Identifying and evaluating the risk related to the warehousing job using the JSA method in a waste service company in Ahvaz city

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Abstract

Background: Every day, many incidents occur in work environments that cause death and injury. These incidents are often due to lack of recognition of potential risks and proper training of workers. Therefore ,by identifying and evaluating risks of the work environment can prevent many incidents and calculated their risk number and provided the required controls.

Methods: JSA method is a systematic way, to identify hazard and assessing their risks also to provide appropriate control. In this method, each stage of the job is carefully examined. The potential risks of each identification step are evaluated and the best control solution is provided to eliminate or reduce the risks. The current descriptive cross-sectional study was conducted in a waste collection service company in Ahvaz city. The most important tool used in conducting Job Safe Analysis(JSA) is risk checklists. In this sense first, the warehousing job was selected. In the next step, system risks were identified and the level and number of risks were calculated.

Results: In the present study a total of 68 risks were identified. The results showed that the level of unacceptable risk was 13.23% and the level of unfavorable risk was 1.47%, Acceptable or in need of revision8.82% , partial 76.47% respectively.

Conclusion: To eliminate or reduce the level of these risks, control solutions were proposed. the most important control solutions provided were, the training of workers, raising their awareness of risks and continuous monitoring of their work.

Key words: Risk assessment, JSA , Risk, Ahwaz

Introduction

Many accidents happen every day in work environments that lead to death and injury. One of the ways for prevention of accidents in the work environment,is identification of risks and their assessment(1,2).Risk assessment consists of: Identifying the risks in a process or a job, calculating their risk number and providing appropriate control measures to control them. In fact, risk assessment is a process of three stage: 1 Identification of all risks,2. Risk calculation,3- Providing control measures(3).One of the solutions that can be evaluated the risk is JSA. JSA method is careful and Systematic study to identify and evaluate existing or potential risks in every process or job(4). In this method, job is broken into successive steps, and in the next step, the risks of each stage and the number of their risks are Identify and finally control solutions are provided(5,6).The main purpose of implementing this technique is to find a safe method to do the job and prevent accidents.Can use of JSA method as a tool in industrial engineering by using this method, it is possible to meet the needs of safety training of employees. JSA, can be used In writing a safety and prevention management program, also, in choosing protection equipment that is needed.(6). In the following, we refer to the projects that have evaluated risk using different methods. In 2017, Sadeghi and Arab in 2008 evaluated the risks related to the employees of the transportation department of Sangan mine using the PHA method. From the investigation of accidents in Sangan iron mine, it shows that 35% of the accidents happened to the employees of the transportation department in different routes of the mine(7,8). In 2004, Hashem Setare and Kohpai have designed a comprehensive risk assessment program in their thesis on the development of risk analysis methods in fire risk assessment using PHA and other risk assessment methods, operational plans and fire safety plans and by this means, it is possible to predict possible fires and try to reduce the probability of accidents and reduce the severity of possible consequences(9) . In 2009, Qalandrazadeh and Babaei evaluated and managed risk in the operation phase of sewage treatment plant projects (case study: Maragheh and Marand sewage treatment plants). And by using FMEA method, they have identified the risks and suggested corrective and preventive measures(10). In 2007, Crossley et al. conducted a preliminary risk assessment of an offshore fuel tank project (production and distribution of biodiesel) in Australia, which reviewed the control systems, equipment design and electronic warning systems for high-risk areas, program design. Leakage management, training of management program executives, program monitoring, provision of high-performance electrical equipment according to AS2430 standard for high-risk sectors, preparation of plans for critical situations, and establishment of a safety management system(11). Mac used a combination of HAZOAP and PHA methods in a risk assessment project conducted on a power plant in Tasmania, as well as a checklist to identify the need for quantitative assessment. Risks such as the burning of fuel stored to fuel boilers, the bursting of high-pressure steam pipes leading to the turbine, which in case of explosion will cause damage to operators and electrical equipment, and solutions such as installing alarms to warn of any temperature change and water leakage have been identified. Or the factors of decommissioning the boilers, installing the air flow monitoring system, etc. have been suggested(12). Seyed Ali Jozi and Sima Barani in 2008 identified and evaluated the risks in the concentration unit of Gol Gohar Sirjan iron ore complex using the JSA method in 2008. In that research, the correct training of workers and equipment engineering controls are emphasized(13).In the occupational safety analysis plan implemented by Nasiri et al. in 2002, in the research of textile industry risk assessment on workers exposed to noise pollution, this occupational analysis method was also used. By using this method, increasing the level of workers' awareness of risks and continuous monitoring of work. They are the most important control solutions provided by their training (14). In 2009, Turan identified and evaluated job risks in a turbine manufacturing company using the JSA job safety analysis method. In this research, 10 jobs were selected and analyzed according to the way of doing the work and the accidents that occurred, and the exposure of people to hazards such as sound, light, rays, magnetic field, atmospheric conditions was measured and monitored, and the results and corrective solutions expressed and recorded(15).

