

Potential Hazards of the Warehouse of the Aluminum Refinery & Risk Associated with it

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Abstract: This inspection and research work being done in one of the largest integrated Bauxite-Alumina-Aluminum- Power Complex in the Country. The Company has a 68.25 lakh TPA Bauxite Mine & 21.00 lakh TPA (normative capacity) Alumina Refinery, and 4.60 lakh TPA Aluminum Smelter & 1200MW Captive Power Plant located at Odisha. In this paper, the complete site of the warehouse of the aluminum refinery was taken in to consideration & different risk assessment techniques being implemented to find out the hazards and control the risk. Risk Theories were studied and being implemented for the elimination of hazard's. In pursuing this objective, a detailed study of different procedures of Risk assessment was studied and analyzed. Various techniques followed for the hazard identification and risk control and further work will be continued for the risk assessment of all the hazard's individually and find out a solution for elimination of the hazard's and the control upon the risk.

Keywords: Aluminium Warehouse, Warehouse Safety, Risk Assessment of warehouse, hazards of warehouse
Aluminum **Warehouse**

1. Introduction: Aluminum warehouse / bagging plant is the unit where the alumina powder is getting stored. The alumina powder is coming from the conveyer belt and drop down at the silo's. Then its getting packed and stacked in the aluminum storage unit.

2. Aluminum warehouse is located behind the SILO's with an area covered around 15000 sq ft. Here all the alumina powder is getting stored in the form of packets and baggage's. In the warehouse unit, many functions such as manual handling, automatic handling and stacking works are being carried out for the protection, movement, control of materials, storage of the aluminum baggage's. Packaging machinery also used for the packaging operations and sealing the baggage's. The baggage's are being packed and transported through train, trucks and through ships to the abroad. All the safety precautions has to be maintained in the warehouse for the safety of the materials and for the safety of the workers those who are working in the warehouse. In this project a deep inspection of the warehouse will be carried out for the identification of the hazard's in the aluminum warehouse and through risk assessment the hazard's will be eliminated and the risk will be reduced for the safety of the warehouse and the workers.

Nomenclature

A P = Probability

B S = Severity

2.1. Aluminum Warehouse

Warehouse operations should be done safely and in a proper way to maintain a safe working environment. To maintain the warehouse operation in a safely manner, we have to find out the hazard's which is exposed and may cause damage or loss to the person, property or environment and also we have to maintain a good waste management system also. We also have to inspect the warehouse in a particular interval to ensure that the operation is going well and the safety system of work is being followed properly, and we also have to take care of the manual handlings and automatic material handling equipment's (Such as conveyers, fork lifts, Industrial Trucks etc). Warehouse Safety Management can protect the health and lives of the employees. So it is important to build a healthy work place environment in the warehouse. Warehouse Safety is important in every industry.

After refining from the bauxite, after the final process the aluminum powder is getting transported through the conveyer belt and the powder is dropped down in the SILO'S of NALCO. Then it's getting packed in various weights and then stored in the warehouse. The baggage's are being stitched by the stitching machine and being stacked properly in the warehouse. Manual handling and automatic handling works are being carried out for the storage of the aluminum baggage's. After the final process where the bauxite is getting converted in to aluminum, it is being transported to the Silo's unit through belt conveyer and getting released in the warehouse. The warehouse unit of NALCO has to maintain all the safety standards by which a safe working process and a safe system of work can be followed in manual and automatic material handling system. This is all about the process of the aluminum storage in the warehouse unit of NALCO.

• Problem Identification

During the site visit & site inspection many problems observed on site and found various hazard's which may harm to the people, property or environment. The hazard's found on site will be reported to the company, and risk assessment will be done for all hazard's and will be reported to the company for taking necessary action after the completion of the project.

