accomplishment for the goal and objective. A simple way to access this level is by using a questionnaire at the

end of the session to ask for trainees' feedback. Examples of questions are: how do the trainees rate the program and is the program interesting? A good indicator of a positive reaction to the program is when the trainees intend to return for the next training. An in-house employee training is quite different from outside training program. One reason is that the training program is mandated for employees. As long as they are employed by the company, a training program is mandated for them. In this case, reaction is very difficult to measure. However, the trainer can observe from the trainees' reaction if they seem to pay attention to the program and if they want to get involved in the training activities.

2. Learning. Successful learning from training programs measures knowledge or skills that trainees gain from the training. Furthermore, the knowledge can be measured by an attitude change on the topic. Tools used to measure knowledge are written examinations or practical examinations. The trainers may ask trainees to take a pre-test and post-test. The two-test scores compare their knowledge. The test questions should not test language ability, but content of the topic. Terminology used in the test questions needs to be covered during the class. Some programs have no specific target and contain broad content; therefore, the learning cannot be measured. For this reason, it is important to state clear objectives of the training program.

3. Behavior. Behavior is the third level of measuring the effectiveness of the training program. Training is aimed at increasing the knowledge and skill of trainees to produce a behavior change. This level of measurement can be done through behavior observation methods such as peer evaluation. Changing behavior is a time consuming and on-going process. According to Kirkpatrick (1994), changed behavior is difficult to

measure and may not be accessible even though reaction is favorable and the learning objectives are accomplished. The trainees need to have motivation to change behavior as well.

4. Results. Lastly, effectiveness of the training program measures an outcome after trainees attended the program. The outcome can be in the form of improved culture of the company and increased production and quality of a product. A desired outcome could contribute to fewer of accidents, injuries, and illnesses. In addition, positive outcomes demonstrate a decrease in loss-work time and insurance premiums. In order to accomplish a beneficial result, the goals and objectives of the training program need to be identified clearly. Measuring subjective elements such as performance improvement, decision making, satisfaction, or motivation is more difficult than measuring objective elements.

The Phillips Five-Levels of Evaluation

Jack Phillips (1996) adapted and modified the four levels of evaluation from Kirkpatrick. Five levels in the Phillip model are reaction, learning, job applications, results, and Return on Investment (ROI).

The first level, reaction, focuses on participants' satisfaction on the program. The second level, learning, concentrates on degree of skill, knowledge, and attitude that participants have changes in. The third level, job application, involves behavior changes. The fourth level, business result, presents the actual contribution of the program to the organization. The fifth level, ROI, is needed because it allows the converting business result to financial unit, its added value, and its costs. ROI step provides the highest value of information and the highest power of shown results compared to other four levels.

However, access to ROI is the most difficult level. For this reason, most of the organizations only evaluate reaction, learning, and job application instead of result and ROI.

The CIPP Model

The CIPP Model was developed based on four basic decision stages from the education field. Four elements of the CIPP are 1) context evaluation, 2) input evaluation, 3) process evaluation, and 4) product evaluation (Galvin, 1983). The model developer claimed that the CIPP Model was more preferred than the Kirkpatrick Four-Levels.

Context evaluation, such as a need assessment, is used to determine objectives, identify accomplishments, needs, opportunities, and to detect particular problems. Context evaluation is useful in forming goals.

Input evaluation gives information to determine how to use resources to best accomplish the program goals. Examples of input evaluation results are procedures, policies, and proposals. Input evaluation supports planning the program.

Process evaluation provides the feedback to persons who are responsible for implementing the program. The data collection can be obtained from formal and informal approaches such as reaction sheets, rating scales, diaries and analysis of existing records. Process evaluation also provides a guideline for implementing the program.

Production evaluation measures and interprets the achievement of objectives including intended and unintended outcomes. This level of evaluation can take place during and after the program. Production evaluation assists in recycling decisions which are to judge and react to attainments.

Selecting the Appropriate Evaluation Design

Selecting the appropriate design is an important part in evaluation activities. Phillips (1997) discussed several evaluation designs and their advantages and disadvantages.

One- Shot Program Design

The one-shot technique, the most common design used in training programs, involves a single group that is evaluated only once after the program has been completed. This technique may be influenced from many uncontrolled factors since no data is collected prior to the program. However, the one shot design is very useful for measuring the performance of a group whenever no significant knowledge, skill, ability and performance are measured before the program is conducted.

Single Group, Pre-Test and Post-Test Design

This technique involves one group of participants who receive the training program. The knowledge, skills, or activities are measured before the program is conducted. After completing the program, the same knowledge, skills, or activities are tested to compare the result and any improvement from the pre-test. One advantage of this technique is that participants have the opportunity to explore topics and questions prior to receiving training. For this reason, change in their knowledge, skills, and abilities may be affected from the pre-test, but not from training program.

Single Group, Time Series Design

A time series design involves multiple measurements before implementing the program and after completing the program. This technique uses an experimental group

itself as a control group and eliminate internal factor. This design is useful when the program requires long periods of time to detect the change of performance or behavior.

Control Group Design

This design involves a comparative result from two groups. One group receives the program identified as "experimental group" and another group does not receive the program known as "control group". This technique requires a well-planned method for selecting similar participant groups.

There are several techniques to collect data from participants. For example, data is collected from both groups prior to the program and the end of the program. Data can be collected from both groups only after one group completes the program. The design can also involve two experimental groups and one control group, and compares pre-test data from one experimental group and control group with the post-test data from all three groups.

Data Analysis Using Statistic Method

Using questionnaires or surveys to access reaction, knowledge, skill or outcome of the training program provides numeric data. Analysis and interpreting data is complex and may require statistic tools. Phillips (1997) suggested guidelines that can be used before analyzing data. Those guidelines are reviewed for consistency and accuracy, using all relevant data, treating individual data confidentially, and using the simplest statistics as possible. Three purposes of using statistics in evaluation (Phillips, 1997) and statistical tools (Janicak, 2000) are:

1. It summarizes the large amounts of information. Statistical tools are distribution methods including frequency, percentage and means

2. It is used to determine the relationship between two or more items. Statistical tools are correlation and regression
3. It allows comparing the difference between two groups such as inferential statistics for means methods including t-tests and one-way analysis of variance (ANOVA).