Materials and methods: The present study is a descriptive-cross-sectional was done in a waste collection service company in Ahvaz city. How to study ,was the case that after coordinating with the relevant company and

necessary assistance for conducting research, Warehouse job was chosen as the research environment. The stages of JSA implementation were divided into the following 4 stages:

1) Breaking a job.To successive steps after selection a job, different stages of doing that particular job.
2) Identification of risks in each stage. At this stage, existing or potential risks associated with each job were identified and determined.
3) Risk assessment. In order to prioritize risks and control measures in this step, risks were identified and classified. For doing this step, 2 parameters were identified: Probability (occurrence of an accident) and the severity of its consequences .Then the severity and probability of the accident are merged to obtain the risk matrix .

   Severity of the consequence of the accident * Probability of the accident = risk(1)

Table No. 1: Classification of the severity of the accident

Type of risk	category	Definition
Catastrophic	1	Death or system failure
critical	2	Injuries, Occupational diseases or injuries to the system are severe
border	3	Injuries, Occupational diseases or injuries to the system are small
partial	4	Injuries, Occupational diseases or injuries to the system are very small

Table No. 2: Risk probability level

Probability of occurrence	Risk level	Hazard description
Repeated	A	It happens frequently
Probable	B	It happens several times during the lifetime of a system
Occasionally	C	Occurs from time to time during the life of the system

Very small	D	The probability of its occurrence during the lifetime of the system is very low
unlikely	E	The probability of its occurrence during the lifetime of the system is so low that it can be assumed to be zero

Table No. 3: Risk assessment matrix

Severity of danger / Probability of occurrence	**Catastrophic 1**	**Critical 2**	**Border3**	**Partial4**
Repeated	1A	2A	3A	4A
Probable	1B	2B	3B	4B
Occasionally	1C	2C	3C	4C
Very small	1D	2D	3D	4D
Improbable	1E	2E	3E	4E

Table No. 4: Decision criteria based on risk index

Unacceptable	1A-1B-1C-2A-2B-3A
Undesirable	1D-2C-2D-3B-3C

Acceptable but in need of revision	1E-2E-3D-3E-4A-4B
Acceptable without revision	4C-4D-4E

Results: The results, are presented in the following tables.

