Course Learning Outcomes for Unit VI

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

5. Explain key industrial hygiene concepts such as routes of entry and hierarchy of controls.
   5.1 Discuss the merits of OSHA’s approach versus the approach used by NIOSH/ACGIH to the permissible exposure limit (PEL) for noise.

6. Examine different types of industrial hazards commonly addressed by the industrial hygienist.
   6.1 Determine which tasks within a specific workplace would present the greatest risk for repetitive motion injuries.
   6.2 Describe how an industrial hygienist or safety officer would create an ergonomics program to address repetitive motion injuries.
   6.3 Identify the greatest obstacles one would face when establishing an ergonomics program.

Reading Assignment

Chapter 11:
Noise, pp. 237–247

Chapter 12:
Radiation, pp. 259–267

Chapter 13:
Thermal Stressors, pp. 293–301

Chapter 14:
Ergonomics, pp. 319–331

Unit Lesson

Understand that the recognition of physical hazards is typically more difficult for students than the recognition of chemical and biological hazards. With chemical hazards, concepts such as particles and molecules present in the air or liquids on the skin can be easily conceptualized. For biological hazards, we are usually familiar with the concepts because of annual influenza outbreaks and news coverage of epidemics such as those involving the Ebola virus. Understanding the concepts of waves in the air, radioactive particles, and heat may be more difficult.

For anyone practicing safety in an industrial setting, noise will usually be an issue. There will typically be at least one area of the facility where noise levels are high enough that noise-induced hearing loss can be present. A problem that is prevalent with noise exposure is that workers tend to dismiss the risk associated with exposures. When a chemical is present at concentrations where an odor is present, many workers assume that harm is occurring and complain. As we saw in an earlier unit, odors may be present at concentrations that may cause no toxic response. However, when noise levels increase to a point that damage to hearing may occur, many workers ignore the risk.

There can be several reasons for worker complacency about noise levels. First, noise-induced hearing loss is commonly chronic. While some hearing problems can develop after acute exposures to high noise levels, most hearing loss associated with occupational noise exposure occurs over a period of years. Because there are no immediate permanent symptoms, workers may ignore the risk. Second, most workers will also have noise exposures related to activities outside of work, such as hunting or attending concerts or car races, while most workers do not typically have exposures to the same chemicals at home that they use at work. Finally,
many workers do not like to wear hearing protection and will not complain about noise levels because they do not want to have to wear ear plugs.

Many safety professionals use direct-reading sound level meters (SLMs) or noise dosimeters to identify areas where high noise levels exist. We will look at the use of noise dosimeters to evaluate noise in another unit. However, most locations do not have or maintain SLMs or dosimeters. A simple approach to identifying areas where an evaluation should occur is to have two workers stand a few feet apart and determine whether or not they have to raise their voices to hear each other. If they do, then the noise levels are high enough that an evaluation should occur. Typical sources of high noise levels in industrial settings include mechanical presses, fans, motors, ovens, back-up alarms on forklift trucks, compressed air hoses used for blow-down, and production processes where metal parts fall into metal containers.

Another potential physical hazard is radiation. One problem with the recognition of radiation hazards is that they are far less obvious than other hazards. Unlike noise, where you can detect high noise levels by the inability to hear others speaking nearby, radiation does not typically cause any immediate effects that can be detected without instrumentation. Another problem is that radiation may be present from a source that is not normally thought of as a radiation source. A good example is the microwave oven that is present in most facility breakrooms.

However, exposure to microwaves that heat food would also heat the cells in your body, causing damage. Most workers would not consider the microwave oven as a radioactive source. Fortunately, modern microwave ovens are well shielded, which prevents high exposures. This was not always true of early microwave ovens, requiring many early industrial hygienists to perform evaluations of microwave ovens in breakrooms using direct read meters.

Most of the potential for exposure to radiation in industrial settings comes from machines that are used for measurements. X-ray machines are commonly used to measure thickness of materials and the quality of welds. X-rays may also be generated by devices such as electron microscopes and cathode ray tubes. X-rays are sometimes used to kill bacteria and viruses in foods or on surfaces. Recognizing radioactive sources is not always easy because the radioactive sources are sometimes sealed inside machines. Even though the sources are sealed and thus represent a low risk of exposure, it is still important to identify the sources. In some cases, states require registration of all radioactive sources. A facility in Kentucky identified several radioactive sources during an audit that had been present for years and realized they needed to register the sources with the state. Another reason to identify the sealed radioactive sources is that maintenance activities could increase the risk of exposure.

Another radioactive exposure that is sometimes overlooked involves lasers. Lasers are commonly used in industry. As with many other radioactive sources, the laser is typically inside a machine, reducing exposure risks. This type of laser is said to be embedded. There are several classes of lasers ranging from Class 1 to Class 4. Class 4 lasers represent the greatest risk for exposure and harm; but, a problem can exist when a facility has a Class 1 or Class 2 laser. In many cases, there is a Class 3 or Class 4 laser embedded inside the Class 1 or Class 2 laser. Recognition of the embedded laser can be important for the protection of workers.