In this chapter, literatures related to hazards in food manufacturing, OSHA regulations for training, and evaluation of training program are reviewed. Hazard in food manufacturing can be grouped as physical, chemical, and biological hazards. Employers need to ensure the health and safety of their employees and follow government regulations. Safety training is one element required from OSHA. Accomplishment of a safety training program should be evaluated and improvements, if any, should be determined.

CHAPTER THREE: Methodology

The purpose of this study was to evaluate the effectiveness of the XYZ Company's safety training program, its organizational impact, and to provide feedback to the XYZ Company for further improvement. This study determined the effectiveness of the XYZ Company's safety training program, how well employees retain training information, and the opportunity to improve the safety training program. The data collected was divided in two sections- surveying and historical reviewing.

This chapter presents the experimental designs, and methodology used to gather the data. The following topics: subjects, sample selection, methods, limitations and data analysis were reviewed.

Surveying

Surveying employees was intended to evaluate their safety knowledge. This section explains how well the employees retained training information.

The following assumption was made. After receiving the training, employees' knowledge of safety related topics was 100%. Employee's safety knowledge was anticipated to decrease as time passed, thus refresher training for each topic was necessary. This section answers how often employees needed to receive the refresher training.

Subjects

The subjects in this study were the current employees of the XYZ Company. All participants were voluntary and received safety training prior to taking the questionnaires.

Sample Selection

It was estimated that there were 350 employees from the XYZ Company during the time this study was conducted. The samples were representative of the employees from all departments of the company. The samples were selected and determined with the coordinating of the safety manager.

Method

The method used in this section was a questionnaire. The purpose of the survey was to examine the post-training safety knowledge of employees.

All questions were already developed by the XYZ Company and had been used for reviewing the knowledge of employees at the end of each training section. Five topics were selected from 15 total training topics at the XYZ Company. The researcher and the XYZ safety manager decided to choose these representative topics because of the convenience of test format and time involved. The tests consisted of short answer and true/false questions. For other training topics, knowledge reviews was in the form of class-based activity, team activity, and others which were difficult to survey and were not selected for this study. The questionnaire package (Appendix) contained a consent form, instructions, and five selected training topics. These five topics were 1) bloodborne pathogens, 2) emergency eye wash/shower safety, 3) lock-out/tag-out, 4) personal protective equipment, and 5) hazard communication. The questions tested minimum information which employees were required to know for a particular topic.

Training for emergency eye wash/shower safety and bloodborne pathogens was conducted in March of 2004. Knowledge retention was determined after one month. The

bloodborne pathogens test had 15 total true/false questions. There were four short answer questions and nine true/false questions in the emergency eye wash/shower safety section.

In February 2004, the training was based on lock-out/tag-out issues. Retention of knowledge on this topic was assessed after two months. Ten fact/fiction questions were asked on this issue.

Personal protective equipment training was conducted in October of 2003. Retention levels were determined after six months. The questionnaire contained seven short answer questions, and 10 true/false questions.

The XYZ employees received training on hazard communication in September 2003. The knowledge retention from this topic was accessed after seven months. The questions were presented in manner of six situations requiring short answers.

A hard copy of the questionnaire package was administered to the subjects by the safety manager. The subjects were requested to complete all questions and return them to the coordinator. Distribution of the questionnaires was started and completed in April of 2004. A total of 34 responses or about 10% of all XYZ Company employees were received.

Limitations

Limitations identified by the researcher were:

1. Fifteen total topics were currently being implemented in the XYZ Company. It was impossible for this study to sample all 15 topics due to time limitation, and employees' motivation to participate
2. The questions used in the survey were developed by the company. Therefore they were expected to be appropriated to evaluate the knowledge of trained employees

3. In this study, retention time was tested in the following monthly increments; one, two, six, and seven months after the training program. This information was the only useable data the researcher was able to obtain from company.

Data Analysis

Data was gathered from the hard copy format, then graded and analyzed. Descriptive analysis including percentage, means, and standard deviation were used as a statistical tool. Student's *t* Distribution (Blalock, 1960) was used to calculate *t* values for determining the difference between sample means and population means.

Historical Reviewing

The purpose of reviewing historical records of the XYZ Company regarding accident, injury, and illness of employees and training records was to measure the outcome of training program.

Method

The data was collected by reviewing the XYZ Company's historical record and personal communication with the safety manager. The data included training attendance, incidence rates, and total incurred cost from June 2003 to February 2004.

Limitations

1. Availability of data. The data was reviewed and kept by the XYZ Company's safety manager. Prior to the year 2003, the company did not have a valid procedure to collect and maintain the safety records. It was difficult to review the data previous to this period.

2. Reliability of data information. It was questioned whether all information was reported by the employees. There might be a case that employees refused to report their injury and illness to the supervisor. Some potential data might be missing.

Data Analysis

The historical data obtained from the XYZ Company was analyzed and formulated into graphical format.

Based on the data gathered from personal communication, historical records, and surveying, the options of improving training programs were suggested and recommended.

CHAPTER FOUR: Results

As described in chapter one, there were three objectives of this study:

1. To determine the effectiveness of the XYZ Company safety training program,
2. To determine how well employees retain training information, and
3. To determine the opportunity to improve the safety training program.

In order to achieve the goals of this study, data was collected through employee surveys and historical safety records. Details of methods and activities to collect all data were described in chapter three. In this chapter, results of the study are presented.

Survey Results

A total of 34 questionnaires were received from XYZ employees. Only 32 questionnaires were completed and contributed to 10% of total population from the XYZ Company. Initially five topics including bloodborne pathogens (BBP), emergency eye wash/shower, lock-out/tag-out (LOTO), personal protective equipment (PPE), and hazard communication were planned to be used for determining the knowledge retention of XYZ Company employees. The hazard communication topic was dropped because there were not enough responses for this topic. A majority of the respondents refused to complete this session. For this reason, only four topics were remaining in this study.

