

# Evaluation of Occupational Hazards of Quay Side Crane Operator Using Job Safety Analysis

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**Abstract** Nowadays the development speed of the technology is beyond of the human perception. However, every new and innovate profession is not completely safe and sound. How to identify and recognize those work menace and risks is the question that in this study we want to clarify it. There are many methods to concern about risks assessment and here we can refer to Job safety analysis, Safety Audit and etc. What do we mean by Job safety analysis is to put all the processes and activities into a detailed analysis in order to reach the main goal of the work. In this analytical-descriptive study, the vintage is mainly focus on the identification and Job safety analysis of the quay side cranes operator in Imam Khomeini port and offering convenient controlling strategies for reduction and prevention of the probable incidents and unfavorable events. The resulted data of the risks evaluation showed that in the checking level for the facilitating before the start, the risk of the insufficient room in the powerhouse and the body parts contact with the considered items attends the risk priority of 54 and in the discharging level: the risks of the wires cut and falling of the cargo on the stuff and the trucks attends the risk priority of 100 and in the discharging and loading ironware level: the risk of the hook wire cut attends the risk priority of 100 respectively. Finally for each mentioned risk, some suggestive control methods were presented.

**Keywords:** risks, operator, quay side cranes, Grain terminal, job safety

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## 1. Introduction

Human beings are very vulnerable toward the novel risks of science and technology nowadays. Hence, the most important part of the security program is to identify and recognize those risks and move forward due to prevent them and without having an integral recognition of the risks we cannot encounter them or suggest the controlling methods. The more the recognition of the risk is punctilious, the more the security system will act preferable [1].

JSA Job safety analysis is one of the methods that seems popular in the prevention of the unfavorable events and risks controlling that it had been used in the industrial countries since 1930 [2]. Job safety analysis is the most substantial management implementation on which sided toward the risks elimination and events diminution. We can add here that JSA can enhance the optimization of the productivity processes, too and beside this, it is able to model the safe work methods for the different jobs [3]. The Job safety analysis unlike the most methods on which lead to some statistics data and experts' resolution comments, it is very simple method and it will target the main point with direct mark. This method even can prove its transaction ability within a minimum possibility facility and the result will be as simple as every conductor

(managers, supervisors, experts, etc.) will understand them without any specific statistical data knowledge [4].

The main concern of the present study is the identification and analysis of the work security in the Grain terminal in Imam Khomeini port and presenting appropriate controlling strategies for reduction and prevention of the risks and unfavorable events.

JSA sometimes come next to the synonymous items of Job Hazard analysis, Job Hazard Breakdown and safety Task Assignment and its considered one of the preventing risks method that has been used in industrial countries since 1930 [5]. There are two definitions for Job safety analysis as following:

- Is an applied methodology with various techniques that provide a researcher with a rich data due to regulate and determine the justice strategies.
- Is a systematic study of a job due to identify it's potential risks, risk level evaluation and appropriate control method for governing the recognized risks.

JSA is a significant component of the risk management system and consisted of such techniques that analyze the basic tasks in the job for identification of the potential risks and determine a safe way to encounter them [6]. It is notable to mention here that sometimes this technique may name Job Hazards Analysis.

## 2. Methodology

The present study is a kind of analytical-descriptive research and conducted in Imam Khomeini port that for collecting the necessary data, subject's team (security experts, terminal's experts, performance supervisors and crane operators) were selected and consisted from 20 individuals that for extracting their ideas, interviews and brainstorming sections were organized.

When defining a job we can infer it is a series of processes that follows a particular aim. So what else is going to be subordinated in the source table are JOBS to TASKs, for instance when a wider focus on the wilding(job) the four sections together with the four different manner(task) is typed in that term in the analytical table and following to TASKs we move to STEPs respectively. Therefore, those jobs that seem are more dangerous are in the higher priority for putting into a table in order to excogitate prevention and risk control method for it [7]. In an ideal manner, all jobs should follow JSA but the following below cited jobs are considered of more priority for analytic performance and selection:

- A kind of jobs that is potential for events and dangerous sickness occurrence.
- The first-time adopted jobs
- occasional and unusual jobs
- a kind of examined jobs that cause a semi events

According to the high potential of events occurrences and the importance level of this job, this study is analyzed and surveyed by coast cranes operator of the grain terminal in Imam Khomeini port.

