

RESEARCH ARTICLE



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HAZARD IDENTIFICATION AND ASSESSMENT IN AUTOMOTIVE SERVICE CENTRES

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ABSTRACT

Too many people are injured while working in automotive workshops due to unsafe and unscientific methods.

Manual handling injuries are the most common type of injury occurring in motor vehicle workshops. HAZOP study is conducted for these and the hazards associated with the vehicle movement, Outside Field work, Lifting Equipment, Parts Storage and Racking, Tyre or Wheel change, Electrical works, Awkward Postures, Welding and cutting, Painting etc are analyzed .

Using Job Safety Analysis Method (JSA) the risks involved with all these processes are categorized using Quantitative rating. Preventive measures were also suggested to mitigate the risks to its minimum acceptable levels.

Keywords— Hazards, HAZOP analysis, JSA Risk assessment, Risk Numbering Examples.

1. INTRODUCTION

WorkSafe's guidance material contributes to 'the state of knowledge about hazards and risks and the ways of removing or reducing the hazard and risk'; these are two elements of the definition of 'practicable' which qualifies the extent to which an employer's obligation, under provisions such as section 21 of the Occupational Health and Safety Act (1985), must be met.

An employer should consult any relevant published guidance material when addressing hazards and risks. However, information in published guidance material, including material published by WorkSafe, is not necessarily the only way in which a hazard or risk may be adequately addressed. Whichever approach is used, it is important to apply the principles.

GENERAL

This Journal Can be utilized for

- understanding the extent of the problem – injury to people working in automotive workshops
- understanding WorkSafe's expectations
- a reference to other sources of information

- a source of specific guidance including the hazards described in the Comparative Charts
- Each Workshop must identify those operations and activities where control measures need to be applied to ensure safe operations. Workshop must plan these activities to ensure that they are carried out under specified conditions by establishing and maintaining documented procedures/work instructions/safe operating procedure to cover situations where their absence could lead to Unsafe Condition or deviations from SHE Policy.

2. DISCUSSION**HAZOP STUDY**

A Hazard and Operability (HAZOP) study is a structured and systematic examination of a planned or existing process or operation in order to identify and evaluate problems that may represent risks to personnel or equipment, or prevent efficient operation. The HAZOP technique was initially developed to analyze chemical process systems, but has later been extended to other types of systems and also to complex operations and to software systems. A HAZOP is a qualitative technique based on guide-words and is carried out by a multi-

disciplinary team (HAZOP team) during a set of meetings.

OBJECTIVES

At the end of this course, the attendees will have an understanding of the application of HAZOP and other identification techniques in process safety studies. Practical experience of participating in HAZOP exercises of both batch and continuous operations will have been gained. The impact of human factors and automated control systems will also be understood.

HAZOP in the process industry may be focused either to the assessment of safety or to the operability (with regards to keeping of the required quality of the product). From the experiences gained from the practical application of HAZOP of the following factors,

HAZOP METHODOLOGY

Essentially, the HAZOP examination procedure systematically questions every part of a process Or operation to discover qualitatively how deviations from normal operation can occur and whether further protective measures, altered operating procedures or design changes are required. The guide words ensure that the questions posed to test the integrity of each part of the design will explore every conceivable way in which operation could deviate from the design intention. Some of the causes may be so unlikely that the derived consequences will be rejected as not being meaningful. Some of the consequences may be trivial and need be considered no further. However, there may be some deviations with causes that are conceivable and consequences that arc potentially serious. The potential problems are then noted for remedial action. The immediate solution to a problem may not be obvious and could need further consideration either by a team member or perhaps a specialist. All decisions taken must be recorded. are identified in all steps and finally the risk number is estimated for each hazard and control measure are recommended. This method is also known as Task Hazard Analysis (THA), Safe Job Analysis (SJA) and Job Hazard Analysis (JHA). In the world many studies have been done to reduce accidents in different fields that each of them leads to reduce accidents with some interventions. Given that very few studies have been conducted to assess the risks

in Auto mechanic and hardly can find a comprehensive study in this area, this study aimed to identify hazards and assess risks in the automotive repair shops

Methods and Materials

3. Risk assessment

Risk assessment is a reasonable method to determine the qualitative and quantitative risks and evaluate the potential consequences arising from possible accidents to people, materials, equipment and environment. In fact, the effectiveness of the existing control methods is specified and the valuable data for decision-making on risk reduction, improve and control systems are provided. In this method, every step of the job is carefully checked, potential risks of each step are identified and assessed, and the best solution to eliminate or reduce hazards is recommended. JSA is a systematic study to identify and assess existing or potential risks in any process or job¹⁷. In this method the job is broken to steps, then hazards