Frequency histograms of the knowledge retention scores were presented in Figures 1-4. Figures 1 and 2 represent knowledge retention of employees in BBP and emergency eye wash/shower. Frequency histograms of employee knowledge retention scores in LOTO and PPE are represented in Figure 3 and Figure 4.

All four distributions had a single peak but were skewed to the left meaning that most of the respondents had high scores on the knowledge test and only a few employees approximately 1%, received low scores on the knowledge test of each topic.

According to Figure 1, a total of 12 respondents maintained a high score range of 15-16 points on BBP topic. A majority of the subjects (15 respondents) maintained their BBP knowledge score in the range of 13-14 points. There was one respondent who received a low score in the range of 9-10 points. The rest of the samples, 4 respondents, maintained their BBP knowledge score in the range of 11-12 points. On average, employees maintained a score of 13.8 points with standard deviation of 1.41 on their safety knowledge in BBP topic.

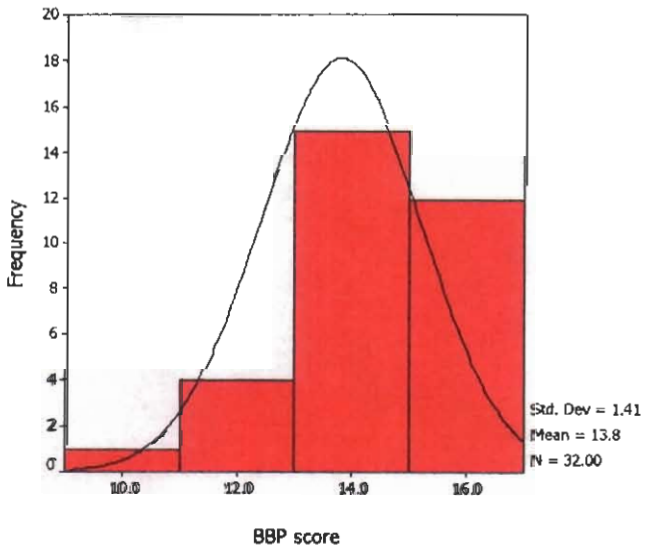


Figure 1. The histogram of knowledge retention of bloodborne pathogens one month after employees received the training

According to Figure 2, most of the samples (15 respondents) maintained their emergency eye wash/shower knowledge score at 13 points. A total of 12 respondents maintained their knowledge score at 12 points and three respondents maintained their

score at 11 points. There was one respondent who received a score of 10 points which was the lowest score of all respondents. On average, employees maintained their emergency eye wash/shower knowledge at 12.3 points with a standard deviation of 0.78.

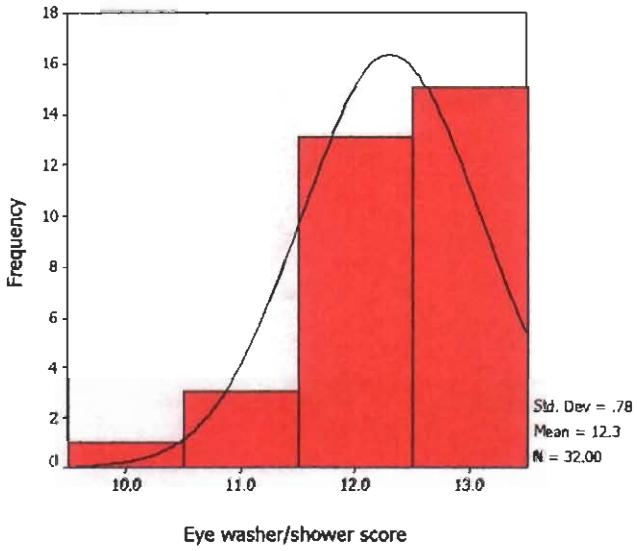


Figure 2. The histogram of knowledge retention of emergency eye wash/shower one month after employees received the training

According to Figure 3, a majority of the samples (22 respondents) maintained their LOTO score in the high range of 9-10 points. Five respondents maintained their score in the range of 7-8 points, and four respondents remained their knowledge score at the range of 5-6 points. Only one respondent accounted for the low range score at 3-4 points in the LOTO topic. Average LOTO score was 8.8 points with a standard deviation of 1.78.

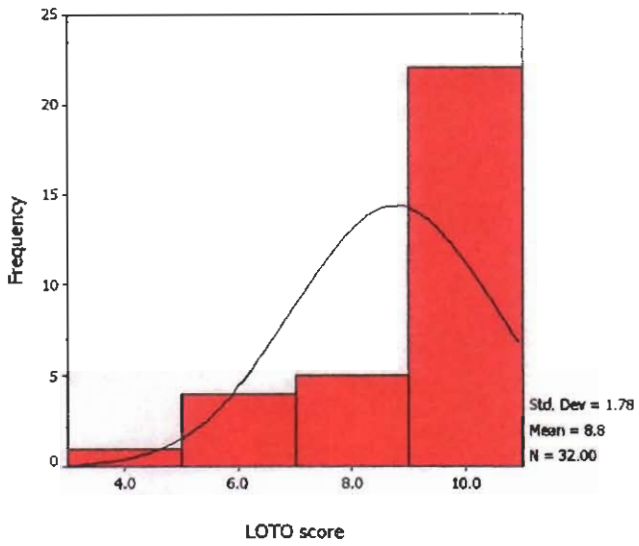


Figure 3. The histogram of knowledge retention of lockout/tagout two months after employees received the training

Safety knowledge retention of the last topic (PPE) is summarized in Figure 4. A total of two respondents maintained the highest range score of 17 points but majority of the samples (10 respondents) maintained their PPE knowledge at 16 points. Nine respondents maintained their score at 15 points. There were ten respondents who maintained their knowledge score in the mid range (12-14 points). Only one respondent received a score of 6 points, the lowest score of all samples. On average, the respondents remained their PPE knowledge score at 14.6 points with a standard deviation of 2.04.

