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Safety program for the operation

Of cranes, and hoists at company XYZ

By

Juan Carlos Gamboa Porras

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

Risk Control

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Abstract

Fatalities and serious injuries can occur if cranes are not inspected and used properly. The purpose of the study was to evaluate the industrial crane and hoist safety program at company XYZ to reflect best practices and promote effective implementation and compliance to organizational standards and expectations. This study was accomplished through an assessment and inventory of the crane and hoisting material of company XYZ to develop an accountability system that would promote adherence to the developed crane and hoist policy.

The findings following the inspection indicate few elements of the safety program were missing, such as employee and management participation during the equipment inspection, and gaps in the company accountability system. Finally for the completion of this evaluation, several recommendations were provided to increase the effectiveness of the safety program, for instance the automation of the inspection process to help control inventory of equipment, and retrieve information such as their maintenance deadlines, load ratings, guidelines for safe use, the risks involved and what to do in case of an emergency.

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Chapter I: Introduction

Why should a safety program be important? First, because safety in the working environment is something that everyone has to think about, from management to employees. Everyone has a right to a safe and healthful workplace, so it is important that employers have a clear and workable plan to enhance workplace safety. Second, it has become too costly to have people injured. That includes employees, contractors, and the general public. Many managers had no idea what the total cost of accidents and injuries are to their organization, and the generated costs of finding and training people to fit the job every time an individual is hurt (Haines, 2011). Many states require written safety and health plans under worker's compensation rules and many organizations implement safety plans to increase productivity, reduce work related injuries, and save costs in worker's compensation insurance.

There are several other good reasons to have an effective safety program. Numerous federal, state, and local laws and codes that must be met are a serious consideration. The Department of Labor's Occupational Safety and Health Administration (OSHA) requires organizations to use a combination of safety training and safety protocols to prevent as many employee injuries as possible. Failure to comply with regulations can result in fines and willful violations. At this point, most managers are interested in taking action to prevent injuries because small losses contribute to increase worker's compensation and medical costs.

According to the dictionary of management, training involves an expert working with learners to transfer to them certain areas of knowledge or skills to improve in their current jobs.

Training and education are major factors in determining long term profitability of an organization. The purpose of training programs is to develop the skills and knowledge of individuals so they can perform their roles effectively and efficiently, increasing capacity to

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adopt new technologies and methods, and enhance company image. Training provides the trainee with the knowledge and skills needed to perform functions associated with the position for which training is being conducted.

Those supervising a particular task can greatly improve workplace safety by targeting the hazards that cause the greatest hazards and risk. Basic hazard prevention measures can be taken to eliminate these hazards. Workplace safety is more than complying with a few safety rules. Everyone must be involved, including management, supervisors, and the work crew. Each has specific safety responsibilities and a mutual understanding of who is responsible for what is essential. A fact that is often overlooked is that hazards are the primary cause of most accidents, so training on hazard prevention, is what brings about a safe workplace.

How to lift a load is a problem as old as humankind. From the earliest time people have faced this problem. Moving large, heavy loads is crucial to today's manufacturing and construction industries. Much technology has been developed for these operations, including careful training and extensive workplace precautions. There are significant safety issues to be considered to ensure the safety of all personnel who may be in the immediate areas where cranes and diverse lifting devices are being operated, not just the riggers, signalers, and operators but employees who work in or around them.

In our highly mechanized world, cranes are the workhorses that have increased productivity and economic growth in construction, mining, logging, maritime operations, and maintenance of production and service facilities. Statistics show, however, that there are inherent hazards that occur during normal working circumstances. A crane can be a very dangerous piece of equipment. Most crippling injuries and deaths from crane accidents can be attributed to several basic hazards. Training personnel must be responsive to the needs of the organization, working hand in hand with management and line supervisors would ensure that training needs are properly analyzed, and that training is developed and implemented in the most effective and efficient way possible.

Statement of the problem

Company XYZ utilizes cranes and hoists to move and store heavy material which will be later used in the manufacturing process of its product. The use of industrial cranes and hoist require organizations to have developed safety related systems to effectively deal with the potential loss associated with this material handling equipment. To ensure that loses are minimized safety systems are needed, program standards known, understood and implemented.

Purpose of the study

The purpose of the study was to evaluate the industrial crane and hoist program at company XYZ to reflect best practices and promote effective implementation and compliance to organizational standards and expectations.

Objectives

The completion of the study will be stated as follow:

 Conduct an assessment and inventory of the crane and hoisting material at Company XYZ.

2. Analyze the existing crane and hoisting policy at company XYZ and compare it to best practices.

3. Develop an accountability system that would promote adherence to the crane and hoist policy.

Significance

Now a day it has become too costly to have people injured, this includes employees, customers and general public. A well stated safety program on site can eliminate and minimize the number of injuries and deaths, property damage, legal liability, illnesses, workers' compensation claims, and missed time from work, keeping also the required OSHA mandated safety training courses organized and up to date. This program will create a safety conscious culture within the organization by implementing a safety awareness program encouraging safe work practices and an effective risk assessment that will significantly improve the organization revenues.

Definition of terms

Cantilever gantry crane: Means a gantry or semi-gantry crane in which the bridge girders or trusses extend transversely beyond the crane runway on one or both sides.

Gantry crane: Means a crane similar to an overhead crane except that the bridge for carrying the trolley or trolleys is rigidly supported on two or more legs running on fixed rails or other runway.