Risk Criterion	Potential risks	Risk Possibility	Intensity	Rank	Consequences	Risk Criterion
Load risks	1) Heavy load	C	3	3C	1)Musculoskeletal injury	1)Undesirable
	2) Bulky or bulk cargo	C	3	3C	2)load fall	2)Undesirable
	3) The presence of grip problems	D	3	3D	3)Falling load - bodily injury	3)Acceptable or in need of revision
	4) Presence of sharp edges	D	3	3D	4)physical injury	*4)Acceptable or in need of revision*
Workplace hazards	1) space limitation (obstacles in the traffic path)	D	4	4D	1) Load falling - financial damage - collision - bodily injury	1) partial
	2) Improper surfaces or floors (failure to use reinforced and resistant concrete	E	4	4E	2)Slipping - falling load - bodily injury - inability to bear load	2)partial
	3) difference of levels on the floor	E	4	4E	3)Falling - bodily injury	3)partial
	4)Heat/cold conditions	E	4	4E	4) Heat stress	4)partial
	5) The presence of wind	E	4	4E	5) Unsuitable working conditions - environmental mismatch	5)partial
	6) sound - inappropriate lighting	E	4	4E	6) Non-standard working environment - hearing damage	6)partial
	7) Improper ventilation	E	4	4E	7)The presence of moisture - dangerous atmosphere	7)partial
	8) Lack of proper slope on the warehouse floor	E	4	4E	8) Accumulation of water and excess fluids – slipping	8)partial
	9) Slippery warehouse floor - no cracks or gaps in the warehouse floor	E	4	4E	9)Slipping - personal injury –	9)partial
	10) Presence of toxic and dangerous gases	E	4	4E	10)financial damage	10)partial

Warehousing	11) Absence of conventional and anti-spark vents 12) Storm 13) Lightning 14) flood 15) Earthquake 1) Failure to observe sufficient distance in storage 2) Storing materials in inappropriate containers 3) The existence of a cover. Dry ingredients. wood chips and papers 4) The existence of an oil source. gas fat Gasoline and flammable waste 5) Absence of a system for recording the entry and exit of goods 6) Failure to separate incompatible chemicals and poisons 7) Failure to observe the appropriate distance in the arrangement of goods from electrical appliances 8) Not using the door for flammable liquids 9) Inaccessibility of rescue vehicles and fire extinguishers 10) No brick arrangement of cardboard or cube-like loads 11) Absence of metal pallet 12) Lack of coding system in warehouse 13) Building storage in areas where the underground water level is high 14) Building a warehouse near	E E E E E E E B E E E E E E	4 4 4 4 4 4 4 3 4 4 4 4 4 4	4E 4E 4E 4E 4E 4E 4E 3B 4E 4E 4E 4E 4E 4E	11)Ignition – poisoning 12) Creating dangerous atmosphere - fire - explosion 13)Human damage – damage to equipment *14) Human damage – damage to equipment* 15)Human damage – damage to equipment 1) Falling of the load - disruption of the arrangement of materials 2)Risk of material splashing - explosion – ignition 3)Risk of ignition 4)Fire hazard *5) Possibility of theft of goods* *6)Poisoning – fire* *7)fire* *8)fire* *9)Failure to send items in emergency situations - inability to manage time* *10)load fall*	11)partial 12)partial 13)partial 14)partial 15)partial 1) partial 2) partial 3) partial 4) Undesirable 5) partial 6) partial 7)partial 8)partial 9)partial 10)partial 11)partial 12)partial 13)partial 14)partial 15)partial

	residential areas. schools. stores . hospitals . Fruit market. Drinking water sources and water reservoirs 15) Failure to observe the distances between each row of goods 16) Lack of first aid box 17) Lack of shower and eye wash bottles 18) Using open flame heating devices inside the warehouse 19) Absence of characteristic signs for tools and containers 20) Absence of necessary instructions for using the warehouse contents 21) Absence of white lines in the warehouse corridor 22) Absence of warning signs outside the warehouse (signs such as the danger of poisons, fire, not allowing unauthorized people to enter) 23) Bugs in installing shelves 24) Improper picking and storage of goods	E 4 4E E 4 4E E 4 4E E 4 4E E 4 4E E 4 4E E 4 4E E 4 4E E 4 4E E 4 4E E 4 4E B 3 3B B 3 3B	*11)Damage to the product (due to the effect of humidity)* *12)work confusion* *13)Flooded* 14)Release of chemicals - injury - fire - explosion 15)Load mixing 16)Inability to help the injured 17) Inability to help the in fire 18) Fire 19)Waste of time - poor management 20)Confusion about how to use the contents - improper management 21)Failure to comply with storage criteria and standards 22)People's lack of knowledge about the risks 23)Falling cargo - damage to goods 24)Mixing goods - damage to cargo	16)partial 17)partial 18)partial 19)partial 20)partial 21) Undesirable 22) Undesirable

