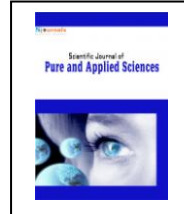

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Original article

Safety and health work-instruction in mechanics provided using job safety analysis technique

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ABSTRACT

Automotive and automotive industries in developed and developing countries are important. Many experts are associated with this industry. Mechanics is one of them. In order to reduce the effects of the economic losses caused by diseases and accidents, several methods are presented to identify hazards in the workplaces which can be helpful in controlling risks. One of them that rely on aspects of health, safety and ergonomic is Job Safety Analysis techniques. In this study, 63 Mechanics workshops in a city in Iran were selected for analysis. All of these workshops were analyzed using JSA technique. First the jobs were broken to their tasks and steps. Next, the hazards were identified for each of these tasks. Finally, for each of these hazards, corrective actions and control measures were offered in a work instruction. JSA is one of the most important management tools that help eliminating hazards and reducing workplace injuries and incidents. Also JSA identifies errors in the production process and increases productivity. JSA completed forms can be used for retraining workers and train new workers, and to investigate the causes of the accident. JSA allows to workers that be involved in this process and share their knowledge and experience.

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1. Introduction

Annually a large numbers of workers in different countries are injured or die. According to statistics provided by the ILO in 2000, the number of occupational accidents in the world has been announced about 25 million items that one million people have died as a result of them. In Iran more than 17 million people are working in two million workshops. According to studies, about 80% to 90% of accidents are caused because of employee unsafe behaviors and only cause of 10% to 20% of them is the unsafe conditions. According to the statistics provided in 2005, each year 2.2 million people, men and women, due to work-related accidents and illnesses are deprived from their rights. Work-related deaths and injuries impose heavy costs on societies especially in developing countries (Najafi 2001; Sori 2005; Mohammadfam 2009; Alizadeh, Mortazavi et al. 2013; Alizadeh, Mortazavi et al. 2014).

Automotive and automotive industries in developed and developing countries are important. Many experts are associated with this industry. Mechanics is one of them. Automobile mechanic is a person who repairs and overhauls cars and other automotive vehicles, or their systems and parts. He/she examines them, makes necessary repairs, emplacements, adjustments, and presents the repaired vehicle to his/her superior or to the customer (ILO 2000). Auto mechanics work in environments that have high probability of risk in it. There are many harmful factors in Mechanics workplaces such as chemical and physical agents, ergonomics factors, mechanical and biological factors (al. 2012).

In order to reduce the effects of the economic losses caused by diseases and accidents, several methods are presented to identify hazards in the workplaces which can be helpful in controlling risks. One of them that rely on aspects of health, safety and ergonomic is Job Safety Analysis techniques. It is easy to understand and is very practical and effective in planning and implementation. The implementation of this method is almost with minimal equipment, and only with careful study and analysis based on the individual's ability to take hold. Finally, regardless of any number but technically provided information for all individuals (managers and workers). Considering these factors the implementation of this technique is recommended in every industry and jobs (G Halvani 2006). One of the workplaces which workers are exposed with a variety of deleterious effects, but considered by few researchers is Mechanics. There are various methods for hazard identification and safety assessment; such as safety audits, job Safety Analysis, ETBA, PHA, etc (G Halvani 2006). JSA is an accurate and systematic method for identifying and evaluating potential or existing hazards in any process or job (M.d.o.l.i. ; Esposito 2004; G Halvani 2006; Arezes and A.S 2008). OSHA recommends that by doing the proper job hazard analysis can prevent a lot of injuries and diseases. Also it can determine the technical and managerial control measures, training needs, personal protection requirements and operating procedures established for each activity (T and A.L 2005). The main objective of this technique is to find safe for work accidents and prevention (Najafi 2001). This method is known as Job Hazard Analysis, Safety Job Analysis, and Task Hazard Analysis (Najafi 2001; OSHA 2002; Parvin Nasiri 2006). The purpose of this study is to provide a workinstruction for health, safety and ergonomics based on the results of JSA for Mechanics.

2. Materials and methods

JSA technique is a great tool for identifying hazards in safety and health management systems and has an exact nature of component-oriented and is highly effective in identifying hazards and safety improvements. Finally and in the next steps, safety managers using the results of this technique can write safe working procedures for all jobs (Parvin Nasiri 2006). In this study, 63 Mechanics workshops in a city in Iran were selected for analysis. All of these workshops were analyzed using JSA technique. First the jobs were broken to their tasks and steps. Next, the hazards were identified for each of these tasks. Finally, for each of these hazards, corrective actions and control measures were offered in a work instruction.