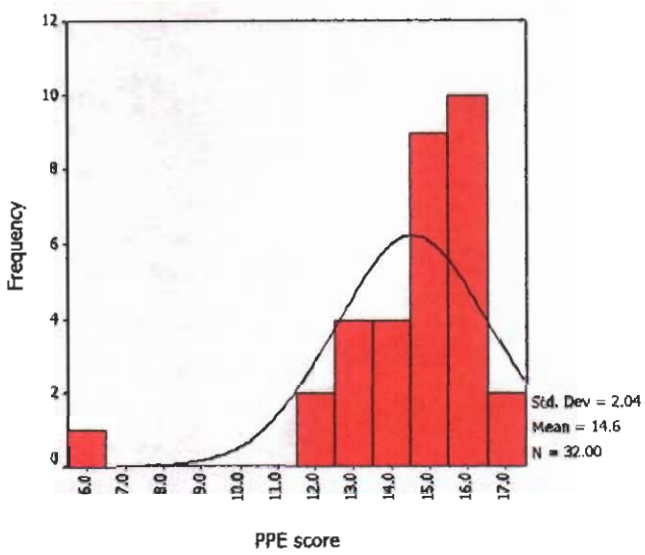


Figure 4. The histogram of knowledge retention of personal protective equipment six month after employees received the training

Descriptive statistics including minimum score, maximum score, means and standard deviation of employee safety knowledge are presented in Table 3. Student's *t* Distribution (Blalock, 1960) was used to calculate *t* values for determining the difference between sample means and population means.

Table 3

Descriptive Statistics of Employee Safety Knowledge (N =32)

Topic	Minimum	Maximum	Mean± Std. Deviation	df	*t* value
BBP	9.00	15.00	13.78±1.41	31	4.82*
Eye Wash/Shower	10.00	13.00	12.31±0.78	31	4.93*
LOTO	3.00	10.00	8.75±1.78	31	3.91*
PPE	6.25	17.00	14.56±2.04	31	6.64*

Note. * $p < .001$

According to Table 3, the t value of each topic indicated that there were extremely significant differences ($p < .001$) between sample mean and population mean. Another way of saying this is that XYZ Company employees had significant loss of their safety knowledge in all four topics one month after training. Knowledge loss after six months was greater than knowledge loss after one or two months. However, other contributing factors should be considered such as the nature of each topic. Some topics could be more interesting, more practical, and more preferred than other topic.

Historical Data

Historical safety data was used to provide an overview of occupational health and safety function at XYZ Company. Monthly historical safety records were reviewed from June 2003 to Feburary 2004.

Figure 5 represents monthly safety training attendance of employees in percent. It was noticeable that the percentage of attendance had declined during the year. The highest percentage (85.32%) of training attendance was in August of 2003 and the lowest percentage (63.89%) of attendance was in February of 2004. The 21.43% difference of these attendance records appeared to be a very significant drop.

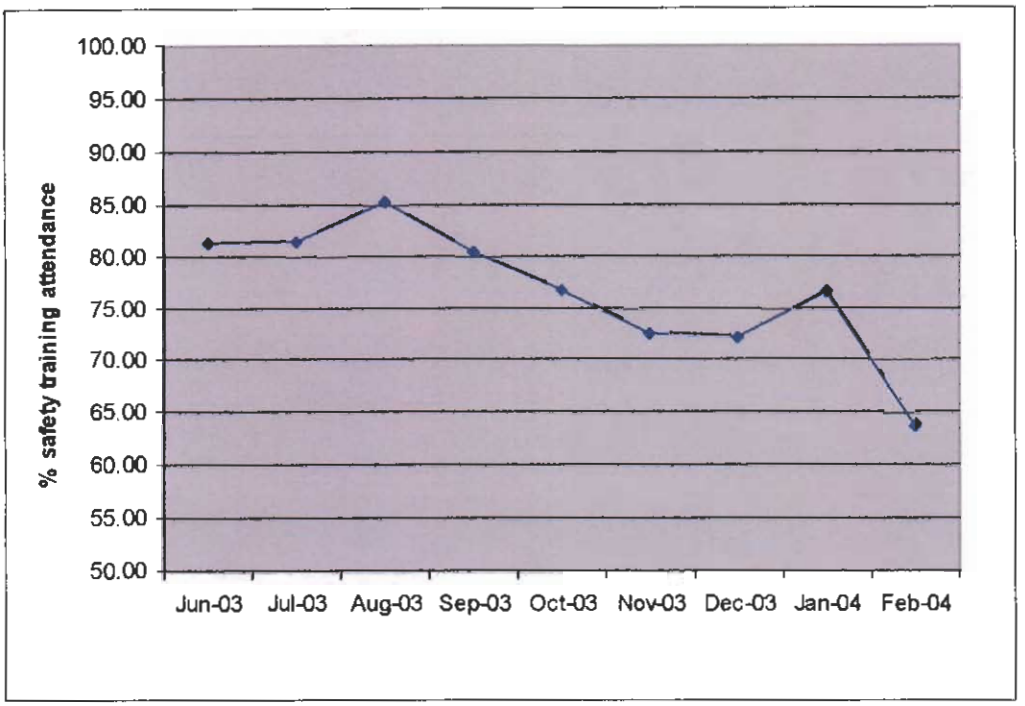


Figure 5. Monthly safety training attendance of XYZ Company employees from June 2003 to February 2004

Figure 6 shows the statistical data of incidence rates including first aid and OSHA recordable injuries at XYZ Company from June 2003 to February 2004. The incidence rate was calculated based on number of cases over total working hours in each month. June 2003 and January 2004 had the highest incidence rate and the lowest incidence rate respectively. There was no relationship observed between the incidence rate and percentage of safety training attendance of each month. An increased number of safety training attendance had no correlation with a decreased incidence rate.