Groove: Depressions in the outer surface of a shave or drum for positioning and supporting the rope.

Lever: Is a rigid object that is used with an appropriate fulcrum or pivot point to multiply the mechanical force that can be applied to another object.

Pulley: Is a mechanism composed of a wheel on an axle or shaft that may have a groove between two flanges around its circumference. A rope, cable, belt, or chain usually runs over the wheel and inside the groove, if present.

Safety Program: Are a number of procedures, which goal is to foster a safe work environment. It may also protect co-workers, family members, employers, suppliers, nearby communities, and other members of the public who are impacted by the workplace environment.

Semi-gantry: Is a gantry crane with one end of the bridge rigidly supported on one or more legs that run on a fixed rail or runway, the other end of the bridge being supported by a truck running on an elevated rail or runway.

Storage bridge crane: Means a gantry type crane of long span usually used for bulk storage of material; the bridge girders or trusses are rigidly or non-rigidly supported on one or more legs. It may have one or more fixed or hinged cantilever ends.

Wall crane: Means a crane having a jib with or without trolley and supported from a side wall or line of columns of a building. It is a traveling type and operates on a runway attached to the side wall or columns.

Limitations of the Study

The limitations of the study are:

1. Retrieving manufacturer's data regarding cranes models and their specifications due to several cranes were out of date and/or manufacturer was out of business.

2. Difficulty accessing several hoists' labels to find out serials number and models due to crane location.

3. The major part of cranes' hooks may not display lifting weight limit impressed on the hook.

4. Some hoists' labels may be blurred and difficult to read, which hindered retrieving manuals and model specifications.

Chapter II: Literature Review

This chapter gives an overview of the importance of implementing safety programs in today's manufacturing industries. Companies are always looking for new ways to keep employees safe. Such companies must comply with strict federal or state Occupational Safety and Health Administration (OSHA) regulations, Environmental Protection Agency (EPA) regulations, National Fire Protection Association (NFPA) guidelines and International Standards Organization (ISO) controls (Wilkins, 2006). Some companies find it hard to make their employees realize how important it is for them to work safely.

The safety rules and guidance that involve the use of cranes and hoists are aimed to controlling the hazards associated with moving large and heavy loads. Cranes and hoists are the most common types of lifting equipment used nowadays. Crane accidents and preventive measures will be discussed in this chapter.

Safety Programs

Safety programs are to encourage employees to comply with regulations to prevent occupational injuries and illnesses (Snyder, 2011). Workplace hazards and safety concerns need to be identified along with ways to handle them effectively. This is why companies need to develop safety programs, policies and plans for their specific workplace. Safety should be managed like any other company function (Petersen, 2003, p. 31). A safety program represents a sincere attempt on the part of management to encourage employee participation in the process of identifying unsafe hazards and conditions (Roughton, 2007).

In order to ensure that a workplace is a safe place is to train both employees and management on safety issues that pertain to the particular workplace. An important part of a safety program is getting employees involved in safety procedures which are an excellent way of installing accountability and compliance. Encouraging employees to have safety committees, set safety goals and be a part of safety inspections are all good ways to get employees engaged and interested in this issue. Employees also should feel comfortable talking about safety with co-workers and managers (Williams, 2010).

There are several other good reasons to have an effective safety program Companies have a vested interest in maintaining a healthful, safe and secure work environment for their employees. Occupational injuries and illness are very expensive. There are direct costs related to work place injuries and illness such as workers' compensation and indirect costs including absenteeism, turnover and negativity (Haines, 2011). It is important that a company control these and all other employment-related costs. There are two main regulatory legislation employers must comply with: Workers' Compensation and OSHA. According to The Dictionary of Legal Terms (2011), Workers' Compensation are state statutes which establish liability of employers for injuries to workers while on the job or illnesses due to the employment, and requiring insurance to protect the workers. This is an insurance program governed by each state and funded through the employers residing in the state. Workers' Compensation is designed to protect workers in case of work related injury and disease. The Occupational Safety and Health Administration, has the responsibility of ensuring safety at work and a healthful work environment. Its mission is to prevent work-related injuries, illnesses, and deaths by issuing and enforcing rules called standards for workplace safety and health. Since OSHA was created occupational deaths and injuries in the US have declined by half.

Elements of a safety program

An organization must develop and implement several components in order to have a successful safety program. (Roughton, 2002) outlines eight elements necessary to establish a successful safety program. Those elements are:

- Provide visible top management, commitment, leadership and involvement in implementing and sustaining the management system so that all employees understand that management's commitment is serious.
- 2. Arrange for and encourage employee participation in the structure and operation of the management system and in decisions that affect the employee's safety. This will help to commit their insight and energy to achieving the safety program goals and objectives.
- Clearly state a policy and/or vision statement on safety expectations so that all employees can understand the value of safety activities and programs.
- 4. Establish and communicate a clear goal for the safety program and define objectives for meeting the established goals so that all employees understand the desired results and measures planned for achieving them.
- 5. Assign accountability and communicate responsibility for all aspects of the program so that all managers, supervisors, and employees know what performance is expected.
- 6. Hold all managers, supervisors, and employees accountable for meeting their responsibilities so those essential tasks will be performed.
- Provide adequate authority and resources to responsible parties so that assigned responsibilities can be met.
- Review management system elements at least annually to evaluate their success in meeting the goals and objectives so that deficiencies can be identified and the program

and/or the objectives can be revised when they do not meet the goal of an effective safety process (p.45).

