

Repair the Layout of Finish Goods Due to Fire Precautions in Warehouse of Manufacture Industry

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Abstract: The objective to be achieved in writing this article is to design the layout of finished goods in an efficient warehouse which refers to the guidelines for fire prevention, so that the fulfillment of finished goods based on demand remains fulfilled and the accumulation of goods is carried out by the FIFO method. Arrange the layout of the new warehouse in the warehouse using the pyramid stacking method and special clusters because the available storage locations are determined based on groups of goods making it easier for warehouse operators to identify and store. The difference between the initial layout and the proposed layout is based on the data contained in the Guidelines. The finished goods before the application of fire prevention measures are 2729 pallets position, and after the application of 2394 pallets position, there are 335 pallets depreciations, where fire precaution of storage area is have been successfully implemented.

Keywords: Finish Goods, Fire precaution, Warehouse etc.

I. INTRODUCTION

Warehouse is one of the very important infrastructures in the industrial world that functions as a temporary storage area in terms of distribution of goods (Ristono, 2008). Placement of goods regularly and efficiently in a warehouse is an obligation that must be done by a retail, manufacturing or freight forwarding company to speed up the process of sending and receiving goods (Yulianto, 2018). As one of the special facilities that remain, the warehouse is designed to help achieve the target level of good service with the lowest total cost (Indrajit, 2003). The warehouse also becomes a logistics system of a company that functions to store products and provide information about the status and conditions of the material / products stored until the goods are in accordance with the production schedule. The term Warehouse Management (Warehouse Management) means an order to manage warehousing and distribution of goods so that the goods stored remain in good condition and connected to the requesters for the right amount. The benefits of warehouse management include quality and logistics and equipment qualifications, structuring logistics and equipment, improving distribution services, providing accurate, actual and accountable data and information, easy access to control and supervision, and disciplining administrative processes (Willey et al, 1999).

A suitable and sufficient fire risk assessment for the premises should be undertaken in compliance with national legislation

and guidelines. The combustibility of the stock and packaging, the nature of the operations, the internal layout and the method of storage have a major influence on the hazard presented. Measure that should be considered include suitable fire detection and warning system in case of fire, the installation of sprinkler, portable fire fighting equipment, emergency action plan to protect life and property (CFPA Europe, 2017).

Problems that arise among others are related to the effectiveness of the arrangement of goods in the warehouse, resulting in weak implementation of the guidelines for fire precautions in preventing fires in the area. Bleaching earth industry requires the production process to empower high heat energy, with the potential for spreading of fire; of course, maximum protection against fires in the work area is needed, including in the area of finished goods storage including evacuation access and emergency exit (Clariant, 2014).

To help solve these difficulties, steps are taken to build a pyramid system at a certain height for finished goods with a non-pallet jumbo bag. To maximize the buildup of goods that are able to provide a simulation of how the process of placing goods in the warehouse optimally while still carrying out efforts to prevent the potential for fire in the warehouse area.

Storage Indicator to Implement Fire Precautions

Compartement:

A fire compartment is a defined room or area, which is separated in such a way from neighboring rooms or areas that a fire is likely to be contained, i.e. fire cannot spread from a given compartment to adjacent rooms, upper or lower floors, other parts of the building or neighboring areas or buildings for a specified period of time. In buildings, compartments are preferably separated by passive elements such as fire resistant walls, ceilings, fire doors etc. Alternative solutions may be applied if an equivalent degree of protection is made evident. For *open air storage areas*, compartmentation is mainly achieved by enlarged safety distances between blocks (see *segregation*). Walls exceeding the height of the *stored goods* may be used where not enough space is available (Clariant, 2014).

The concept for fire prevention and protection of a *warehouse*, an *open air storage area* or a *compartment* consists of a defined combination of preventive and protective

elements that result in the reduction of the *warehousing* risk to an acceptable level (Clariant, 2014).

Emergency Exit:

That portion of the *escape route*, which is separated from all other spaces by fire walls. Emergency exits include exit doors, exit passageway and exit stairs. Emergency exits are clearly marked and exit doors are easy to open from the inside and not obstructed from the outside. A continuous and unobstructed way from any point in a *warehouse* or an open *storage* area to the outside, consisting of the path to the *emergency exit*, the exit and the path from the exit to the outside (Clariant, 2014).

FIFO:

First In - First Out. This *storage* concept ensures that products are taken out of the *storage area* in the same sequence as they were stored. This principle avoids “dormant stock” and ageing of stored good beyond shelf-life (Clariant, 2014).