An example of this occurred at a facility that manufactured computer chips for automobiles. The facility used a Class 2 laser with an embedded Class 4 laser to trim the edges of the chips. The process was designed to take place inside the machine, which is why the machine was rated as a Class 2 laser. An engineer decided it would be interesting for production employees to see how the laser worked, so he bypassed all of the controls, opening up the machine so the other workers could watch the trimming process. The nature of lasers made this process even more dangerous.

Some lasers operate at a wavelength within the visible spectrum of light; these laser beams are the ones you see used as pointer devices, since you can see the laser beam. Other lasers operate at wavelengths that are not in the visible spectrum of light. These laser beams are not visible, and you may be exposed to the laser beam without realizing you are being exposed.
The damage caused by visible and non-visible lasers differs. Visible light is focused on the back of the eye. Since laser light is already more focused, when the light is further focused on the back of the eye, physical damage can occur to the retina. Non-visible light is not focused in the same way, so the damage tends to be a heating of the vitreous humor. Tissue proteins are denatured due to the temperature rise following absorption of the laser energy. This commonly leads to the development of cataracts.

Heat is another physical hazard that causes high rates of occupational injuries and illnesses each year—typically in the summer. The issue is serious enough that the Occupational Safety and Health Administration (OSHA) has included it as a special campaign for years. You can review the materials OSHA produced concerning heat stress at the following link: https://www.osha.gov/SLTC/heatillness/index.html.

Recognizing and controlling heat illnesses is fairly easy. Review OSHA’s quick card for heat illnesses at the following link for some ideas: https://www.osha.gov/Publications/osha3154.pdf. At times, one of the biggest obstacles to a successful heat illness program is convincing management that workers are required to rest for significant periods of time each hour to prevent illness.

The final area of physical hazards we are discussing in this unit is related to ergonomics. Physical stressors in some work environments can lead to musculoskeletal disorders (MSDs). MSDs are second only to noise-induced hearing loss as the most common occupational injury or illness. In some industries, MSDs are much more common than noise-induced hearing loss. Many MSDs occur as a result of repetitive motion. In some industries, production requires workers to repeat the same task over and over through the entire work shift. The strain produced by the repetitive motion is, at times, complicated by the design of the machine or tool being used. Because workers’ body types differ so much, machines and tools must be designed based on the “average” body type. This means that, for many workers, the design may lead to increased strain on certain body parts, leading to MSDs.

Recognizing physical stressors that could lead to MSDs is complicated because OSHA is constrained on what ergonomic regulatory powers it can use. OSHA published a final ergonomics program standard on November 14, 2000, which took effect January 16, 2001 (Siegel, 2001). Congress passed Senate Joint Resolution 6, which rescinded the original ergonomics rule that, under the Congressional Review Act, prohibited OSHA from issuing a rule that is substantially the same as the former one. Since 2001, OSHA has issued several ergonomics guidelines for some specific industries, and OSHA can cite ergonomic hazards only under the General Duty Clause. If you do not work in one of the industries for which OSHA has published a guideline, there are limited resources available. Many industries will use outside contractors with educational backgrounds in ergonomics (and some with national certifications) to perform an ergonomic assessment of the workplace.

Reference


Suggested Reading

The CSU Online Library contains many articles that relate to this unit’s reading assignment.

In order to access the resources below, you must first log into the myCSU Student Portal and access the Academic Search Complete database within the CSU Online Library.

One of the newer issues with physical hazards is exposure to radiation from cell phones. There have been a number of studies performed about this issue. The following article summarizes the history of research on testing of radiation exposure and cell phones.

Musculoskeletal disorders (MSDs) typically make up a large percentage of occupational injuries each year. Ergonomics is the study that is used to try and control these injuries. The following article discusses seven mistakes that management typically makes in establishing and maintaining an ergonomics program.


Sometimes, we forget that physical hazards can impact the developing fetus. The following article looks at the effect of occupational noise exposure during pregnancy and hearing dysfunction in the children after birth.


Exposure to high noise levels can occur in academic settings also. The following article looks at noise exposure in collegiate music students.


In order to access the resources below, you must first log into the myCSU Student Portal and access the Academic OneFile database within the CSU Online Library.

Heat stress is an annual problem in many regions during the summer months. The author discusses the process of screening for heat stress in workers and athletes in the following article.


Learning Activities (Non-Graded)

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.

The Occupational Safety and Health Administration (OSHA) uses grant money to have training materials published by contractors for different topics. One such training program is for heat stress in farm workers. The training can be accessed at https://www.osha.gov/dte/grant_materials/fy09/sh-19485-09/trainer_guide.pdf. Access and complete the training program. Did the training increase your knowledge about illnesses associated with heat exposure?