Training

Because numerous injuries can result from improperly handling and storing materials, workers should also be aware of accidents that may result from the unsafe or improper handling of equipment as well as from improper work practices. Whether moving materials manually or mechanically, employees should know and understand the potential hazards associated with the task at hand and how to control their workplaces to minimize the danger (U.S. Department of Labor, 2002).

It is important for companies to develop a good training program to keep their staff motivated. Training may cover a wide range of reasons from new-hire training about your operation, to introducing a new concept to a workgroup to bringing in a new computer system (Monahan, 2011).

Training is used to train and qualify personnel. It provides the trainee with the knowledge and skills needed to perform functions associated with the position for which training is being conducted. It would provide safer work environments to employees, providing them with motivation and skills to perform their jobs. Periodical training must be achieved to comply with state laws, furthermore it will reduce worker's compensation claim costs and maintain employees educated in safe work practices heightening safety awareness. Training is crucial for organizational development and success. It is fruitful to both employers and employees of an organization (Management Study Guide, 2008).

Line managers and supervisors bear the primary responsibility to assure that people perform their jobs safely and effectively. Training personnel must be responsive to the needs of the organization, working hand in hand with line managers and supervisors to ensure that training needs are properly analyzed, and that training is developed and implemented in the most effective and efficient way possible (International Atomic Energy Agency, 2003).

Principles of effective training

- Training requires a strong commitment from line management to support training
 programs that contribute to fulfilling company goals and objectives. The training mission
 must be clear, and individual roles and responsibilities need to be defined. Management
 must effectively direct and adequately support training activities.
- Line managers are responsible for the effective conduct of training and qualification programs. They ensure the content and conduct of the training and qualification programs to produce competent and professional workers and supervisors. Line and training managers ensure that personnel attend required training or participate in timely makeup training.
- Training records are maintained to support management information needs and to provide required historical data.
- Training managers, instructors, and program development personnel possess and maintain the educational, technical, and experience qualifications required for their respective positions.

Reasons for Training

There is a direct relationship between an organization's training programs and its growth, competitiveness, safety record, and financial success (Safety BLR, 2011). Here are several reasons why training in general, and safety training in particular, is a good investment:

- Safety training reduces accidents and protects employees from injuries and illness, saving the company the cost of lost time, diminished productivity, and increased insurance premiums.
- Training also assists in compliance with OSHA standards and decreases the chance of being cited and fined for safety and health violations.
- 3. Training in general increases employee job satisfaction, motivation, and morale.
- 4. Employee training and development provides a pool of skilled and knowledgeable people who can move up in the organization and fill critical jobs and perform critical functions.
- 5. Training helps the organization ride the crest of technological change and innovation.
- 6. A trained workforce provides the human resources to expand into new markets and seize opportunities in a highly competitive and fluid global economy.
- Training helps develop a positive organizational culture in which confident, knowledgeable, creative employees are poised to provide superior products and services to customers

According to the management study guide of the University of Phoenix (2011), an employee will become more efficient and productive if he is trained well. Training is given on four basic grounds:

- New candidates who join an organization are given training. This training contributes to familiarize them with the organizational mission, vision, rules and regulations and the working conditions.
- 2. The existing employees are trained to refresh and enhance their knowledge.

- 3. If any updates and amendments take place in technology, training is given to cope up with those changes. For instance, purchasing new equipment, changes in technique of production. The employees are trained about use of new equipments and work methods.
- 4. When promotion and career growth becomes important. Training is given so that employees are prepared to share the responsibilities of the higher level job.

Within an organization, training brings good benefits and job satisfactions among the employees. It helps to get job security and contribute to organizational success increasing efficiencies in processes, resulting in improved financial gain (Management Study Guide, 2008). Training is the best practice an employer can incorporate into to their safety program. Most accidents and injuries are preventable by training employees to wear protective safety gear and avoid unsafe practices.

Cranes Overview and Types

Overhead cranes are used in many industries to move heavy and oversized objects that other material handling methods cannot. These cranes have a railed support structure called a bridge, and a wheeled trolley that travels across the bridge horizontally. Several varieties of overhead cranes exist including gantry, semi-gantry, cantilever gantry, storage bridge cranes and wall cranes (GHC Specialty Brands, 2011).

Cranes are used in a broad range of industrial settings to hoist and transport materials. Mobile cranes used in construction, mining, and transportation move between locations, often while carrying a load. Tower cranes are used at urban building construction sites where limited maneuvering room is available. Overhead traveling cranes are a necessity in heavy manufacturing, railroad and seaport operations (NIOSH, 201). The first construction of cranes was invented by the ancient Greeks and was powered by men or beasts of burden, such as donkeys. These cranes were used for the construction of tall buildings. Larger cranes were later developed, employing the use of human tread wheels, permitting the lifting of heavier weights. In the High Middle Ages, harbor cranes were introduced to load and unload ships and assist with their construction, some were built into stone towers for extra strength and stability. The earliest cranes were constructed from wood, but cast iron and steel took over with the coming of the Industrial Revolution (J. J Coulton, 1974).

For many centuries, power was supplied by the physical exertion of men or animals, although hoists in watermills and windmills could be driven by the harnessed natural power. The first mechanical power was provided by steam engines, the earliest steam crane was introduced in the 18th or 19th century, with many remaining in use well into the late 20th century. Modern cranes usually use internal combustion engines or electric motors and hydraulic systems to provide a greater lifting capability than was previously possible, although manual cranes are still utilized where the provision of power would be unprofitable (Alolayan, 2007).