Extinguishing System:

Extinguishing systems, which are easy to initiate and have an immediate extinguishing or suppressive effect. Initiation can be manual from a safe place outside the *compartment* or automatic. (Examples: CO₂ systems, deluge systems and sprinklers). Hydrants and Hoses provided in a *compartment* are not considered as fixed extinguishing systems. Extinguishing systems provided in a *warehouse* or an *open air storage area* for fighting a fire in its initial phase, such as manual fire extinguishers, mobile fire extinguishers, hose reel stations, standpipes and water hoses (Clariant, 2014).

Piece Goods Potentially Fire:

Piece goods are materials stored in movable containers: Pallet loads, mobile tanks, containers, bags, big bags, drums, boxes, trays, bottles, cans, gas cylinders, etc. Combustible substances or *piece goods* which have been subjected to elevated temperatures and/or mechanical stress, in particular to drying, milling and heat-shrink-wrapping within the last 24 hours, are goods subject to safety quarantine. For goods known to tend to the formation of glowing nests longer settling times are required. Procedure for appraisal of risks with the aim of implementing specific safety measures if necessary. The term includes both formal procedures according to a defined method and informal procedures, such as safety discussions, provided the results are documented such that the reasoning behind conclusions can be reconstructed (Clariant, 2014).

Storage Area Procedures:

Keeping of goods in spaces, which are designed for and dedicated to that purpose. *Storage* areas are spaces, which are designed for and designated to the *storage* of goods. Stored goods comprise stored *piece goods* as well as stored packaging materials. Warehousing consists of receiving, *storage*, assembly and dispatch of goods and packaging

material and includes the respective infrastructure (Tomkins, et al, 2003).

II. METHODOLOGY RESEARCH

To complete this research, several stages of research are needed, namely conducting initial observations, problem solving, library research, determining research objectives, collecting data, processing data and analyzing results, and drawing conclusions and suggestions.

1. *Initial Observation*

Preliminary observations were made to understand the initial conditions of the company so as to formulate existing problems. Observations can be made by direct observation and interviews with the company, then identify what problems occur.

2. *Formulate the problem*

Based on the description in the background, it can be seen that the inventory system and ordering of raw materials and the storage system of raw materials in the warehouse are problems in the inventory system and warehouse layout.

3. *Literatur Review*

In understanding the existing problems and solving them, the study literature is needed to have the right direction. By studying the appropriate literature, the writer can look for alternative solutions to problems. Books that are used as references are books relating to the inventory control system and warehouse layout.

4. *Determine Research Objective*

After understanding the problems that occur, the research objectives to be achieved based on the formulation of the problem above is to design the layout of raw materials in an efficient warehouse, so that the collection of raw materials can be done by FIFO (Heragu, 2008).

5. *Collecting Data*

Data collection method is done by interview and also by direct observation (observation) in the company. Data and information taken are categorized into two types, viz:

- a. Primary data is data obtained directly through interviews and observations, namely the size of the pallets used, material handling used, types of products stored in the warehouse, the area of the warehouse.
- b. Secondary data, which is data obtained from company records, includes data on past purchases, data on raw materials entering and leaving the warehouse, data on message costs, shipping costs, prices for each raw material, and supplier information, dimensions or volume of packaging raw materials will saved.

III. CATEGORIZATION OF GOODS STORAGE

The categorization of finished goods is needed to determine the buildup of goods whether finished goods are of the same type or combination. The categorization also involves the characteristics of the finished goods whether flammable, explosive, or finished goods which are a combination of both (Tersine, 1994). To ensure that the area of the accumulation of finished goods meets the criteria and fulfills the amount of inventory, the best system is needed so that the distance between goods is not a problem in applying fire precautions. Project was to build up a product (Clariant International Ltd, 2014).