Job Safety Analysis Process

Job Safety Analysis Process includes below steps

Job Safety Analysis (JSA) form										
Job title:		Work-hours: day week		Work condition: routine no routine						
Assessment team members:										
Job description:										
Task	Step	Hazard	Incident	Cause	Consequence	Probability	Severity	Risk	Risk level	Required

Table 1. Accident severity classification

Description	Class	Hazard type
Death or disappearance of the entire system	1	Catastrophic
Severe injuries, illnesses and damage to the	2	Critical
Small injuries, illnesses and damage to the	3	Marginal
Very small injuries, illnesses and damage to the	4	Inconsiderable

Table 2. Accident occurrence probability criteria

Description	Hazard level	Occurrence probability
Frequently occurs	A	$X > 10^7$
Several times occurs during the life of the system	B	$10^2 < X < 10^4$
Occasionally occurs during the lifetime of the system	C	$10^2 < X < 10^2$
Its Occurrence probability is very low during the lifetime of the	D	$10^2 < X < 10^3$
Its occurrence probability in the life of the system is minimal	E	$X < 10^4$

Table 3. Decision making criteria based on risk levels

Risk classification	Risk criteria
1A, 1B, 1C, 2A, 2B, 3A	Unacceptable
1D, 2C, 2D, 3B, 3C	Undesirable
1E, 2E, 3D, 3E, 4A, 4B	Acceptable but needs reconsideration

Hazard Identification

In this step the researchers identified each step hazards using a pre-prepared checklist¹⁸, activities

observing and interviewing with the repairman, then recorded identified hazards in JSA form.

Risk Assessment

To calculate risks, the following factors were identified and using equation 1 each accidents risk estimated:

Accident Occurrence Probability (P) Accident Consequence Severity (S) Equation 1 Risk = P*S Information related to the above two factors were obtained based on interviews; review of accidents records, Mechanics experience and observation their activities. In all of these steps, the assessment tool was a set of structured questionnaires. To calculate the probability of occurrence, consequences severity and decision-making based on the level of calculated risk, Tables 1-4. were used respectively.

Control Measures

Based on the risk assessment and risk priorities, the control measures were recommended. According to

risk priority can insure that effective control measures are provided and implemented.

4. Results

According to Table 4, the repairing radiator job has 2 hazards with “unacceptable” risk level. In this job, there are 7 hazards with “undesirable” risk level. Contact with welding flame is the most important accident in this job. The oil changes and tire change job has 5 hazards with “unacceptable” risk level. In this job, there are 7 hazards with “undesirable” risk level, 4 hazards with “acceptable but needs reconsideration” risk level. Fire caused by gasoline, motor oil and other petroleum products is the most important accident in this job. The front part of car repair job has one hazard with “unacceptable” risk level. In this job, there are 8 hazards with “undesirable” risk level. Falling car on person is the most important accident in this job.

Example of Risk Analyze using JSA

Hazards, risks and required actions for repairing radiator, oil changes and tire change and the front part of car repair jobs

Job	Hazard	Incident	Consequence	Risk number	Risk level	Required action
Repairing radiator						- Use of personal equipment
	Welding flame	Contact with the body	Burning	3A	Unacceptable	
						- Training
		Throw hot water on the face and body	Face and body burning			- Training
	Hot water			3A	Unacceptable	- Check the radiator when is cooling
	Radiator falling risk	Falling the Radiator on feet	Feet injury	1D	Undesirable	- Use safety shoes. - Training
		Exposure with inadequate lighting				- Redesign Lighting
	Lighting		Vision loss	1D	Undesirable	- Paint and clean the workplace walls
	Entry the metal filings	Damage to eyes	1D	Undesirable	- Use of personal protective	

		in the eyes				equipment
						- Use of appropriate shoes
	Slippery workplace	Slipping and falling	Injury and fracture	3C	Undesirable	- Clean the workplace floor continuously
	Splurge the materials	Contact with	Body injury	3C	Undesirable	- Housekeeping
	and tools on the floor	materials and				- Training
		tools				
	Radiator hot parts	Contact with hot parts of the radiator	Burning	3C	Undesirable	- Use safety gloves
		Improper handling of the heavy radiators	Musculoskeletal Disorders			- Use the proper equipment to
	Heavy radiators			3C	Undesirable	carry heavy radiators
						- Training
						- Separation of
	Motor oil, gasoline and other petroleum products		Burning and financial costs			materials from fire sources
		Fire		1B	Unacceptable	- Training
						- Use of warning signs
						- Provide extinguisher
		Falling car on person	Death, injury and fracture			- Use the proper jacks
	Car Falling risk			1C	Unacceptable	- Training
						- Use of an auxiliary base
	Gasoline and motor oil vapors	Inhalation of vapors	Respiratory diseases and other diseases			- Use of appropriate protective masks
		of gasoline and motor oil		2B	Unacceptable	

