Evaluation of Employee Exposure to Hazards

Name

Institution

Introduction

Sincerely, the nature of job defines the workplace of the employees. Some workplaces have favorable working conditions while others have adverse working conditions. Most manufacturing companies expose the employees to hazardous working conditions because the employees are required to operate heavy machines and interact with chemicals in the course of their work. This paper presents an evaluation of the employee exposure to hazards at a small automobile manufacturing firm. In particular, the manufacturing firm requires the employees to operate two metal presses, three welding stations, two machining stations, and a paint booth. Additionally, other employees are deployed at the shipping and receiving area to facilitate the movement of goods from the production section to the warehouses using electric forklifts.

Part1: Identifying the Hazards Present in the Manufacturing Facility

Certainly, there are various hazards present in the manufacturing facility. One of the potential hazards includes the use of 1,3 butadiene by one of the employees in cleaning the nozzles of the paint booth. According to the Occupational Safety and Health Administration (OSHA), 1,3 butadiene presents two categories of exposures including acute and chronic exposures. Acute low exposures might cause the irritation to the throat, eyes, lungs and nose. Acute high exposures might cause severe damage to the nervous system and distort vision, cause nausea, general tiredness and headache. Xylene and methyl ethyl ketone (MEK) are equally hazardous as 1,3 butadiene. Xylene and methyl ethyl ketone (MEK) are potential sources of hazards to two employees at the paint booth. Regretfully, inhaling the vapor of Xylene and methyl ethyl ketone (MEK) might cause the depression of the nervous system, and present symptoms such as dizziness, vomiting, headache and nausea.

Furthermore, four employees working at the two metal presses are vulnerable to amputation hazards. One metal press has a capacity of compressing 2000 tons while the other press has a capacity of 200 tons. Improper handling of the metal presses might cause damage of body parts and lead to amputations. The metal presses especially the 2000-ton press, are also likely to cause hearing problems to the two employees because they are nuisances in the manufacturing facility. Three employees at three welding stations are likely to suffer from irritation of the eyes. Therefore, the welding machines are potential causative agents for loss of sight or blurred vision. Occupational Safety and Health Administration (2010) argues that metalworking fluids might cause health hazards through skin contact or inhalation. Lastly, four employees working at the shipping/receiving area should charge large lead-acid batteries that power the electric forklifts routinely to avoid the cases of draining the battery while lifting heavy loads. Four employees might be at risk if the electric forklifts malfunction because of insufficient power.

Part 2: Measuring the Exposures of Personal Hazards

This section focuses on providing a specific sampling and analytical method for the chemicals exposed to the employees at the manufacturing facility. The chemicals identified in the manufacturing facility that have potential to cause adverse health effects include 1,3 butadiene, Xylene and methyl ethyl ketone (MEK). As with 1,3 butadiene, the sampling and analytical procedure would involve the use specially cleaned charcoal that is coated with 4-tert-butylcatechol (TBC) as the sampling media. According to OSHA (2010), this sampling media is more improved than the method that uses the activated coconut shell charcoal. TBC brings stability in the sampling media because it is a major polymerization inhibitor for the 1,3 butadiene chemical. Samples are gathered using personal sampling pump that is calibrated within

+ or – 5% of the recommended 0.05 L/min sampling rate. The samples would be placed in the laboratory prepared sampling tubes that are 5-cm long and constructed using silane-treated glass. The o.d would be 6mm while the i.d would be 4mm. One end of the sampling tube would be tapered to allow a glass wool end plug to hold the samples in place throughout the sampling procedure. Essentially, both ends of the sampling tube would be fire-polished to enhance safety. Then the tube would be packed with two sections of the pretreated charcoal that is coated with TBC. The injection size for use in the analytical procedure would be 0.80 µl to determine the detection limit of the procedure. The diluted 1,3 butadiene would be injected with 100-mg of TBC coated charcoal and be stored overnight in a freezer before the analysis. The reason for selecting the pretreated charcoal coated with TBC than the activated coconut shell charcoal is because this sampling method is adequate and stable for use even at low levels of 1,3 butadiene. Moreover, TBC is an excellent polymerization inhibitor for the chemical, 1,3 butadiene.

Xylenes are isomers that bear substantial quantities of ethylbenzene. For that reason, the most appropriate sampling and analytical method is the use of coconut shell charcoal sampling method and personal sampling pumps. The sampling equipment would be attached to the employee safely to avoid interfering with work performance. The sampling media would be collected using charcoal tubes. In this case, the samples would be collected using personal sampling pump comprising two sections of the coconut shell charcoal. The front section of the tube contains 100mg of the coconut shell charcoal while the back section holds only 50mg of the same charcoal. However, the two sections are separated and held in place by polyurethane and glass wool plugs. The sampling process would take up to four hours at 50mL/min when collecting long-term samples. Short-term samples would require at least 5minutes at 50mL/min.