Everyone is aware of the fact that cranes can lift and move heavy loads way beyond a human's capabilities, but we all have one question in mind, how do they do it? Cranes just use a combination of two or more simple machines to create a mechanical advantage. The basic components that make up the crane are: The Lever, which allows a heavy load to be lifted by a comparatively smaller force. Pulleys are used to change the direction of an applied force and transmit rotational motion, and the hydraulic cylinder, which is used to give a unidirectional force through a unidirectional stroke, is used to move the beam carrying the load. These components work in perfect synchronization and thus help in lifting and moving heavy weights from one place to another (Alvin S, 2010).

Overhead cranes are utilized for a variety of material handling needs and other industrial applications. They are available in a range of capacities, typically from 1 to 250 tons, and may be found in thousands of plants and facilities nationwide. Industrial uses include shipbuilding, automotive and heavy equipment assembly, and other industrial operations where heavy material loads have to be moved (J. W. Spencer, 1998).

Depending on various features like mobility, capacity, and industry, cranes can be used in, there now are some variants of the basic cranes. Broadly classifying, cranes can be either mobile or fixed. Mobile cranes, as the name suggests, can be moved around from one place to another, with or without loads. Fixed cranes, although able of lifting heavier loads, cannot be moved or used for transport. However, modern fixed cranes now combine the special features of the two crane types to present some major advancement in the lifting industry (Alvin S, 2010).

Cranes now have the ability to lift loads much heavier than the traditional fixed cranes and are possible to be used at different work sites by being assembled and disassembled. The various types of cranes traditionally mobile are: crawler crane, truck-mounted crane, side-lift crane, floating crane, rough terrain crane, all-terrain crane, railroad crane and aerial crane. Cranes that were traditionally truly fixed, but are now somewhat mobile include tower cranes, self-erecting cranes, overhead cranes, telescopic cranes, and hammerhead cranes (Vikrant, 2010).

Each is tailored to a specific use. Sizes range from the smallest jib cranes, used inside workshops, to the tallest tower cranes, used for constructing high buildings. For a while, minicranes were also used for constructing high buildings. Taking this into account over the period of time, many models of cranes have come into the market, some of them being the truck mounted crane, as the name suggests, is placed on a truck for transport purposes and many more, each named aptly according to its use. Finally, we can find larger floating cranes, generally used to build oil rigs and salvage sunken ships (U.S. Department of Labor, 2009).

Crane Accidents and Preventive Measures

According to OSHA (2010), fatalities and serious injuries can occur if cranes are not inspected and used properly. Many fatalities can occur when the crane boom, load line, or load contacts power lines and shorts electricity to ground. Contact between cranes and overhead power lines, is a major cause of fatal occupational injuries in the United States. Based upon an analysis by the National Institute for Occupational Safety and Health (NIOSH) of the data from the Supplementary Data System of the Bureau of Labor Statistics, there were approximately 2,300 lost workday occupational injuries in the United States in 1981 which resulted from contact with electrical current by crane booms, cables, or loads. These 2,300 injuries were extremely severe, resulting in 115 fatalities and 200 permanent total disabilities. Comparable statistics obtained in studies conducted by the National Safety Council from 1965 to 1976 produced an estimated annual average of 150 fatalities resulting from such incidents. Other incidents happen when workers are struck by the load, are caught inside the swing radius, or fail to assemble/disassemble the crane properly.

What is a hazard? As it relates to cranes, a hazard may be thought of as any unsafe situation leading to loss. Hazards may be present in three forms: dormant, armed, and active (AEF companies, 2010).

Dormant is an undetected hazard created either by design or crane use. Armed is a dormant hazard that has become armed and ready to cause harm during certain work circumstances. Active is an armed hazard triggered into action by the right combination of factors. At this point it is too late to take any preventive action to escape injury or avoid death (AEF companies, 2010).

To change the design of a crane on a job site to make safer it is almost impossible, but there are measures that can be taken to prevent a hazard from becoming armed and active. The most effective ways to control hazards are:

- Eliminate or minimize the hazard. The major effort during the planning phase of any project must be to select appropriate work methods for cranes to eliminate hazards created by particular work circumstances.
- 2. Guard the hazard. Hazards that cannot be totally eliminated through planning must be reduced to an acceptable level of risk by the use of appropriate safety devices to guard, isolate, or otherwise render the hazard effectively inert or inaccessible. If this cannot be done, then nearby personnel should be protected from the hazard. For example, the employer should ask the manufacturer to assist in installing guards to provide physical protection against moving parts. Listed below are other methods of guarding particular hazards or the danger zone they create.
 - a. Install screens or covers over moving parts.
 - b. To prevent electrocution when cranes are to be used in the vicinity of overhead energized power lines, have the local electric utility install line guards or covers on the lines. The use of an insulated link on the hoist line is recommended to prevent the passage of electrical current from the hook through the load to the person guiding the load on the ground.
 - c. Install fences, guardrails or other barriers to prevent entry into the danger zone created by the rotating crane cab.