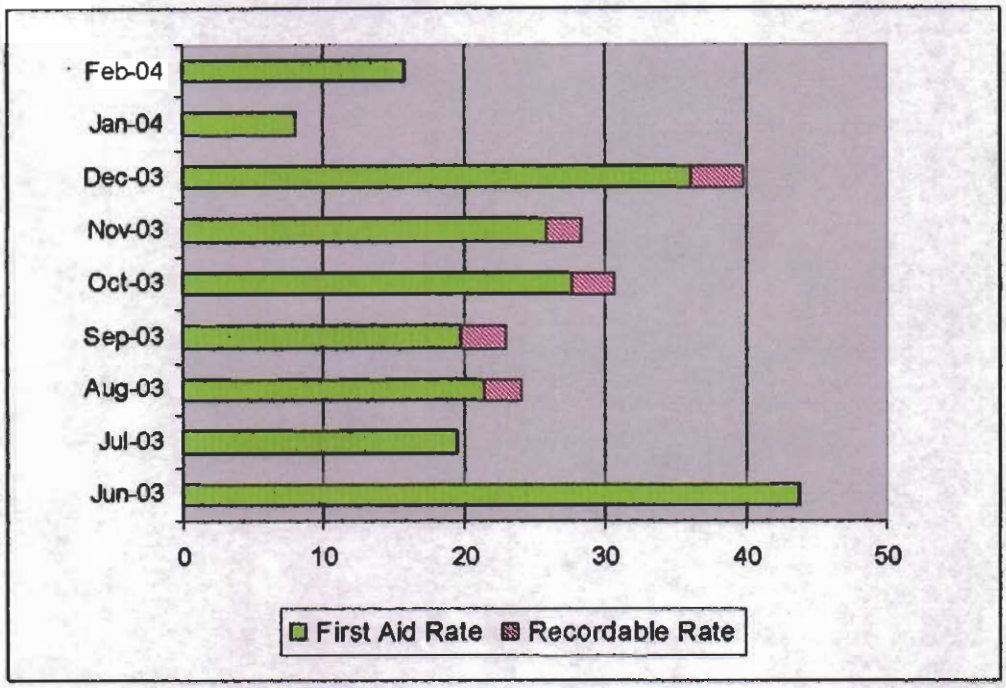


Figure 6. The bar chart of incidence rate at XYZ Company from June 2003 to February 2004

Figure 7 represents the bar chart of monthly total incurred costs of XYZ Company from June 2003 to February 2004. Total incurred cost is the amount of money that XYZ Company spent on worker compensation claims and closed claims for a specific month. The XYZ Company spent an approximately $30,000 to $48,000 on total incurred cost for each month. Total incurred cost for June 2003 was the lowest cost compared to other months because the XYZ Company fiscal calendar starts from June of each year. At that month, there were no other records of worker compensation claim cases in the previous month.

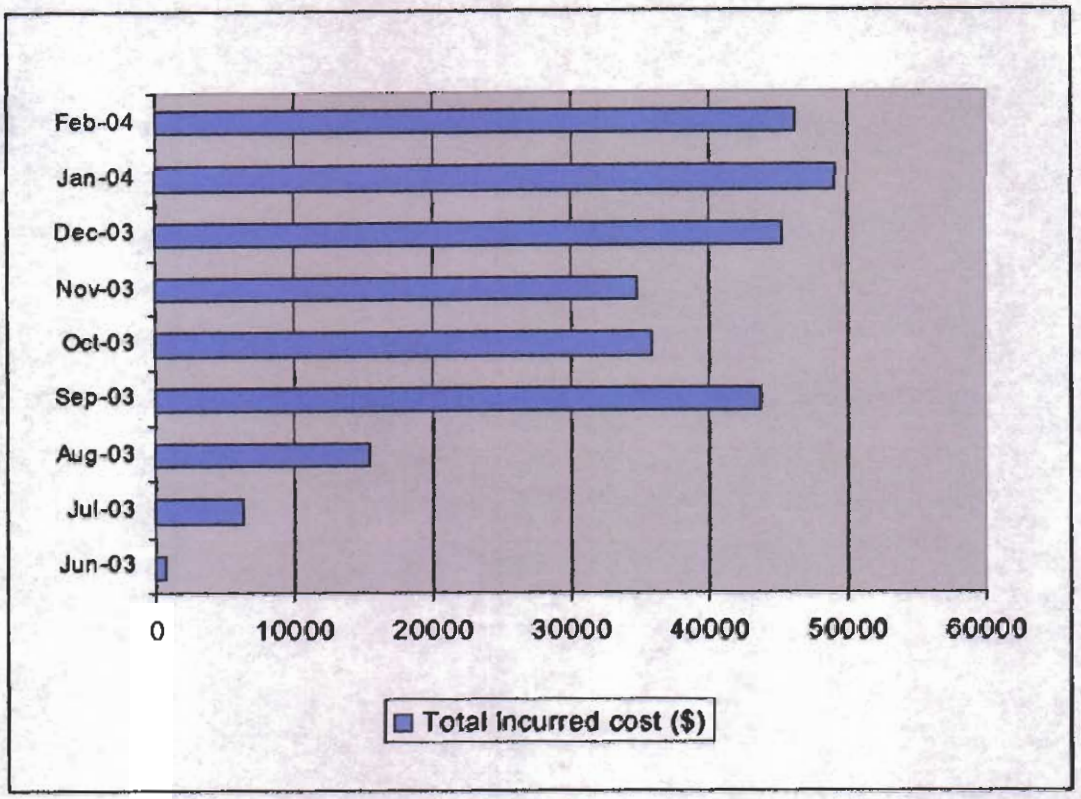


Figure 7. The bar chart of monthly total incurred cost in dollars of XYZ Company from June 2003 to February 2004

This chapter was devoted to highlighting the survey data of safety knowledge retention from XYZ Company employees after various periods of time and reviewing historical records of the company regarding safety training attendance, incidence rate, and total incurred costs from June 2003 to February 2004. The XYZ Company employees demonstrated a loss of their safety knowledge one month after receiving the training. The history reviews also indicated that there were no relationship between number of employees who attended the safety training and the incidence rate. The XYZ Company spent approximately 30K each month on total incurred cost of their worker compensation claims.