Jobs observation and breakdown in processes: After selecting a job, it should be broke down in steps and the best person for this job may be an experienced worker or a supervisor of that worker. For implementing the broken steps, the worker, he himself should present during the processes or the implantation should be followed by his counsel [8,9,10] for breaking the processes down to smaller steps we interviewed the operator and performance supervisors and conducted some brainstorming section with the experts.

Identifying the risks in all of the performance processes: As we may know, events occur in two conditions: insecure performance and insecure situation, thus for risk identification we should focus on these two classes of insecurity [11,12,13]. Some results will obtain by observation and some of them by checking job lists. After recording the main processes of each job, all related risks of that process as peripheral or job related or as raised from the neighborhood stations should be mentioned and checked. These tasks will do by interviews with the workers and supervisors about the events and semi previous events that happened and also by conducting brainstorming sections with experts and probing the occurred events of the surveying terminal.

Risks evaluation and preventive methods suggestion for eliminating them: In this process some methods will put forwards due to control or eliminate the identified risks [4]. General methods for encountering risks can be one of the below mentioned condition:

- risks elimination through: by deleting a harmful task or substituting a safe material with a deleterious one or conducting a new methods and optimizing a peripheral condition

- risks limitation through: setting conservatives or restrictions
- observing and examining the strategies through: integrating the processes, deleterious process amendment, progressive shifting in processes
- Benefiting from safe machines like: warns, safe locks, safe automatic machines Individuals contact reduction through: the reduction of contact number with risks, shift madding of job, using personal safe instruments.

### 3. Results

In this process by conducting brainstorming sections with the council experts, preventive suggestion and risks elimination methods will propose and present. finally the identified risks will be classify and prioritize according to their severity, probability and cost determination and risk priority number will obtain from the multiplying of these three numbers.

Is an evaluation of a capability level that identifies a cause of the hazard occurrence. In other words, it is an ability to recognize a hazard before the occurrence. And for achieving this number there are some actions and among them, standards controlling processes study, jobs principles and a manner of performance are very useful here [5].

**Severity number:** The severity or a seriousness of the hazard depends on the individuals' potential and it is just considered when it is occurred and the reduction of this hazard is just attainable with some changes in the process performance and the manner of performance [1]. For this goal there is a quantitative index that based on the 1 to 10 class ranked scale.

**Occurrence probability:** This is to determine the power of the frequency. We can reduce the number of the risk occurrence just by eliminating the cause of the risk and this is measured from 1 to 10, too. Surveying the previous documents and dossiers are not useless concerning to this matter.

**Calculating the risk priority number:** This is conducted by multiplying the three numbers of severity, occurrence and probability determination. The risk priority number is between 1 and 100. Performance processes of Job safety analysis:

1. Jobs selection and prioritizing their ranks for analysis in this study is according to high potential of the risks occurrence and the importance level of this job and conduction based to the experts of the coast cranes operator of the grain terminal in Imam Khomeini.
2. Observation and breakdown of the processes to the subordinated steps done with the conduction of the brainstorming sections with the experts and also interviews finally, crane operator job is subdivided into three consecutive sections (Table 1, Table 2 and Table 3).
3. Then for conducting each one of the separated section, by the interview with the operators and workers and supervisors about the previous events and also setting brainstorm section in the surveyed terminal risks determination performed and outlaid (Table 1, Table 2 and Table 3).