- 3. Give warning. When a hazard cannot be controlled by applying either the first or second method, an active, intercessory warning device should be installed in order to detect a hazard and emit a timely, audible and/or visual warning signal. Examples are alarms, horns and flashing lights. Warning systems must emit the standard variety of sounds or flashes so the meaning of the warning will be understood. Some hazard detection systems not only give audible or visual warnings but are wired to stop or prohibit movement. Signs and labels are passive warnings. They must be very explicit and state what the hazard is, what harm will result, and how to avoid the hazard. The signs for lifethreatening hazards should be pictorial if possible, with the word DANGER written in white letters on an oval red background with a black border. Signs and labels are not substitutes for eliminating or guarding the hazard. Rather, warnings are best used to make users aware of a specific change of circumstances that can create a hazardous situation or of a dormant hazard that could not be totally eliminated or controlled. Warnings should also inform users as to why the specified safeguard must be used. Requirements for signs and labels are set forth in Occupational Safety and Health Administration (OSHA) standards, "Specifications for Accident Prevention Signs and Tags," 29 CFR 1910.145; "Signs, Signals, and Barricades," 29 CFR1926.200; and Society of Automotive Engineers Recommended Practices (SAE) J115, "Safety Signs."
- 4. Special procedures and training. When a hazard cannot be eliminated or its risk reduced by any of the first three methods, planning special operating procedures such as training and audits must be employed to guarantee that a viable, continuing regimen will effect avoidance of the hazard.

5. Personal protective equipment. Use of gloves, taglines to guide the load, hard hats, safety shoes, aprons, goggles, safety glasses, lifelines, life jackets and other protective equipment at all appropriate times will also protect users from injury. Often a combination of several of these five preventive measures is necessary to control a life-threatening hazard (AEF Companies, 2010).

OSHA Crane-Manual Material Handling Standard

Handling and storing materials involve diverse operations such as hoisting tons of steel with a crane, carrying bags or materials manually and stacking palletized bricks or other materials such as drums, barrels, kegs, and lumber (U.S. Department of Labor, 2002). The efficient handling and storing of materials are vital to industry. In addition to raw materials, these operations provide a continuous flow of parts and assemblies through the workplace and ensure that materials are available when needed. Unfortunately, the improper handling and storing of materials often result in costly injuries (OSHA, 2002).

OSHA regulates overhead cranes through 29 CFR 1910.179 Overhead and Gantry Cranes Act. This regulation covers general requirements, design, inspection, and maintenance requirements, as well as operations (Safety Info Online, 2011).

General Requirements

- All overhead cranes installed after August 31, 1971, must meet the specifications of the American National Standard Institute (ANSI) / American Society of Mechanical Engineers (ASME) Safety Code for Overhead and Gantry Cranes, ANSI B30.2.
- Cranes can be modified and load capacity rerated as long as the modification and associated structure is thoroughly checked for the new rated load by a qualified engineer or the equipment manufacturer.

- 3. The rated load of the crane shall be plainly marked on each side of the crane. If more than one hoist is present, each hoist will have its rating shown.
- 4. Clearance must be maintained above and to the side of cranes. Walkways cannot be placed in a crane operating zone that would compromise employee safety when the crane is in operation. Parallel cranes must have adequate clearance between the two bridges if no walls or structures are between them.
- 5. Only designated personnel will be permitted to operate a crane.

Design Requirements

All overhead cranes are required to have characteristics to promote their safe use. The OSHA regulation specifies design requirements on the construction of the cab and its controls, foot-walks, ladders and stairways; bridge and trolley bumpers; hoist, holding, trolley and bridge brakes; electrical components; hoisting equipment; and warning devices.

Inspection Requirements

Due to the large and heavy objects often being transported by overhead cranes, routine inspections are necessary to ensure continued operation of the crane and the safety of the employees around the crane. An initial inspection of the crane prior to initial use of new and altered cranes is necessary. Once placed into service, overhead cranes will require two different types of inspections.

Frequent inspections

Frequent inspections are done at daily to monthly intervals, while periodic inspections are completed at monthly to annual intervals. The purpose of the two inspection types is to detect critical components of the crane and to determine the extent of wear, deterioration or malfunction. Items to be inspected are: hoisting and lowering, trolley travel, bridge travel, limit

switches, locking and safety devices, load test of not more than 125% of rated load.

Table 1

Items to be inspected daily and monthly periods to assure crane best performance

Items to be inspected	Frequency
Operating mechanisms for maladjustment	Daily
Deterioration or leakage in pneumatic and hydraulic parts	Daily
Hooks with deformation or cracks (visual)	Daily
Hooks with deformation or racks (written record with signature of	Monthly
inspector and date)	
Hoist chains and end connections for wear, twist or distortion (visual)	Daily
Hoist chains and end connections for wear, twist, or distortion (written	Monthly
record with signature of inspector and date)	
Running Rope and end connections for wear, broken strands, etc. (written	Monthly
record with signature of inspector, rope identity and date)	
Functional operating mechanisms for excessive wear	As needed
Rope reeving according to manufacturers recommendations	As recommended

Periodic Inspections

Items to be inspected:

- Deformed, cracked or corroded members.
- Loose bolts or rivets.
- Cracked or worn sheaves and drums.
- Worn, cracked or distorted parts such as bearings, gears, rollers, etc.
- Excessive wear on brake system parts.
- Inaccuracies in load, wind and other indicators.
- Electric or fossil-fuel motors.
- Excessive wear of chain drive sprockets and chain.
- Deteriorated electrical components such as pushbuttons, limit switches or contactors.

Maintenance Requirements

A preventive maintenance program based on the crane manufacturer's recommendations must be implemented. If any deteriorated components or unsafe conditions are detected during the required inspections, they must be completed before the crane is allowed to be used. Only designated personnel may perform the required maintenance and repairs. The requirements of 29 CFR 1910.147, The Control of Hazardous Energy or lockout/tagout, should be used to deenergize the crane.