• Hazard's definition & Description of hazard's on site

A hazard is an agent which is having the potential to cause harm to a person/property /environment. The term hazard and risk often use interchangeably. During the site visit, many hazard's found on site which may harmful and may cause any accident / incident in coming future, the hazard's found on site are mentioned below

• Hazards Identified on site (Aluminum warehouse)

- Objects Fall from height due to improper stacking
- Unsafe Manual handling of Aluminum baggage's by workers
- Unsafe mechanical means of transport of baggage's through forklift
- Poor Illumination / Lighting
- Chances of fire & Explosion due to bulk storage
- Dusty Area (Huge dusty condition found on warehouse)
- Huge spillages from the aluminum baggage's
- Fire extinguisher not placed in proper location

- **Methodology**

I I E R R

I – Identify the Hazard

I – Identify Who might be at Risk (Person / Property/ Business)

E- Evaluation of Risk (Risk Ratings, Risk Matrix etc.)

R – Record Significant Findings & Implement them

R – Review the Assessment & update if necessary

- **HIRA**

In current scenario of Industrialization world new types of hazards are arising very faster manner. As industrial demand and supply have a limited time period, so it is difficult to control. So within this limited time schedule worker have to work and production is must for all organizations. To control all type of industrial hazards most of the companies in India are following ISO 45001:2018 Occupational Health & Safety Management System (Previously OHSAS 18001), Factories act 1948 and other act & rules as per the industry category, where it is mentioned that all the potential hazards should be identified through HIRA technique & safe system of work and Risk assessment sheet must be provided. This is a legal requirement for all organizations otherwise enforcement action may take by authorities. So to achieve zero accident in industry HIRA technique must be followed where risk assessment is carried out for all potential hazards.

- **Hazard Identification**

Before starting of any high risk activity hazard identification must be done through a competent team and previous statistical history of records. The competent team includes engineer, supervisor, operation specialist, safety specialist, workmen's team lead. Whereas the previous statistical history of records includes accident statistics, first aid cases, occupational diseases, enforcement actions, notice from govt authorities etc. After discussion with competent team and reviewing historical data's potential hazards has to be classified which may harm to person, property or business in future. The potential hazards are classified as per their nature, causing, probability/likelihood, and consequence/severity, risk level etc. Finally the identified hazards should be recorded and reviewed if necessary.

- **Risk Assessment**

Risk assessment is the technique to analyse the actual level of risk and its consequences associated with a particular activity. In this method one activity is to be taken and that to be discussed with competent risk assessment team and historical data of same is to be analysed to find out the actual consequences of a particular hazardous activity. All the findings should be recorded separately for different activities.

- **Risk Analysis**

In this step again risk assessment sheet is considered and hazard ranking is provided to every activity. The hazard ranking is based on the nature of work, history of accident, future occurrences which may happen. This could be done through 5*5 matrix system.

- **Monitor & Review**

All the updated HIRA have to be monitored and reviewed by management and competent staff at regular interval.

- **Risk Matrix**

This is the evaluation technique of any risk through Likelihood/probability & Consequence/severity by which the extent level of risk is calculated. This is also a main part of risk assessment process. This is an international updated method of categorization of risk level as per ISO 45001:2018 Occupational health and safety management system. Basically it is a 5*5 matrix with row and column. The row describes the likelihood/probability and column describes the consequence/severity. So the final risk is calculated as: -

Risk(R) = Likelihood (L)*consequences(C) Or Probability*severity I.e. final risk is the multiplication of likelihood and consequences. If the product of “L*C” is much higher i.e. exceeding 9 immediate action should be taken and if found more dangerous work should stop till prior control measures to be taken.

Table 1

Probability Description(The highest category will always be used)		
Value	Status	Description
4	Very likely	The event is almost certain to occur and has occurred in repeatedly in the construction industry
3	Likely	The event will probably occur in most circumstances
2	Unlikely	The event may occur only in exceptional circumstances
1	Very unlikely	Very unlikely but remotely possible

Table 2

Severity Description(The highest category will always be used)	
Value	Result of hazard to personnel / Environmental impact
4	Fatality
3	Reportable injury or illness resulting in more than two days off work/ Permanent Total Disability/ Major pollution
2	Non Reportable Lost Time Injury or Illness resulting in less than two days off work
1	Injury or illness requiring first-Aid treatment/ minor pollution

After determining the likelihood and the severity, the risk / impact level was determined by using the following risk matrix. To determine the risk/ impact level, select the appropriate column for severity and the appropriate row for likelihood; the cell where they intersect indicates the risk / impact level.

