Hazard Identification And Risk Assessment Of Crude Oil Storage Tank: A Systematic Research Paper

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Abstract- *The major accidents in petrochemical facilities occur during storage processes. Many disastrous accidents occurred in the past, causing death or injury for workers, huge economic losses and massive environmental pollution. Thus, this work aimed to profound and adequate hazard identification and risk assessment in the oil storage facility. Flammable liquid storage tanks usually plant in a potentially dangerous zone. In order to avoid the tank fire, the tanks extended to the nearby storage tanks facilities. In consideration of safety conditions, flammable liquid storage tank for the safety and security distance is necessary. In this work various accidents of storage tanks that taken place in industrial facilities. Prevention and mitigation measures provided to handle similar types of situations. Firstly, the potential undesired accidents in the oil storage farm were identified using Hazard identification and risk assessment (HIRA). The qualitative and quantitative analysis has shown for causing the tank fire and explosion.*

Keywords- Hazard Identification, Risk Assessment, Fire and explosion, Safety measures, crude oil storage tank.

I. INTRODUCTION

In crude oil storage tank, there is a maximum chance of accident. Since crude oil is a flammable liquid, there are numerous potential hazards including fire, explosion, working at heights, liquid spills, and health problems. It could cause major or minor fatality. For this purpose, it is very necessary to analyze the risk. Now scenario for the industry to be successful it should meet not only the requirements of production but also achieve safety standard for all concerned. Hazard identification and risk assessment is a systematic approach to protect health and reduced property life & environment. In the project we are performing (HIRA) hazard identification and risk assessment to make the workplace safe. We will use risk assessment methodology by knowing hazard consequences and given safety recommendation to reduce the hazard based on all above analysis.

Figure 1 - Fire Triangle

Fire spread by direct burning of the combustible material. the heat of the fire is normally transfer by radiation, conduction and convection.

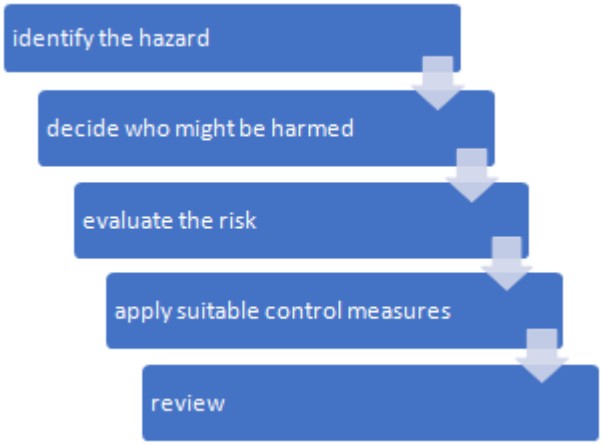

Figure 2 - Steps of HIRA

II. OBJECTIVE

a) The objective of this project is analyzing the risk through risk matrix in crude oil storage tank.

b) Carryout a systematic, critical appraisal of all hazards involving plant services and operation methods.
c) Identify the appropriate safeguards available to control the risk due to the hazards.
d) Suggest additional control measures to minimize risk to the acceptable level.
e) Prepare a risk register that will help in monitoring this risk detect any changes and ensure the controls are effective.
f) Fire and explosion in a crude oil storage tank is one of the dangerous threats for oil storage area or terminal. This kind of hazard results in environmental damage, human fatality and causes a great economic loss. With the help of methodology, we pointed out the accident which may lead in crude oil storage tank.

III. OBSERVATION

The Table below shows what responses are appropriate for the risks. For Environmental issue having a low risk, the response is to accept the risk. For accident having a medium risk (higher likelihood), the response is to control the risk. And lastly, for health issue, fire or explosion, since it has both high severity and high likelihood, the response is to mitigate the risks.

Table 1 Risk and its Corresponding Risk Level

Risk	Likelihood	Severity	Risk score	Risk Level
Accident	4	2	8	Significant risk
Fire or explosion	4	3	12	Severe risk
Health issues	4	4	16	Severe risk
Environ-mental issues	1	1	1	Acceptable risk

IV. PROBLEM FORMULATION

OISD STD 129 (Inspection of Storage Tank) is the responsibilities of the inspection division:

i. To inspect, measure and record of material and to evaluate current physical conditions of the tanks for its soundness to continue in service.
ii. To keep the concerned operating and maintainance personnel fully informed as to the condition of the various tanks
iii. iTo determine the causes of deterioration, investigate abnormalities and advice remedial measures
iv. To inspect while doin repairs and accept after completion of repairs.
v. To maintain proper maintenance and inspection records and tanks history.