Hand signals

Audible and discernible voice communication should be kept with the operator at all times. If this cannot be accomplished, a signal system should be used (Safety Info Online, 2011). Standard signals are shown below the text; however, it may be necessary to create special signals in certain circumstances. In these circumstances, the signals must be understood and agreed upon by all individuals using the crane. The signals are located in ANSI/ASME B30.2-2005. These are standard signals recommended by ANSI; however, OSHA does not require the signal system in its Overhead and Gantry Crane regulation. The manufacturers of overhead cranes may also provide their own version of crane signals.

Table 2

Standard Hand Signals for Controlling Overhead and Gantry Cranes



Hoist: With forearm vertical, forefinger pointing up, move hand in small horizontal circle.



Lower: With arm extended downward, forefinger pointing down, move hand in small horizontal circles.



Bridge Travel: Arm extended forward, hand open and slightly raised, make pushing motion in direction of travel.



Trolley Travel: Palm up, fingers closed, thumb pointing in direction of motion, jerk hand horizontally.



Stop: Arm extended, palm down, move arm back and forth horizontally.



Emergency Stop: Both arms extended, palms down, move arms back and forth horizontally.



Multiple Trolleys: Hold up one finger for block marked "1" and two fingers for block marked "2." Regular signals follow.



Move Slowly: Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal.



Magnet is Disconnected: Crane operator spreads both hands apart--palms up.

Summary

The effectiveness of safety programs has dramatically improved due to a significant change in the culture of the company. The development of safety programs, policies and plans for a specific workplace are to encourage employees to comply with regulations and prevent occupational injuries and illnesses. Getting employees involved in safety procedures represents an excellent way of installing accountability and compliance. This change is a result of the focus on safety as a number one priority at all levels of the company combined with the use of specific tools that identify and reduce risks throughout the company.

Chapter III: Methodology

The purpose of the study was to revise and employ a program to operate hoists and cranes at Company XYZ. The study was also conducted to reflect best practices and promote effective implementation and compliance to organizational standards and expectations. The objectives of this study were to:

 Conduct an assessment and inventory of the crane and hoisting material at Company XYZ.

2. Analyze the existing crane and hoisting policy at Company XYZ and compare it to best practices.

3. Develop an accountability system that would promote adherence to the crane and hoist policy.

The subject areas to be addressed are: Instrumentation, data collection, data analysis, and limitations.

Instrumentation

The instrumentation that was used in this study was the company safety program for cranes and hoist, and the company policies. These two documents were revised and assure the effective implementation and compliance to organizational standards.

Data Collection

An inspection was conducted to locate all cranes and hoisting material presented within the production floor of Company XYZ. This inspection was based on model of crane, manufacturer, serial, capacity, location, and frequency of use. The purpose of this procedure was to provide guidelines for the inspection and load testing of cranes, hoists, and slings. It is designed to comply with OSHA standard 29 CFR 1910.179.

Data Analysis

The data analysis was complete to determine how well the company safety procedures and practices were in compliance with OSHA safety regulations and standards

Limitations

The limitations of the study are:

1. Retrieving manufacturer's data regarding cranes models and their specifications due to several cranes were out of date and/or manufacturer was out of business.

2. Difficulty accessing several hoists' labels to find out serials number and models due to crane location.

3. The major part of cranes' hooks may not display lifting weight limit impressed on the hook.

4. Some hoists' labels may be blurred and difficult to read, which hindered retrieving manuals and model specifications.

Chapter IV: Results

The purpose of the study was to revise and evaluate the industrial crane and hoist program at company XYZ to reflect best practices and promote effective implementation and compliance to organizational standards and expectations. Another goal of the study was to develop a crane policy and adapt it to an accountability program to promote the effective use of cranes and hoisting materials.

Objectives

The completion of the study will be stated as follow:

 Conduct an assessment and inventory of the crane and hoisting material at Company XYZ.

2. Analyze the existing crane and hoisting policy at company XYZ and compare it to best practices.

3. Develop an accountability system that would promote adherence to the crane and hoist policy.

To achieve the objectives of this study, an inspection of all cranes and hoists materials was conducted and then a qualitative evaluation of the company policies was performed. Finally an accountability system was developed to promote adherence to the company crane and hoist policy. First of all to accomplish the first objective, an assessment and inspection of the cranes and hoisting materials at company XYZ was conducted within the production floor, each department was checked to identify specific information regarding: model, manufacturer, serial number, capacity, location, and frequency of use. All crane and hoist materials on site were inspected to provide guidance for future inspections and load testing of cranes, hoists and slings. This procedure was performed to comply with OSHA standard 29 CFR 1910.179. The data

obtained in regards of this lifting equipment was organized by means of cranes' specifications and department where the crane was located. During the inspection, some equipment did not displayed technical specifications; the limitations of this study provide several reasons why some technical information was hard to locate or identify. Therefore said information was retrieved throughout a thorough research on the manufacturer's website and instruction manuals kept and stored by the maintenance department. The following table summarizes the data collected during the inspection of the crane and hoisting material at company XYZ.