**Table 1. checking out the equipment before starting**

Operations department		Job Title: Crane Operator		Task: checking out the equipment before starting	
Sequence of basic job steps		1 - checking out equipping situation 2- checking out motor home 3- checking out leaving Winch 4- checking out power room			
no	Type of Risk	cause of risk	Consequences of risk	Recommended action or procedure	
A1	Tire Bursting	Being worn tires	Hearing loss	Inspection of Equipment / Replacement of worn tires	
A2	Chassis	Collision of the head with under the parts of chassis due to short height	head fracture	Health and safety compliance	
A3	Dust	Loading and unloading of grain / weather conditions.	Pulmonary complications.	Use the appropriate mask	
A4	Slippery surface (and the mesh of stairwell)	being Oily and lubricated surface and were not tight fitting	Injury and bruises	Periodic cleaning of oil and grease / mesh bottom right of inspection and control the engine room	
A5	Inadequate lighting	Being burned out bulbs and active in various parts of the engine itself or the system is turned off	Fracture and bruises	Inspection of the illuminating equipment by electrical inspector and supervisor of safety	
A6	Hot surfaces	Contact with Mini-Fold hot surfaces, exhaust system and low dark the engine room / Hot Oil	Burn	use of personal protective equipment / lighting equipment by inspectors	
A7	Parts of the engine room	Insufficient space in the engine room	Injury	Health and safety compliance	
A8	Door <i>Aslypryng</i>	Return Door is not locked and <i>Aslypryng</i> because it did not restrained	head fracture	Health and safety compliance	
A9	Hydraulic hoses	Hose burst and encounter oil in the engine room due to wear and loose fitting body	Damage to the eyes and face / bruises and fractures	Inspection of equipment and use of appropriate work clothes	
A10	Chemical substances	Contact with chemicals, gasoline and oil / leaking hydraulic hoses	Dermatologic side effects / allergy	Use gloves and appropriate work clothing	
A11	Hot surfaces of Mini-Fold	Contact with Mini-Fold hot surfaces, exhaust system and low dark the engine room / Hot Oil	Burn	Recommended action or procedure	
A12	Exhaust fumes and oil mist	Inhalation of oil mist exhaust of engine	Pulmonary complications.	Inspection of Equipment / Replacement of worn tires	

**Table 2. Unloading grain from a ships hold**

Operations department		Job Title: Crane Operator		Task: Unloading grain from a ships hold	
Sequence of basic job steps		1- Climbing from staircase of Tower 2- Start the machine from the cabin 3- Start loading and unloading operations			
no	Type of Risk	cause of risk	Consequences of risk	Recommended action or procedure	
B1	Operator chairs	Vibration of chair	Musculoskeletal complications.	Vibrations measurement / standard seats installation	
B2	Dust	Grain unloading	Damage to the lungs.	Using a mask	
B3	Fire	Existence of Flammable material	Human and financial losses	Inspection by supervisor of and safety mechanical inspectors	
B4	Operator	Working long and monotonous	Fatigue or psychological injury	Pass and move a few split shift operator	
B5	Noise	Operation of the equipment	Hearing loss	Use protective device	
B6	Sunlight	Reflected in the cabin	Poor eyesight	Delivery UV400 sunglasses	
B7	Working at Height	Being worn out ropes	Serious injuries fracture and death	Rescue rope safety inspections by supervisor of / safety compliance	
B8	Mayer and Grab	Wire cut / fall times and Grab on workers and truck hopper	Human and financial losses	Inspect the wire by supervisor of safety	
B9	Weather conditions.	Storm	Human and financial losses	Not operate in bad weather conditions	
B10	Boom Camera	Mist of dust or muddy conditions	Minor accident Or Generic	Regular grooming Boom tip camera	
B11	ship Projectors	Too much light in the night shift	Human and financial losses	-	
B12	Staircase of Tower	Daily high and low pressures in skeletal	Musculoskeletal Complications	Ergonomics Training	
B13	Vibration	Seat vibration caused by crane	Musculoskeletal Complications	Measuring genocide Seat Wrench Set	
B14	The Light of Tower	Fluorescent lighting being burnt due to lack of	Fracture	Safety Inspection and replace burned out lights	
B15	Sharp edges	Legs contact with sharp edges inside the cabin	Minor injury to the body.	Inhibition of sharp edges inside the cabin	