Methyl ethyl ketone (MEK) is another chemical present at the manufacturing facility that requires sampling and analysis to evaluate the exposure of its hazards to the employees. The most appropriate sampling method is the use of SKC Anasorb carbon molecular sieves (CMS) tubes together with the personal sampling pumps to collect workplace air. The sampling apparatus would be attached to the employee in a manner that it would not interfere with work performance. The sampling apparatus would include SKC Anasorb sampling tubes. For that reason, the samples would be gathered with 7cm x 4mm i.d x 6mm o.d glass tubes with two sections of the SKC Anasorb CMS. The front section would hold 150mg while the back section would contain 75mg of SKC Anasorb CMS. The glass wool plugs would sit between the two sections to hold them in place. When collecting the samples for long-term, the sampling rate of SKC Anasorb CMS would be 240 minutes at 50mL/min. Conversely, the sampling rate for short-term samples would be 5 minutes at 50mL/min. The reason for selecting SKC Anasorb CMS is because it allows collection of 4-hour sample of both MIBK and Methyl ethyl ketone (MEK) using a single sampling tube, unlike Anasorb 747 sampling that do not have enough capacity to permit both MIBK and MEK through the same sieve. Secondly, Anasorb CMS is carbon molecular sieve that is proprietarily owned by Supelco.

Part 3: Calculating Time-Weighted Averages (TWA)

This section shows the calculations of the Time-Weighted Averages and comparison to the OSHA PEL. The permissible exposure limit (PEL) describes the legal limit or threshold for exposure of the employees to various substances including dusts, chemicals, mists, fumes, and gases among others. Essentially, PEL is expressed in milligrams per cubic meter (mg/m^3) or parts per million (ppm). Conversely, TWA describes the measure of concentration to substances over time. The OSHA utilizes TWA to determine whether the substances at the workplace are hazardous or not by comparing it with the PEL. In particular, if TWA exceeds the PEL, then the substance is regarded as hazardous.

According to the OSHA, the PEL for noise is 90dBA at 8-hour TWA. Therefore, the 2000-ton press is hazardous because the TWA exceeds the OSHA PEL. Additionally, the PEL for 1,3 butadiene is 2.21mg/m^3, which is lower than the TWA in the manufacturing facility. Therefore, 1,3 butadiene used to clean nozzles is hazardous and require controls to minimize the chances of causing antagonistic health effects. As with methyl ethyl ketone (MEK), the OSHA PEL is 200ppm or 590 mg/m^3, which is lower the current TWA exhibited at the manufacturing facility. Hence, the employer needs to develop controls for ensuring that methyl ethyl ketone does not affect the employees' health.

Part 4: Hierarchy of Controls

Employers are required to calculate employee exposure to hazards in the workplaces to guarantee the workers maximum safety. Indeed, the employees could be safe when the exposures are maintained below the OSHA PEL. However, some exposures exceed the OSHA PEL and therefore the employer requires to take a hierarchy of controls to minimize illnesses, and avoid injuries at the workplace. According to OSHA (2010), the controls ranges from the most effective to the least effective. The most effective controls are at the top of the hierarchy of controls while the least effective controls are at the bottom of the hierarchy. For that reason, the employer should select controls that are permanent, effective and feasible.

One of the controls would involve physically removing the 2000-ton press that makes the loudest noise and replace it with another metal press that does not make such noise. The control of eliminating and substituting the 2000-ton press would safe two employees that work on it from hearing problems. Additionally, the employer should eliminate the use of 1,3 butadiene to clean nozzles. 1,3 butadiene is a deadly chemical if inhaled because it causes malfunctioning of the nervous system. Other option of controlling hazards afflicted by the chemicals such as 1,3 butadiene, xylene and methyl ethyl ketone includes imposing administrative controls to change how employees would work. Since the exposure rates of employees to these chemicals exceed the OSHA PEL, the employer might reduce the exposure time to keep the exposures below the OSHA PEL. As a result, the employees would be safer than before.

Besides substituting machines with other advanced machines, and enacting administrative controls, the employer needs to ensure that each employee has personal protective equipment. For instance, employees working at the machining area, welding and paint booth require special attire to reduce the chances of contacting the metalworking fluid and chemicals such as 1,3 butadiene, methyl ethyl ketone and xylene with their skins. The interim control that I would recommend the employer to use is organizing for workplace training on industrial hazards. The employees would be able to take better care of themselves if they understand the dangers associated with each machine and chemical at the workplaces.

The implementation of the hazard controls would be facilitated by the establishment of a concrete hazard plan. The hazard plan would include comprehensive details of what controls to give the highest priority and those to give lowest priority depending on the degree of exposure. In short, the employee exposures that exceed the OSHA PEL by a big margin would be given a higher priority than the exposures that are below or exceed the OSHA PEL by just a small margin. The evaluation process would be based on the adherence of the employer to the hazard plan. In other words, the hazard plan will aid in measuring the effectiveness of these controls. The hazard plan would be able to tell the employer whether the engineering controls are properly executed. Moreover, performing regular inspection at the workplace would be of paramount importance in determining the effectiveness of the controls. For instance, the employer would know that the controls are effective if there are consistent decrease in the number of injuries and illnesses that result from the exposure to adverse working conditions.

References

Occupational Safety and Health Administration. (2000). *Occupational safety and health standards: Occupational health and environmental control* (Standard No. 1910.95). Retrieved from https://www.osha.gov/dts/sltc/methods/toc.html