Table 3

Beams and hoist capacity inventory

Location	Structure/Beam	Hoist	Hook	Brand	
Tooling Stacker	2000 Lbs	1800 Lbs	Unknown	Rack Master	
Tool Washer	2000 Lbs	2000 Lbs	Unknown	CM Lodestar	
Mounter Proofer RM	1000 Lbs	1000 Lbs	Unknown	Dayton	
E-1600 Stacker	500 Lbs	300 Lbs	Unknown	Spancon	
E-1600 East	1000 Lbs	1000 Lbs	Unknown	Dayton	
E-1600 West	1000 Lbs	1000 Lbs	Unknown	Dayton	
E-1400 Winder	3200 Lbs	4000 Lbs	4000 Lbs	Saturn	
E-1400 Printer North	1000 Lbs	1000 Lbs	Unknown	Dayton	
E-1400 Printer South	1000 Lbs	1000 Lbs	Unknown	Dayton	
E-1100 Winder	3200 Lbs	4000 Lbs	4000 Lbs	Saturn	
E-1100 Printer North	1000 Lbs	1000 Lbs	Unknown	Dayton	
E-1100 Printer South	1000 Lbs	1000 Lbs	Unknown	Dayton	
E-1000 Winder	3200 Lbs	4000 Lbs	4000 Lbs	Saturn	
E-1000 Printer North	1000 Lbs	1000 Lbs	Unknown	Dayton	
E-1000 Printer South	1000 Lbs	1000 Lbs	Unknown	Dayton	
E-900 Winder	4000 Lbs	4000 Lbs	4000 Lbs	Saturn	
Maintenance Shop	2000 Lbs	2000 Lbs	Unknown	CM Lodestar	
Cup Printing West	1000 Lbs	1000 Lbs	1102 Lbs	Harrington	
Cup Printing East	1000 Lbs	1000 Lbs	1102 Lbs	Harrington	
E-2200 Trim Press	2000 Lbs	2000 Lbs	Unknown	CM Lodestar	
F-1300 Trim Press	2000 Lbs	2000 Lbs	Unknown	CM Lodestar	
F-900 Trim Press	2000 Lbs	2000 Lbs	Unknown	CM Lodestar	
F-1400 Trim Press	2000 Lbs	2000 Lbs	Unknown	CM Lodestar	
Battery Char 6L-R	1000 Lbs	1000 Lbs	Unknown	CM Lodestar	
F-2000	2000 Lbs	2000 Lbs	Unknown	CM Lodestar	

Cup Room North	1000 Lbs	1000 Lbs	Unknown	Harrington
Cup Room South	1000 Lbs	1000 Lbs	Unknown	Harrington
Machine Storage	1000 Lbs	1000 Lbs	Unknown	Konecranes

The result of this evaluation threw the following findings:

- Most hoist systems did not have uniform load ratings on all components.
- There was no capacity label on several hoists.
- Several "Below the Hook Lifting Devices" (BTHLD) were not labeled with serial number and warning label.
- Several labels were found damaged or hard to read important information of the hoist systems.

To accomplish the second objective the existing crane and hoisting policy at company XYZ was revised and compared to OSHA Overhead Crane Safety 29 CFR 1910.179 regulations and ASME - ANSI B30.2, Overhead and Gantry Cranes standards. OSHA regulations specifies that due to the large and heavy objects often being transported by overhead cranes, routine inspections are necessary to ensure continued operation of the crane and the safety of the employees around the crane. The primary objective is to avoid accidents through the means of eliminating unsafe working conditions and work practices.

The Company policies state that all slings and hoists shall be inspected for damage and defects before initial use and every 12 months by a qualified person trained in detection of slings and hoists defects. The inspections shall involve maintenance department. It was found that there was limited evidence of monthly inspections for hoists in routine use, or pre-use inspections for hoists that have not been used for an extended period of time. All periodic inspections and load

test are required to be documented and file to keep record of which cranes and hoisting materials have been inspected and assure:

- Functional operating mechanisms
- Deteriorations or leakage and other parts of air or hydraulic systems
- Hooks for deformation or cracks

Documentation of daily visual hoist inspections was found inconsistent throughout all departments of the facility.

The third objective was the development of an accountability system that would promote adherence to the company crane and hoist policy. Through the literature review, the elements of a safety program were discussed. These elements serve as the foundation for a safety and health program that should be implemented to hold managers and employees accountable for safety in the work place and promote adherence to the company policy.

The information gathered regarding safety programs, are the basis of the conclusions and recommendations that are presented in Chapter V.

Chapter V: Summary, Conclusions and recommendations

The focus of this study was to evaluate the industrial crane and hoist safety program at company XYZ to reflect best practices and promote effective implementation and compliance to organizational standards and expectations. An overview of safety management systems was performed to develop an accountability system to promote adherence to the crane and hoist policies at company XYZ. The concepts discussed in Chapter II of this study where used to achieve the development of the accountability system.

Restatement of the problem

Company XYZ utilizes cranes and hoists to move and store heavy material used in the manufacturing process of its product. Organizations are required to have safety related systems to effectively deal with the potential losses associated with this material handling equipment. In order to ensure as much as possible that hazards are minimized, safety programs are needed, must be understood and implemented.

Purpose of the study

The purpose of the study was to evaluate the industrial crane and hoist program at company XYZ to reflect best practices and promote effective implementation and compliance to organizational standards and expectations.