CHAPTER FIVE: Summary, Conclusion and Recommendations

Chapter One provided background and introduction including statement of the problem, objectives, significance, and limitation of this study. Chapter Two presented the review of literature related to hazards in the food industry, safety training programs, and evaluation steps. Methodology to collect and analyze the data was explained in Chapter Three. The data and findings were described in the previous chapter. This chapter will discuss the conclusions and recommendations resulting from this study.

Summary

Statement of the Problem

Currently a safety training program is developed and implemented at XYZ Company. It is questionable whether the XYZ Company training program is effective and minimizes injuries, illnesses, accidents, and associated cost.

Methods and Procedures

Data was collected through employee surveys and historical safety records. The purpose of the survey was to examine the post-training safety knowledge of employees. The five topics selected for this study were BBP, emergency eye wash/shower, LOTO, PPE, and hazard communication. All questions were developed by the XYZ Company. Data was analyzed using descriptive analysis and Student's *t* distribution.

Historical safety records of the XYZ Company were reviewed to measure the outcome of the training programs. The data included training attendance, total incidence rate, and total incurred cost from June 2003 to February 2004.

Major Findings

The safety training program of XYZ Company is scheduled for all employees on a monthly basis, however the current practice has been found to be ineffective and requires improvement. All topics are rotated every month thus employees are only retrained in one topic annually. The survey indicates that trained employees had shown significant loss of their safety knowledge after the first month. Undoubtedly, majority of employees are unable to retain their safety knowledge for a year.

The review of historical safety data of the XYZ Company from June 2003 to February 2004 indicates that training was not a factor for preventing incidents, injuries and illness. Other techniques such as behavior-based control, engineering control including redesigning the workstation, or loss prevention activities should be considered as well. The percentage of employee training attendance (65 -85%) indicated that XYZ Company should work to increase training attendance. The company has shown a need for better approaches to promote their training program.

Conclusions

Findings from employee surveys and historical safety records indicated the needs for improvement. The XYZ company should review and improve its safety training program. Even though OSHA had published the guideline for occupational safety and health for general industries, the guideline did not provide specific information on how to attain the training objectives or on the training process itself, including size of training group, length and/or frequency of training, manner of instruction, trainer credentials, and training/transfer conditions (NIOSH, 1998).

Recommendations

Areas for improvement are suggested as follows:

1. Review objectives of the company training program. The objectives of the training program should be set up prior to starting the program and the commencement of evaluation of the program should be done after implementing the program. The objectives are important for measuring the success and failure of the program.
2. Develop a protocol to evaluate the training activities. There is no solid system to evaluate safety training at the XYZ Company at this time. The instructor asks employees' opinions on the training section verbally. An evaluation form should be constructed in order to assess trainees' attitudes.
3. Schedule and retrain employees on each safety topic more often than once a year. It is not necessary to hold a formal training session. This can be easily done as short safety reviews through shift meetings everyday. People have a tendency to remember and understand better when they have repeated the same information more often.
4. Consider using several styles of training delivery. Classic classroom style would not be effective for all employees especially for those who may have special needs. For example, the company could video broadcast the training via the internet. On-line training is more practical and effective in today's globalization era. This will allow employees to review at their convenience.

5. Increase interests and attention among employees. Training of adults is a complicated matter. They need high motivation based on individual interests. Supervisors should role model to their employees. Assigning a key person to be held responsible for training will add benefits to the program. A person with various responsibilities may not be as effective in enforcing the program (NIOSH, 1998).
6. Integrate safety training with other approaches such as hazard control. The most important goal of occupational safety and health training is the long-term reduction of injury and illness among workers. However, the training program itself is not an effective way to minimize accident, injuries and illness. Combining training program with other approaches will provide the ultimate desired outcome.

Common safety functions, especially safety training, are not a priority from a manufacturing and production standpoint. However, safety training is important and needs to be integrated into all functions of the organization. Supervisors and management should also support safety training and emphasize its importance.

Recommendations for Further Study

Further study should be done in these following areas:

1. Develop a model to evaluate the safety training program including all four aspects related to reaction, learning, behavior and result.
2. Assess behavior changes after implementing a training program.
3. Evaluate return on investment of safety training program.

4. Study and compare the training result before and after implementing the revised training program.
5. Compare the training results from different delivery methods for the best fit to the organization.
6. Evaluate the effectiveness of the safety orientation program for new employees.

References

Atherley, G., & Robertson, D. (1998). Education and training: Principles of training. In J.M. Stellman (Ed.). *Encyclopedia of Occupational Health and Safety* (4th ed., Vol. 1, pp. 18.5-18.7). Geneva: International Labour Office.

Baker, R., & Wallerstein, N. (1998). Education and training: Worker education and training. In J.M. Stellman (Ed.). *Encyclopedia of Occupational Health and Safety* (4th ed., Vol. 1, pp. 18.7-18.12). Geneva: International Labour Office.

Blalock, H. M. (1960). *Social statistics.* London: McGraw-Hill Book Company.

Bureau of Labor Statistics, U.S. Department of Labor (2004). *Career guide to industries*, 2004-05 Edition, Food manufacturing. Retrieved April 15, 2004, from http://www.bls.gov/oco/cg/cgs011.htm.

Bureau of Labor Statistics, U.S. Department of Labor (2004). Occupational Outlook Handbook, 2004-05 Edition, Food-Processing Occupations. Retrieved April 15, 2004, from http://www.bls.gov/oco/ocos219.htm.

Confer, R. G., & Confer, T. R. (1999). Occupational health and safety: Terms, definitions, and abbreviations (2nd ed.). Boca Raton, FL: CRC Press LLC.