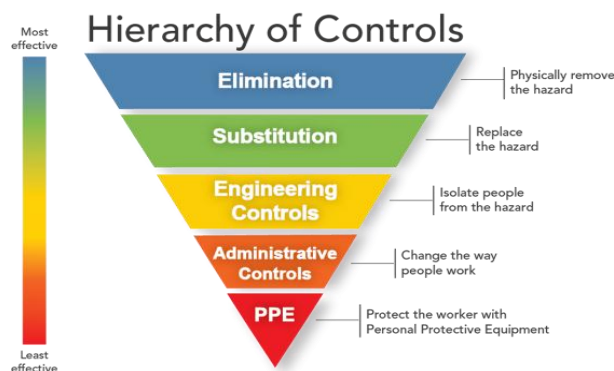
Risk matrix		Severity (S)			
		1	2	3	4
Probability (P)	1	1	2	3	4
	2	2	4	6	8
	3	3	6	9	12
	4	4	8	12	16

Determine controls

Based on the risk/ impact level determined, control measures were selected to reduce it to an acceptable level. This was done by reducing the likelihood and/ or Severity.

Risk Rating (P XS)	Risk level	Recommended Actions
1 to 3	Low risk	No additional risk control measures may be needed.
4 to 8	Medium risk	Work can be carried out with risk controls in place
9 to 16	High risk	Don't start work risk level must be reduced to medium/ low before Commencing work.

Hierarchy of Controls



Elimination – In the elimination part, we will try to eliminate the hazard which can remove the cause of danger completely.

Substitution – In the substitution part, we will try to find a substitute, if we can't eliminate the hazard completely, by finding a substitute it will be less risky to achieve the same outcome.

Engineering Control – In Engineering Control, we can implement the engineering techniques to reduce the risk of the hazard's such as doing any physical changes, adding safe guards etc.

Administrative Control - In administrative control, the administrative works should be followed up properly such as proper training to the employees & workers, Risk assessments, issue of permits etc.

PPE (Personal Protective Equipment's)- This the final stage, here proper PPE'S to be provided to the employees and workers to save themselves from the hazard's.

RISK'S Associated due to the hazard's found on the site of the Warehouse

HAZARDS RISKS

1. Objects Fall from height due to improper stacking Injury / loss of materials
2. Unsafe Manual handling of Aluminium baggage's by workers Injury of person
3. Unsafe mechanical means of transport of baggage's through forklift Overturning/Collision/Loss of material
4. Poor Illumination / Lighting Slip & Trip or fall may occur
5. Chances of fire & Explosion due to bulk storage Fire
6. Dusty Area (Huge dusty condition found on warehouse) Unsafe condition /suffocation
7. Huge spillages from the aluminium baggage's Slip, Trip, loss of materials
8. Fire extinguisher not placed in proper location Fire

Results & Discussions

During the inspection of the warehouse, there were several hazard's found on the site, and the details of the hazards has been kept in the record's and informed to the plant EHS Department.

Hazard's found in the warehouse

Risk assessment of these hazards will be done and to be reported to the company and also recommendations will be given to the company for elimination of the hazard's and reduction of the risk.

1. Objects Fall from height due to improper stacking
2. Unsafe Manual handling of Aluminium baggage's by workers
3. Unsafe mechanical means of transport of baggage's through forklift
4. Poor Illumination / Lighting
5. Chances of fire & Explosion due to bulk storage

6. Dusty Area (Huge dusty condition found on warehouse)

7. Huge spillages from the aluminium baggage's

8. Fire extinguisher not placed in proper location

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