Objectives of the study

The completion of the study was stated as follow:

1. Conduct an assessment and inventory of the crane and hoisting material at company XYZ.

2. Analyze the existing crane and hoisting policy at company XYZ and compare it to best practices.

3. Develop an accountability system that would promote adherence to the crane and hoist policy.

Methods and procedures

The purpose of the study was to evaluate the industrial crane and hoist program at company XYZ. To accomplish the goals of the study, an inspection of all cranes and hoists was conducted throughout the facility and production floor. During this inspection a total of 25 cranes and hoists were found and classified by department and permitted weight limits according to their manufacture standards. The data obtained was organized by means of cranes' specifications and department where the crane was located. Followed by an evaluation of company policies and safety standards to develop an accountability system, focusing on the concepts discussed on Chapter II of this study, to promote adherence to the company crane and hoist policy.

Major Findings

Most hoist systems did not have uniform load ratings on all components, and several below the hook lifting devices were not labeled with serial number and warning label. Federal laws require all equipment be appropriately labeled with warning signs to prevent and eliminate potential health hazards. Proper labeling identifies and warns about safety hazards, as well as providing information about potential hazards. The best approach is to eliminate the cause of the hazard. But if the hazard cannot be eliminated, labeling and signs should be used to identify the hazard and provide essential information.

Conclusions

The first objective was to conduct an assessment and inventory of the crane and hoisting material at company XYZ. Based upon the results the following conclusions were made:

 People have a right and need to know what type of equipment they are working with, and that they should follow basic precautions when using any heavy machinery. Labels give identification information as well as general guidelines for safe use. Overall labeling and signs are an important because they are a means of providing safety related information. Communication is important, and labels and signs are an effective means of communicating relevant information at the point where it is needed.

The second objective was to analyze the existing crane and hoisting policy at company XYZ and compare it to best practices. Based upon the results the following conclusions were made:

- Hoists and cranes in routine use are subject to a number of inspection procedures to make sure they are in good operating condition. Well maintained and inspected cranes will prevent accidents and maintain safe operations of bridge, gantry and monorail crane.
- Regular inspections will avoid unnecessary interruption in production, addressing potential problems before they become more costly or inconvenient.

The third objective was to develop an accountability system that would promote adherence to the crane and hoist policy:

There is need to increase accountability and employee involvement. Eighty percent of
incidents are management controlled (Bird and Germain, 1985). By increasing
accountability of management regarding the performance of the safety system, a majority
of incidents may be reduced or eliminated. Regarding employee involvement, employees
must be involved in activities that have a major effect on safety system performance (J.J.
Keller, 2011). "A positive safety culture is one where employees are actively involved in

managing safety efforts, and safety management systems such as training and discipline are in place and effective" (Williams, 2008).

- As Bird and Germain (1985, p, 32) stated in *Practical Loss Control Leadership*, "80% of the mistakes people make involve things that only *management* can do something about. Therefore, it is necessary to hold managers accountable for safety system performance.
- Information as we may see, is crucial, then for its effective management the ideal accountability system should consider the use of the IT (information Technology) that best suits it, whether it be an intranet whose data base includes information and instructions for safe use of equipment and handling of materials, or simply a file-box with that information.

Recommendations

- The use of labels and signs provide information about processes and procedures. Labels frequently contain other information, such as precautionary measures. This information could be employed to prevent workplace accident and subsequent injuries.
- The use of barcodes can help control inventory of equipment, and retrieve information such as their maintenance deadlines, load ratings, guidelines for safe use, the risks involved and what to do in case of an emergency.
- Management should create a safety hotline to which any employee can report any unsafe or unhealthy work condition, and any observation, no matter how small it is, should be taken care of immediately.
- To enforce that all equipment be always properly labeled, operators must be held accounted for operating machinery whose labeled is unreadable or absent; it should be made a routine that they check and read labels on machinery before operating them, if

information is missing or labels damage, they should report it their immediate supervisor, who may then solve the problem. If it isn't, the operator may refuse to operate it without prejudice until problem has been taken care of.

- To avoid the presence of unnecessary or untrained personnel in the cranes' or hoists' operation area, credentials must be issued daily, after checking every employee has been assigned and trained for the task, and understands the risks involved and what to do in case of an emergency. This should be issued for the estimated time of work, with a chance of renewal if task could not be completed on time.
- Cranes and Hoists operator should make sure they know conditions when operating this mechanical equipment. Keeping in mind that bad weather can damage a crane, not only that it will damage the equipment but it will also increase the risk and the chances of an accident. When weather is not within the operation parameters of the crane or there is very high or very low temperature than usual then measures should be taken prior to operate a crane without taking safety for granted.
- Cranes should only be operated by designated trained person. Supervisors are accountable of ensuring that employees under their supervision receive the required training and are certified and licensed to operate the cranes and hoists in their areas.
- Supervisors are responsible for ensuring that hoisting equipment is inspected and tested monthly by a competent person.
- Operators that have access to a fire extinguisher must receive "Fire Extinguisher Training" from Risk Management and Safety or other qualified persons. Training must be documented by creating training record that contains the name of the trained individual, date and the name and signature of the competent person providing the training.

- Finally, but if not most as important, it should be understood that culture is not some abstract word that proposes an answer to a problem little or not understood; safety culture is something that must be practiced day by day, the best safe practices and guidelines must be present in signs, in the organization's general policies, disseminated through daily chats, courses, journals and all kind of imaginable media and most important, modeled from top management down. A productive activity is supposed to bring about benefit to one's quality of life, but they always involve risks, the point is to actively contribute to preserve everyone's physical and mental integrity in order to be able to enjoy the profit of good work.
- All operations near overhead lines must be done in accordance with 29 CFR 1910.333(c)(3) requirements.
- Consider developing an accountability system to ensure that those responsible for crane safety are held responsible to do so.

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