STATEMENT OF PROBLEM FOR WHICH PROJECT IS PROPOSED

1. EXPLOSION HAZARD
2. OIL SPILL
3. HEALTH HAZARD
4. LIGHTENING
5. FIRE HAZARD- RIM SEAL FIRE

Rim seal fires comprise many fires in external floating roof tanks but can occur in internal floating roof tanks or domed roof tanks. As with many tank fires, lightning is the primary cause of ignition, although with floating roof tanks, an induced electrical charge without a direct lightening hit may occur. As per the LASTFIRE incident survey, 83.87% initial fire events within the scope of the survey were lightning ignited rim seal fire.

Figure: RIM SEAL FIRE

V. METHODOLOGY

Job safety analysis (JSA) is an accident prevention technique that is used to identify the potential hazard associated to the job and give the control measure to minimize the hazards.

An analysis includes five steps:

i. Select a job.
ii. Break down the job into successive steps.
iii. Identify the potential hazards.

iv. Apply & evaluate the controls to the hazards.

Job safety analysis are primarily used for controlling risks to the safety and health of the workers. However, JSA can be used as a tool to identify how the task can pose hazards to the environment or assets. IN addition to identifying the inherent hazards of a task, a well conducted JSA can uncover other subtle issues that pose risk to the individual, such as discrepancies between the way the procedures recommend a task to be carried out and the actual situation, problems with risk controls that supposedly act to reduce the risk but when brought to light during the JSA are found to be deficient, missing, inoperable or the hazards associated with personnel change during the tasks.

Table: Risk Matrix

RISK MATRIX			LIKELIHOOD				
			1	2	3	4	5
			Very rare	Rare	Unlikely	Possible	Likely
SEVERITY	1	Negligible	1	2	3	4	5
	2	Minor	2	4	6	8	10
	3	Serious	3	6	9	12	15
	4	Fatal	4	8	12	16	20
	5	Catastrophic	5	10	15	20	25

Table: Types of accident happened in the industry

Content	**External floating roof**	**Cone roof tank**	**sphere**	**Cone roof internal floating roof**	**total**
Crude oil	23	5	0	2	30
Oil products	3	10	0	1	14
Gasoline	20	3	0	3	26
LPG	0	0	11	0	11
Subtotal	**46**	**18**	**11**	**6**	**81**

VI. FINDING AND CONCLUSION

For accident, explosion or fire, health issue and environmental issue having a low risk, the response is to accept the risk, but before the observation higher in accident, explosion or fire, health issue now it is controlled.

Risk and its Corresponding Risk Level

Risk	**Likeli hood**	**Severity**	**Risk score**	**Risk Level**
Accident	2	2	4	Acceptable risk
Fire or explosion	2	2	4	Acceptable risk
Health issues	2	3	6	Acceptable risk
Environ-mental issues	1	1	1	Acceptable risk

The use of risk assessment methodologies contributes to the prevention of accidents and helps to make the system a safe place to work. Thus, in this analysis job safety analysis has been performed in every section of the industries potential hazards associated to manufacturing work under different section have been identified and proper control measures have been recommended by preparing job safety analysis worksheet. risk rating is also calculated of each work as per hazards identified and listed in JSA worksheet which are performed during manufacturing. This may help to know the level of risk faced while performing work, safety regulations must be established in all the factories.

The analysis clearly shows that the accidents are held mostly due to human error, an effective safety management with the proper training and education for the workers may prevent the accident considerably.

The researcher observed different factories and reviewed different related studies to identify risk and its factors and to describe the current situation and process in the factory. Survey was also done to further evaluate the risk and its factors. From the results, the respondents answered that accident, and explosion or fire are the risks that mostly happen on the factory.

After identifying and analysing the risk and risk factors, the researcher assessed the risk to determine the responses appropriate to the risks. The risk response for accident, explosion, or fire, is mitigation, and control, respectively. Health issues and environmental issues are deemed to be an acceptable risk since both likelihood and severity scores were low; risk response for both risks are accepted. Analysis and assessment of risk and risk factors became the guide in making risk management plan. Failure mode and effect analysis, and hazard controls were also used by the researcher to properly determine what's and what's not

to do in the factory. In an uncertain world, people must always prepare for the worst that is why there are risk management plans. Risk management plans reduce risks in workplace. As the risk reduces, workers doubt reduces too. Reduction of doubts may produce efficient workers and increase the industry's reputation.

VII. CONCLUSION

In this paper we observe present scenario of existing safety measures and its efficiency. The risk rating of the present and possible hazard is evaluated which divide them into acceptable tolerable and unacceptable risk level. which risks are in unacceptable level their possible corrective actions also recommended to improve safety measure and analysis. The results of this analysis will be of valuable to find out the consequence on emergency situation that may occur. With this knowledge, the level of preparedness can be assessed and measures taken to enhance capabilities through training and preparation of a more effective response to such occurrences.

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