	Slippery workplace					- Use of appropriate shoes	
		Slipping and falling	Injury and fracture	3A	Unacceptable	- Clean the workplace floor continuously	
		Splash hot oil on the person				- Use of appropriate equipment	
	Hot motor oil		Burning	3A	Unacceptable	- Use of appropriate protective gloves	
	Moving parts of the vehicle	Hand caught in moving parts	Injury and amputation				- Check and repair the vehicle
				1D	Undesirable	when the vehicle is turned off	
					- Use of appropriate equipment		
Lubritorium	Falling into the pit of	Bone fracture and head trauma	1D	Undesirable		- Use the shield and cover whole of service	
	Service						

	Lighting	Exposure with inadequate lighting	Vision loss	1D	Undesirable	- Redesign Lighting - Paint and clean the workplace walls
	Lubritorium with insufficient space	Akward posture	Musculoskeletal Disorders	1D	Undesirable	- Redesign lubritorium
	Heavy tires	Improper handling of tires	Musculoskeletal Disorders	3C	Undesirable	- Use the proper equipment to carry heavy tires - Training

oil changes and tire change	Aerosol	Exposure to aerosol	Respiratory diseases	3 C	Undesirable	- Use of personal protective equipment
	Hammer of batting	Heavy hitting the legs	Bruises and bone fracture in the foot	3 C	Undesirable	- Use of appropriate equipment - Use of appropriate shoes
	Motor oil, gasoline and other petroleum products	Dermal contact	Dermal disease	1 E	Acceptable but needs reconsideration	- Use of personal protective equipment
	The sudden movement of the vehicle	Collision the car with person	Bone fracture and injury	1 E	Acceptable but needs Reconsideration	- Warn when the car is turning on - Ensure that the vehicle is not in gear.
	Metal parts under the car	Collision on the head with them	Head injuries	1 E	Acceptable but needs reconsideration	- Construct lubricatorium with appropriate height - The use of helmets in lubricatorium
	Noise	Noise exposure	Hearing loss	1 E	Acceptable but needs reconsideration	- Use of personal protective equipment - Training - Air compressor isolation
The front part of car repair	Car Falling risk	Falling car on person	Death, injury and fracture	1C	Unacceptable	- Use the proper jacks - Training - Use of an auxiliary base
	Unsuitable workplace	Akward posture	Musculoskeletal Disorders	2B	Undesirable	- Redesign workstations

	Moving parts of the vehicle	Hand caught in moving parts	Injury and amputation	1D	Undesirable	- Check and repair the vehicle when the vehicle is turned off - Use of appropriate equipment
	Lubritorium	Falling into the pit of Service	Bone fracture and head trauma	1D	Undesirable	- Use the shield and cover the hole of service
	Lighting	Exposure with inadequate lighting	Vision loss	2C	Undesirable	- Redesign Lighting - Paint and clean the workplace walls
	Unsafe equipment	Electrocution	Injury	2C	Undesirable	- Providing safety equipment - Training
	Horsepaly	Caught clothing and hands between and inside equipment	Amputation and injury	2D	Undesirable	- Monitoring
	Hot parts of the vehicle	Contact with hot parts of the vehicle	Burning	3C	Undesirable	- Use of personal protective equipment - Use of tools
	Noise	Noise exposure	Hearing loss	3C	Undesirable	- Use of personal protective equipment - Air compressor isolation

6. Conclusion

Job Safety Analysis (JSA) is a useful method for identifying hazards at various jobs including vehicle mechanics. As shown in the results, this method can identify hazards, incident causes and incident

consequences and finally recommends appropriate control measures. Also it is possible using results of this study, determining the training needs of automotive mechanics and writing a health and safety operation procedure for automotive mechan-

ics. Generally to improve health and safety conditions of automotive workshops, the following suggestions are offered:

- Continues monitoring of occupational health and safety in automotive workshops;
- Writing a health and safety operation procedure for automotive mechanics;
- Providing safe equipment;
- Providing personal protective equipment and using them;
- Redesigning the work station based on ergonomically rules;

Implementation of recommended technical-engineering measures in this study.

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