Course Learning Outcomes for Unit I

Upon completion of this unit, students should be able to:

2. Discuss hazard recognition, investigation, and analysis methods.
   2.1 Discuss the requirements for hazard assessment and control by comparing regulations and standards.
   2.2 Analyze hazards in an industry by calculating incidence rates.
   2.3 Develop techniques for analyzing hazards by comparing common hazard analysis methods.
   2.4 Assess control techniques by prioritizing available control methods.

Reading Assignment

Chapter 1:
Approaches to Safety

Chapter 2:
Standards and Legislation

Chapter 3:
Recognition and Control of Hazards

Unit Lesson

Safety and health programs in U.S. facilities have greatly improved since the Occupational Safety and Health Act was passed in 1970. The Occupational Safety and Health Administration (OSHA) has been proactive in addressing workplace hazards to reduce workplace injuries, illnesses, and deaths since that time. According to the U.S. Bureau of Labor Statistics (1995), private industry employers had an overall injury and illness incidence rate of 11.0 per 100 full-time workers in 1973. That incidence rate has steadily declined over the years to 3.4 per 100 full-time workers in 2012, the latest year for which data are available (U.S. Department of Labor, Bureau of Labor Statistics, 2013). The number of work-related deaths has also declined from a total of 6,217 in 1992 to 4,628 in 2012 (U.S. Department of Labor, 2014). The number of work-related deaths in 2012 still represents almost 13 deaths in the workplace every day. Most safety professionals consider one work-related death to be too many.

Further reduction in the numbers of work-related injuries, illnesses, and deaths requires a consolidated effort between all branches of safety professionals. Safety as a profession includes the identification and evaluation of workplace hazards. The term hazard has evolved in meaning over the years. Hazard is most commonly defined as the potential for causing harm to humans or the environment. Many individuals fail to distinguish between the terms hazard and risk. Risk is generally defined as the evaluation of the probability that some harm will occur related to a hazard, and the severity that would be associated with the hazard. An understanding of these terms is important when identifying and evaluating hazard in the workplace. Whenever a hazard is present in a workplace, some level of residual risk is also present. As a relative term, safe is a determination of the acceptability of risk, or What is an acceptable level of risk?

Risk management is a specialized field in safety dealing with identifying and implementing controls to reduce risks in the workplace to what are considered an acceptable level. It is within risk management that safety engineers typically assert their influence. Traditionally, safety engineers have become involved after hazards have been identified in a workplace. The engineers would evaluate the hazards and risks and recommend engineering or administrative controls to reduce the risks to some specified acceptable risk level. Recently,
more emphasis has been placed on prevention of accidents through the design of machines or processes. This process is called “Prevention through Design” or “Safety through Design.”

Some of you may remember an explosion that occurred at a Titan II ICBM missile silo in 1980. The Titan II ICBM was liquid fueled, using two hypergolic chemicals: nitrogen tetroxide, and unsymmetrical dimethyl hydrazine (UDMH). On September 18, 1980, some airmen from the maintenance squadron were working on a platform near the top of the missile in the silo. An airman dropped a wrench socket, which rolled to the edge of the platform and fell through a gap between the platform and the missile. After freefalling approximately 80 feet, the socket struck and punctured the skin of the missile, releasing UDMH into the silo. All personnel evacuated the silo safely, but the next morning two airmen were sent into the silo to take readings of the air concentrations of UDMH. After receiving high readings they departed the silo and made their way to the top of the stairs and exited the complex. As they were leaving the UDMH exploded killing one of the airmen, injuring 21 others, and destroying the complex. What lessons can we learn from this historical example?

At the time, the risks associated with maintenance work in the missile silo were underestimated, and no risk management plan had been implemented. One reason the accident occurred was because the standard operating procedures (SOPs) were not followed. The platforms had extensions with rubber flaps that were supposed to be extended, sealing the gap through which the socket fell.

After the accident occurred all three Titan II missile wings conducted hazard/risk assessments related to maintenance in the silos, and new risk management procedures were implemented—including a policy that a crew member would be present during every maintenance procedure performed inside the silo to ensure SOPs were correctly followed. This is an historical example of how simple hazard analysis and risk management procedures could have been used to reduce the risk associated with an extremely hazardous situation.

Consider a situation where a construction company is building a 30-story office building. There are workers present on every floor of the building who are working under different levels of completion of the project. The first five floors already have the outer “envelope,” including walls and windows installed, and interior work is being performed. The next 10 floors have some level of completion of the outer envelope, but there are still openings in the walls. The upper floors are basically just the skeleton of the building. If one focuses on the fall hazard that is present, one can see how the first three chapters of the textbook apply.

A review of the U.S. Department of Labor data (2014) shows that the construction industry accounted for more deaths than any other industry—except transportation. Most of the deaths in construction were due to falls. The tools presented in Chapter 3 of the textbook could be used to evaluate the risks associated with the work being performed on the building, and a risk management program could be implemented to reduce the risks associated with falls on this project to a level that would be considered acceptable. Can you think of some safety engineering controls that you have seen on construction projects related to falls? How effective do you believe the controls are that you have seen on construction projects? As we proceed through this course, we will review and evaluate some engineering controls related to falls.

References


Suggested Reading

The CSU Online Library contains many articles that relate to the Unit I readings. The following are just a few of the related articles that can be found in the Academic Search Complete database:

- The Failure Mode and Effect Analysis (FMEA) method has been used to analyze hazards. The 2010 article “Enhancing the Failure Mode and Effects Analysis Methodology with Fuzzy Inference Techniques” found in the Journal of Intelligent & Fuzzy Systems discusses how to improve the outcomes of FMEA and Risk Priority Number (RPN) methodologies using fuzzy RPN models.


- Fault Tree Analysis is another methodology that has been used for hazard analysis. Historically, the use of NOT gates has been discouraged for FTA. The May 2001 article, “The Use of NOT Logic in Fault Tree Analysis” in Quality & Reliability Engineering International discusses both the difficulties and benefits that can be derived from incorporations of NOT logic.


- Workplace Injuries and illnesses have steadily declined in the United States since the passage of the OSH Act in 1970. “Workplace Injury and Illness Rate Continues Downward Trend” in Professional Safety summarizes the downward trend.


- OSHA will periodically publish new standards and update existing standards. The June 2014 Professional Safety article “OSHA Publishes New HazCom Resources” discusses the recent OSHA update to the HazCom standard.


Learning Activities (Non-Graded)

The OSHA and Bureau of Labor Statistics websites contain summaries of workplace injuries, illnesses, and deaths. Browse the web sites (www.osha.gov and www.bls.gov). Summarize the trends in overall injuries, illnesses, and deaths in the United States over the last decade. Which occupations appear to have the greatest risk for deaths? Which rate did you use to make that decision? If you are currently familiar with a workplace that records OSHA injuries and illnesses, compare the most recently posted summary with the rates you find on OSHA or BLS sites. How does OSHA use the rates from individual sites?

Non-graded Learning Activities are provided to aid students in their course of study. You do not have to submit them. If you have questions, contact your instructor for further guidance and information.