Ensminger, A. H., Ensminger, M. E., Konlande, J. E., & Robson, K. R. K. (1995). Preservation of food. In *The concise encyclopedia of food and nutrition* (pp.886-889). Boca Raton, FL: CRC Press.

Galvin, J. C. (1983). What can trainers learn from educators about evaluating management training? *Training and Development Journal, 37*(8), 52-57.

Goetsch, D. (2005). *Occupational safety and health for technologists, engineers, and managers* (5th ed.). Upper Saddle River, NJ: Pearson Education, Inc.

Hawthorne, E. M. (1987). *Evaluating employee training programs*. Westport, CT: Greenwood Press, Inc.

Hecker, S. (1998). Education and training: Introduction and overview. In J.M. Stellman (Ed.). *Encyclopedia of Occupational Health and Safety* (4th ed., Vol. 1, pp. 18.2-18.5). Geneva: International Labour Office.

Janicak, C. A. (2000). *Applied statistics in occupational safety and health*. Rockville, MD: Government Institutes.

Kirkpatrick, D. L. (1994). *Evaluating training programs: The four levels*. San Francisco, CA: Berrett-Koehler Publishers, Inc.

Malagie, M., Jensen, G., Graham, J., & Smith, D. (1998). Food industry: Food industry processes. In J. M. Stellman (Ed.), *Encyclopedia of Occupational Health and Safety* (4th ed., Vol. 3, pp. 67.2-67.7). Geneva: International Labour Office.

Mayo, G. D., & DuBois, P. H. (1897). *The complete book of training: theory, principles, and techniques*. San Diego, CA: University Associated, Inc.

Merriam-Webster's Collegiate Dictionary (10th ed.). (2000). Springfield, MA: Merriam-Webster, Incorporated.

Miller, V. A. (1994). *The guidebook for global trainers.* Amherst, MA: Human Resource Development Press, Inc.

National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, Department of Health and Human Services (1998). *Assessing Occupational Safety and Health Training: A literature review* (DHHS (NIOSH) Publication No. 98-145). Cohen, A., & Colligan, M.: Authors.

National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, Department of Health and Human Services (2003). *NIOSH Alert: Preventing lung disease in workers who use or make flavorings* (DHHS (NIOSH) Publication No. 2004-110).

Occupational Information Network (2004). *Summary Report for: 45-2041.00 - Graders and sorters, Agricultural product.* Retrieved April 15, 2004, from http://online.onetcenter.org/report?r=0&id=642.

Occupational Information Network (2004). *Summary Report for: 51-3093.00 - Food cooking machine operators and tenders.* Retrieved April 15, 2004, from http://online.onetcenter.org/report?r=0&id=1015.

Occupational Safety and Health Administration, U.S. Department of Labor. (2004). Code of Federal Regulations (CFR), Title 29, Part 1910.132. *Personal Protective Equipment*. Retrieve April 15,2004 from http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9777.

Occupational Safety and Health Administration, U.S. Department of Labor. (2003). *All about OSHA* (OSHA Publication No. 2056-07R).

Occupational Safety and Health Administration, U.S. Department of Labor. (1998). *Training requirements in OSHA Standards and Training Guidelines.* (OSHA Publication No. 2254).

Philips, J. J. (1996). Measuring the results of training. In R.L. Craig (Eds.), *The ASTD training and development handbook: A guide to human resource development* (4th ed., pp. 313-341). New York, NY: McGraw-Hill.

Phillips, J. J. (1997). *Handbook of training evaluation and measurement methods* (3rd ed.). Houston, TX: Gulf Publishing Company.

Roughton, J., & Whiting, N. (2000). *Safety training basics: A handbook for safety training program development.* Rockville, MD: Government Institutes, a Division of ABC Groups Inc.

Sancho-Madriz, M. F. (2003). Preservation of food. In B. Caballero, L.C. Trugo, P.A. Finglas (Eds.) *Encyclopedia of food sciences and nutrition* (2nd ed., vol. 7, pp. 4766-4772). Oxford, UK: Elsevier Science Ltd.

Vincoli, J. (2000). *Lewis' dictionary of occupational and environmental safety and health.* Boca Raton, FL: CRC Press LLC.

Williams, H. (1992). Amoco: Evaluation designs and procedures. In K.L. Medsker, D.G. Roberts (Eds.), *ASTD trainer's toolkit: Evaluating the results of training* (pp. 55-59). Alexandria, VA: American Society for Training and Development.

Appendix

Consent Form and Questionnaire

Assigned ID: _____

Today's Date: _____

Safety Questionnaire

I understand that by returning the/this questionnaire, I am giving my informed consent as a participating volunteer in this study. I understand that the purpose of this study is to evaluate the effectiveness of the company safety training program. The result from this questionnaire will be used as a part of the study. I am aware that the information is being sought in a specific manner so that only minimal identifiers are necessary and so that confidentiality is guaranteed. I realize that I have the right to refuse to participate and that my right to withdraw from participation at any time during the study will be respected with no coercion or prejudice.

NOTE: Questions or concerns about the research study should be addressed to Pimrutai Monphongchai, the researcher, Graduate student, Risk control center, Department of Industrial Management, UW-Stout, Menomonie, WI 54751, phone (715) 222-2521, or Dr. Elbert Sorrell, the research advisor, 125 Science Wing, Jarvis Hall, UW-Stout, Menomonie, WI 54751, phone (715)232-2630. Questions about the rights of research subjects can be addressed to Sue Foxwell, Human Protections Administrator, UW-Stout Institutional Review Board for the Protection of Human Subjects in Research, 11 Harvey Hall, Menomonie, WI, 54751, phone (715) 232-1126.

Please fill in the blank or circle the correct answer to answer the questions.