Warehousing		E 3 3E E 3 3E		23) Acceptable or in need of revision 24)Acceptable or in need of revision
Human hazards	1) Eating and drinking 2) lack of permanent and periodic control of goods and immunization 3) Not paying attention to the characteristics of the goods. Materials and their storage conditions 4) Smoking 5) Failure to use personal protective equipment 6) Lack of discipline in storage 7) Improper use of warehouse equipment 8) Lack of appropriate information system in stock 9) Theft and robbery 10) Vandalism 11) Lack of proper guarding and care	E 3 3E E 3 3E E 3 3E E 3 3E E 3 3E E 3 3E E 3 3E E 3 3E B 3 3B E 3 3E E 3 3E	1)poisoning (chemical warehouse) 2)Robbery and robbery 3)Corruption and obsolescence of goods 4)fire 5)physical injury 6)work confusion 7)Damage to human equipment 8)work confusion 9)Loss of financial capital and equipment 10)Loss of financial capital and equipment 11)work confusion	1)Partial 2)Partial 3)Partial 4)Partial 5)Partial 6)Partial 7)Partial 8)Partial 9)Undesirable 10)Acceptable or in need of revision 11)Acceptable or in need of revision
Warehouse building	1) Absence of emergency doors 2) Lack of safety lock	D 4 4D	1)Inability to exit safely in case of danger	1)Partial

	3) Lack of awnings for open windows	E	4	4E	2)The possibility of theft and entry of irresponsible people into the warehouse 3)Direct entry of sunlight and increase in temperature inside the warehouse (especially in the warehouse of chemicals and poisons) - fire 4)Possibility of fire - production of sparks 5)Entering sewage into waterways or public sewers 6)Lack of awareness at the moment of danger 7)The possibility of fire spread - loss of life and property 8)Risk of electric shock 9)Fire hazard 10)fire	2)Partial 3)Partial 4)Partial 5)Partial 6)Partial 7)Partial 8)Partial 9)Partial 10)Partial
	4) Using wood. Board and plastic in the warehouse building	E	4	4E		
	5) Failure to drain the waste water of the chemical warehouse	E	4	4E		
	6) Absence of an anti-spark key					
	7) Absence of fire extinguishing system according to firefighting standards	E	4	4E		
	8) Absence of grounding system	E	4	4E		
	9) Non-use of non-flammable materials in the warehouse building (walls and roof)	E	4	4E		
	10) Absence of built-in wiring	E	4	4E		
Back injuries	1) rotation in the waist area	B	3	B3	1)back injury	1)Undesirable
	2) Access to the load in the area above shoulder height and height	B	3	B3	2)Musculoskeletal injury	2) Undesirable
	3) Lifting things in an inappropriate body position	B	3	B3	3)Musculoskeletal injury 4)muscle fatigue	3)Undesirable 4) unacceptable
	4) Sitting and standing for a long time	A	3	A3		

Discussion and conclusion:

This descriptive-cross-sectional study aimed to identify and categorize Classification of risks and potential events and determination of necessary controls by the method of *JSA* in a waste service company in Ahvaz city. Overall 68 risks were identified. For this purpose, valuable resources were first identified and listed. Then the acceptable risk levels and the scope of the assessment are defined . In the next step, system risks were identified and level of risks were calculated using the *JSA* worksheets. The results showed that the level of unacceptable risk was 13.23% and

the level of unfavorable risk was 1.47%, Acceptable or in need of revision 8.82% , partial 76.47% respectively. By training the workers, the risk level can be reduced. In fact, the most important way of control,is raising the level of workers' awareness and monitoring their work.

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