2.1. JSA process

JSA process includes the following steps (Ahmadzadeh ; OSHA 2002; Esposito 2004; Parvin Nasiri 2006; Rozenfeld 2010; Chao and Henshaw 2002):

a. JSA team

The presence of two persons JSA team is required; one expert familiar with the JSA and a skilled worker or supervisor at his/her job (Rausand 2005; G Halvani 2011). In this study, JSA team was included an occupational health and safety expert and skilled personnel.

b. Select jobs and prioritize them for analysis

All jobs can be classified for JSA but in some cases practical barriers such as time and effort required to perform a JSA prevents the selection some jobs for analysis. Due to these reasons, certain occupations are analyzed and detected. In this study, all mechanical workshops in Tekab city (Town in North West of Iran) were evaluated.

c. Observation the jobs and break into sequence steps

After selecting the job, in order to analyze, the next step is identifying the tasks and steps of job (Ahmadzadeh ; G Halvani 2011; Halvani and Zare 2009). In this step, with workers participation, observation and interview all the jobs divided to their constituent tasks and steps, and then they were recorded in JSA form. After completing the form, to ensure the registration complete the tasks and steps, the completed JSA forms were reviewed with workers.

d. Identifying hazards in each step

In this step, the using checklists and observation the activities and evaluation of workplace, hazards were identified in each step of the job and were recorded in the JSA form.

e. Recommending the control measures

The final step in JSA is offering the practical and possible solutions to eliminate or control the hazards identified based on the risk assessment and their priorities .In fact these solutions are specialized solutions that offered by technical and safety experts. It may be exist more than one solution for each case, but the best way to control risk is to be performed easily and with maximum efficiency (G Halvani 2011). One of the objectives of JSA is writing safe operating procedure or safety workinstruction that in this study, one safety guidelines were developed as a way to manage risks (Table 1).

3. Results

The results are shown in Table 1. As can be seen

Table 1
Safety and health work-instruction in Mechanics.

Hazards	Existing the gasoline and motor oil, Car falling, Car moving parts, Slippery floor work, Gasoline and motor oil vapors, Press machine, Lubritorium, Inappropriate lithing, Inappropriate work space, Car hot parts, Inappropriate tools layout, Noise, Vibration, Acidic and soldering vapors, Acid splurge, The lack of warning signs, Inappropriate ventilation system, Metal filings, Heavy parts, Horseplay, Waste on the floor, Thinner, Gasoline, Paint, Resin, Chemical solvents, Aerosol, Severe trauma, Metal vapors, Sharp pieces of metal, Welding flame, Different postures, Poor safety equipment, Inflamed metal, Heat, Electric sanding device, The wind-up spring, Flat tires and heavy parts, Dust, Hammer of batting, Sudden movement of vehicles, Vehicle sub-ferrousUndo edits
Diseases	Musculoskeletal diseases, Lung cancer, Skin cancer, Cataracts, Respiratory diseases
Accidents	Fire, Vehicle falling on the person, The fall of person in the service hole, Stuck hands into the press, Inhaling the vapors of gasoline and motor oil, Noise exposure, Poor lighting exposure, Stuck hands in between moving parts, Burns, Poor pustures, Explosions the battery and throw acid, Inhalation of acid mist and vapor soldering, Pouring acid on the person, Exposure to heat and acid mist, Throw metal filings in the eyes, Lifting heavy parts, Stick hands and clothes among the devices, Working with color and chemical solvents, Iron filings

	thrown into the eyes, Looking at the piece during welding, The oxygen tank explosion, Throwing hot water in the radiator by opening the lid, Pour over the hot engine oil, Lifting heavy tires, Exposure to dust, The constant contact with gasoline and motor oil
Consequences	Death, Broken bones, Head injuries, Amputation, Musculoskeletal disorders, Burns, Hearing loss, Vision loss, Thermal stress, Shock, Damage to the eyes and face, Tissue contusion
Control measures	<ol style="list-style-type: none"> 1. If possible, check and repair the vehicle to the off position. 2. Use of the Jack under the vehicle. 3. Use cover and protection for lubrication when it is not used. 4. Use suitable work clothing. 5. Use proper personal protective equipment. 6. Avoid the Splurge substances in the workplace. 7. Supply and installation of fire extinguishers. 8. Use of the Interlock devices. 9. Keep separate sound-producing devices. 10. Clean the workplace floor continuously. 11. Strengthened and redesigned lighting system. 12. The use of safe equipment. 13. Use of mechanical equipment. 14. Workstation improvement. 15. Keep acids and flammable materials in appropriate locations. 16. Installation of ventilation system. 17. Painting the workplace with bright colors. 18. Installation of appropriate safety warning signs. 19. Putting tools in appropriate place. 20. Guarding the equipment. 21. Use the right tool for handling heavy parts. 22. Avoid any horseplay in the workplace.

4. Discussion and conclusion

Work in Mechanics workshops, including jobs that workers are exposed with a variety of hazardous agents and the occurrence likelihood of accidents and occupational diseases is high in these workshops. Therefore, more attention should be given to these workshops and using safety training to workers and promoting the safety culture should prevent accidents in these workshops (Najafi 2001; Sori 2005; Mohammadfam 2006; Mohammadfam 2009). By following the workinstruction presented in this paper can be hoped that workers are aware of the hazards of their workplaces. With its careful implementation, the accidents and occupational diseases will decrease. This workinstruction has provided an appropriate training guideline for workers and helps them in order to create a healthy and safe workplace and prevent accidents.

JSA is one of the most important management tools that help eliminating hazards and reducing workplace injuries and incidents. Also JSA identifies errors in the production process and increases productivity. JSA completed forms can be used for retraining workers and train new workers, and to investigate the causes of the accident. JSA allows to workers that be involved in this process and share their knowledge and experience. In this method, the type of work done by a worker must be understood and written. Actually the JSA team should be familiar with the production processes and jobs and in an industrial environment. So the first step is a preliminary survey. Perhaps what the employee is doing today is different from other days, or a same work occurs in different physical and environmental conditions. This is one of the reasons of the workers participation in the process. In general, JSA helps to review procedures and clarify them and identify hazards that may be present in the workshop layout and design tools, workstations and processes.

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