Personal Protective Equipments (PPE)

True/False	It is okay to stuff cotton balls into your ears to protect against noise.
True/False	Regular (dress) glasses are just as good at protecting your eyes as 'safety' lenses.
True/False	The biggest cause of foot injuries is from heavy objects falling onto people's feet.
True/False	The #1 workplace injury is from dermatitis.
True/False	Side shields on safety glasses can protect against an eye injury.
True/False	A baseball cap is adequate head protection against something falling on your head.
True/False	Hearing loss is always sudden and painful
True/False	A dust mask protects you from all types of chemical exposure.
True/False	A facemask alone provides you with the ability to breath in a confined space.
True/False	It is important to identify possible hazards and protect against them before starting the job.

Please indicate the PPE you would recommend for the following situations:

- Changing a forklift battery

  Recommended PPE

  _____

- Cleaning a floor with an acid wash

  Recommended PPE

  _____

- Working on the production lines when the machines are in operation

  Recommended PPE

  _____

- Working inside of a construction zone where overhead work is being performed

  Recommended PPE

  _____

- Pumping out caustic from a 55 gallon drum

  Recommended PPE

  _____

- Handing or picking up broken pieces of glass

  Recommended PPE

  _____

- Handling or cleaning up blood

  Recommended PPE

  _____

Emergency Eye Wash/Shower Safety

The purpose of an eye was station is to _____ out the eye.

Eyes should be flushed for at least _____ minutes.

Eye wash/shower stations should be inspected every _____.

The phone number to contact the ERT in case of an emergency is _____.

True/False The purpose of the eye wash station is to store parts and tools.

True/False An eye was station should be difficult to reach

True/False Eye wash stations can be blocked under normal conditions and then cleared when an emergency occurs.

True/False You don't need an eye wash station as long as you have a water fountain nearby.

True/False There should be a direct route to the eye wash station, from chemicals or other possible hazards.

True/False If a chemical enters a person's eye, they first should wash out the injured eye, then go to a doctor to have their eye examined.

True/False Avoid using a high-pressure water hose to clean chemicals or debris off of your skin

True/False Avoid using a high-pressure air nozzle to clean chemicals or debris off of your skin.

True/False If someone gets a chemical on their skin, help them remove any contaminated their clothing, then activate the emergency shower.

Bloodborne Pathogens (BBP)

True/False Bloodborne Pathogens (BBP) diseases may be transmitted through direct contact with blood or other body fluids.

True/False The Hepatitis B virus (HBV) is a bigger threat for infection because it is more common and the virus is hardier than HIV.

True/False It is possible for a person to be infected with HBV or HIV and still look and feel healthy.

True/False To transmit HIV or HBV in the workplace, the virus needs to enter a person's body through broken skin (like c cut) or mucous membranes (such as your eyes or mouth).

True/False Universal precautions mean protecting yourself against a bloodborne pathogens exposure from anyone who could possibly be infected.

True/False HIV is generally a fragile virus and will likely die when exposed to light, heat or air.

True/False HBV however, can possibly survive for longer periods of time and under harsher conditions.

True/False It is possible to become infected by HBV even if the blood or body fluid has dried.

True/False Even if you had gloves on in a BBP incident, if there was blood or other body fluids, you could have been exposed.

True/False Disposable gloves may be used repeatedly as long as they are washed odd and there aren't too many holes in them.

True/False Bloody bandages and other contaminated materials may be tossed away like regular trash.

True/False A person with a minor injury should try to stop the bleeding and treat themselves if possible.

True/False When necessary, help the injured person control bleeding after first protecting yourself with gloves or other barriers.

True/False If you don't have disposable gloves, you can improvise, using plastic bags or diapers (unused!).

True/False IF you have an accidental BBP exposure, immediately wash your exposed skin with soap and water, then report the incident to your supervisor.

Lock-out/tag-out

Fact/ Fiction Activating a cycle stop is the same as activating an emergency stop.

Fact/ Fiction Opening an interlocked door means the same as applying lock-out/tag-out.

Fact/ Fiction Activating a cycle stop means that the machine will immediately stop moving as soon as you press the button.

Fact/ Fiction Once a machine is stopped, there is no chance that any energy can be presented inside of it.

Fact/ Fiction It is all right to use your lock-out/tag-out locks on cabinets or drawers until the lock is needed for actually performing the locking out.

Fact/ Fiction Employees working on a piece of equipments can use the same one key to lock or unlock the equipment and re-energize the machine.

Fact/ Fiction All employees in the facility should receive lock-out/tag-out training, even people who would never actually perform lock-out/tag-out.

Fact/ Fiction Pressing an emergency or cycle stop button means the same thing as locking out the power.

Fact/ Fiction Lock-out/tag-out means as long as someone else is standing next to the control panel, another person can go inside and work on moving parts of a machine that is running.

Fact/ Fiction Air is one type of energy that you should be concerned about when working on machinery.

Hazard Communication

Station one: Your department's written Hazard Communication program.

The written hazard communications program is one section of the plant safety manual. A copy of the plant safety manual can be found in_____

_____.

Station two: Your department's MSDS binders.

These binders contain the chemicals used in your department. The location of your department's MSDS binders is _____

_____.

The full, complete set of plant MSDS's are found in two locations. One location is

_____.

The other location is _____.

Station three: Locating a chemical from the list.

Using the chemical given to you, find the name and MSDS number of the substance from the list provided to you. The MSDS number of your chemical is _____.

Station four: Using the MSDS bindings

Go out and locate the MSDS binders. Look in either the table of contents, or try to find the MSDS numerically in the binder. Is the chemical you have listed in the book?

Yes No

Station five: Finding the emergency number.

Is the chemical company's emergency number printed on the chemical label?

If so, write it down_____.

If you have the MSDS for the chemical, is the emergency number found on the MSDS?

If so, write it down_____.

Do both emergency numbers match? Yes No

Station six: Our plant's emergency procedures, how to contact the ERT in an emergency.

If a chemical spill occurred in this room or area, we would contact the ERT by calling _____. Our location code is _____.

To signal a spill, we would enter the number _____, then press the pound key and hang up.

**** Thank you very much for your corporation and involve improving the safety of our company ****