**Table 3. Loading and unloading of ironware**

Operations department		Job Title: Crane Operator		Task: Loading and unloading of ironware	
Sequence of basic job steps		1-Install the appropriate wires on equipment 2- Close wire on 3- Loading and unloading of operations 4- Loading and unloading of operations 5- Opening the wire			
No	Type of Risk	Cause of risk	Consequences of risk	Recommended action or procedure	
C1	Operator chairs	Vibrating chair	Musculoskeletal complications.	Measurement of vibration / switch seats with above vibration	
C2	Sunlight	Reflected in the cabin	Poor eyesight	UV400 sunglasses delivered to the operator / periodic examinations	
C3	Working in the Height	Fall from height / Rescue Rope	Major injuries fracture / death	Observe safety precautions for work at height	
C4	Weather conditions.	Storm	Human and financial losses	Complete halt operations in stormy weather	
C5	Staircase of Tower	Slipping (fall)	Bodily injury / Fracture	The use of safety shoes	
C6	Ironware	Collision with cabin devices	Human and financial losses	Observe safety precautions	
C7	Wire and Hook	Cutting wire	Human and financial losses	Inspect the wire by continuous safety monitoring	
C8	Sharp edges	Leg Collision with sharp edges inside the cabin	Minor damage to the body.	Inhibition of sharp edges inside the cabin	
C9	Vibration	Seat vibration caused by crane	Musculoskeletal injury.	Measuring genocide Seat Wrench Set	
C10	Operator	Long and monotonous	Psychological damage	Split a double pass to move the shift operators	

Following to this preventive and risk elimination suggestions were proposed. Next each identified risk in the performance processes classified and ranked according to the obtained number of the severity, occurrence and probability determination and the risk priority number gained by multiplying these three numbers together and the calculation represented in Table 4, Table 5 and Table 6.

**Table 4. Risk priority numbers**

NO	P	D	S	R
C1	1	3	3	9
C2	1	6	3	18
C3	1	3	5	15
C4	1	1	10	10
C5	1	10	3	30
C6	1	2	5	10
C7	1	10	10	100
C8	1	6	5	30
C9	1	3	3	9
C10	1	6	3	18

**Table 5. Risk priority numbers**

NO	P	D	S	R
B1	1	10	3	30
B2	1	3	3	9
B3	3	2	3	18
B4	1.1	10	3	33
B5	1	6	3	18
B6	1	6	3	18
B7	1	2	5	10
B8	1	10	10	100
B9	1	1	5	5
B10	1	2	3	6
B11	1	1	3	3
B12	1	10	4	40
B13	1	1	2	2
B14	1	10	2	20
B15	1	6	1	6

**Table 6. Risk priority numbers**

NO	P	D	S	R
A1	1	10	3	30
A2	1	10	2	20
A3	1	10	3	30
A4	3	10	1	30
A5	3	3	2	18
A6	1	6	2	12
A7	3	6	3	54
A8	1	2	2	4
A9	3	6	2	36
A10	1	6	2	12
A11	3	6	2	36
A12	1	6	3	18

### 4. Conclusion

In the present study, the main goal is settled to identify and analyze the security of the coast crane operator job in the Grain terminal in Imam Khomeini port and by presenting appropriate controlling methods for risks prevention and elimination it is tried to restrict and reduce such unfavorable events. In the first phase according to the high potential and the importance level of this job by attention towards the coast crane operator of the Grain terminal in Imam Khomeini port data were obtained and analyzed. In the second phase, this job subdivided into three subsequent processes, then the risks of each process conducted and evaluated by setting brainstorm sections and interview with the considered experts about the previous occurred events and finally for each one of the determined risk, prevention and elimination suggestion were proposed due to their measure number and risk priority number. The resulted data from the risks evaluation shows that in the checking the facility before the start of the process: the risks of the insufficient room in the powerhouse and the contact of the body parts with it gets the risk priority of 54 and the tubes cuts and the

explosion of oil and gasoline in that place because of the lax and exhaustion of the connections gets the risk priority of 36 and the exhaust smoke and oil steam inhalation during the engine supervising gets the risk priority of 36 and in the discharging grain process from the ship store: the risks of the wires cutting and the fall of the cargo on the stuff and the trucks with the risk priority of 100, wharfs pressure in the top with a risk priority of 40, daily stepping down with the risk priority of 33, long time and monotonous job with the risk priority of 100, foot contact with the keen edges of the top cabin with the risk priority of 30 and the slippery state and falling with the risk priority of 30 were the most prior risk in each process respectively and considered as the most hazardous risks in the coast crane operator job in grain terminal.

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