Categorization of Goods to be stored

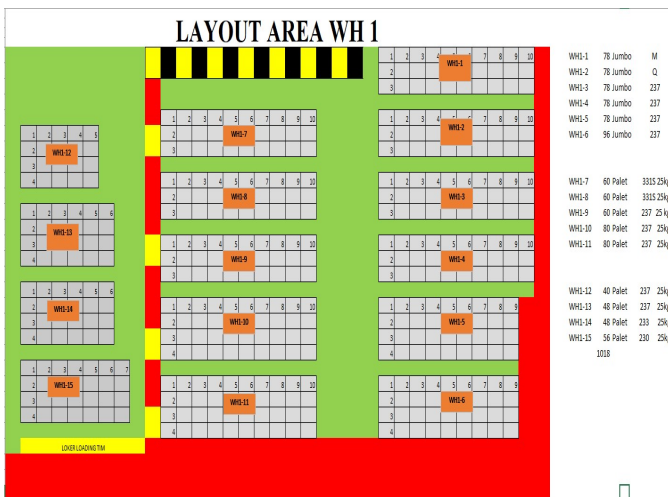
- 1 According the guideline, *stored goods* are assigned to the following *Clariant Storage Categories*:
 - Explosive Substances
 - Gases in pressurized containers
 - Aerosol cans
 - Self-heating substances
 - Substances which in contact with water emit flammable gases
 - Substances that are incompatible with water
 - Organic Peroxides and self-reactive substances
 - Oxidizing Substances
 - Flammable liquids flash-point $\leq 60^{\circ}\text{C}$)
 - Flammable solids
 - Combustible Liquids ($60^{\circ}\text{C} < \text{flash-point} \leq 93^{\circ}\text{C}$)
 - Combustible Toxic Substances
 - Combustible Corrosive Substances
 - Combustible Substances (not assigned)
 - Non-Combustible Toxic Substances
 - Non-Combustible Corrosive Substances
 - Non-combustible Substances

Fig: Categorization of Goods Storage

Source: Guideline 9

IV. IMPLEMENTATION

Before Implementation Fire Precautions



WH2-1 62 Jumbo S
 WH2-2 62 Jumbo S
 WH2-3 62 Jumbo S
 WH2-4 62 Jumbo S
 WH2-5 78 Jumbo WB-EX50
 WH2-6 78 Jumbo WB-EX50
 WH2-7 78 Jumbo Geko 1050
 WH2-8 78 Jumbo Geko 1050
 WH2-9 80 Palet 230 paper
 WH2-10 80 Palet 230 paper

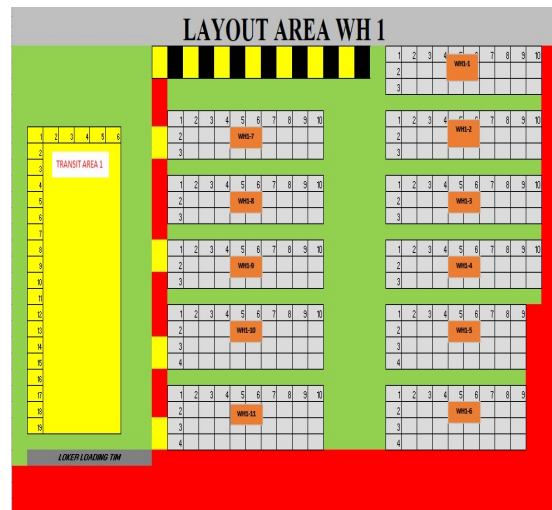
720



WH3-1 54 Palet ETC4
 WH3-2 54 Palet ETC4
 WH3-3 54 Palet ETC4
 WH3-4 54 Palet ETC4
 WH3-5 54 Palet ETC4
 WH3-6 54 Palet ETC4
 WH3-7 45 Palet Gelo 850
 WH3-8 45 Palet Gelo 850
 WH3-9 45 Palet Gelo 850
 WH3-10 45 Palet Gelo 850
 WH3-11 45 Palet Gelo 850
 WH3-12 54 Palet API 2S
 WH3-13 54 Palet API 2S
 WH3-14 36 Supreme 54 CM
 WH3-15 36 Supreme 54 CM

728

After Fire Precautions:



WH1-1 78 Jumbo M
 WH1-2 78 Jumbo Q
 WH1-3 78 Jumbo 237
 WH1-4 78 Jumbo 237
 WH1-5 78 Jumbo 237
 WH1-6 96 Jumbo 237
 WH1-7 60 Palet 3315 25kg
 WH1-8 60 Palet 3315 25kg
 WH1-9 60 Palet 237 25 kg
 WH1-10 80 Palet 237 25kg
 WH1-11 80 Palet 237 25kg
 WH1-12 40 Palet 237 25kg
 WH1-13 48 Palet 237 25kg
 WH1-14 48 Palet 233 25kg
 WH1-15 56 Palet 230 25kg

1018



Fig 3. Importance of main software project management areas (Rahardhio, 2020)

V. RESULT

Before

WH Capacity 1: 1222 position palette

WH Capacity 2: 778 position palette

WH Capacity 3: 729 position pallets

Total storage capacity in finished goods warehouse before fire precautions: 2,729 position pallets

After

WH Capacity 1: 1080 position palette

WH Capacity 2: 720 position pallets

WH Capacity 3: 594 position pallets

Total storage capacity in finished goods after freedings precautions: 2,394 position pallets

Comparison of total capacity before and after fire precautions from the total storage area.

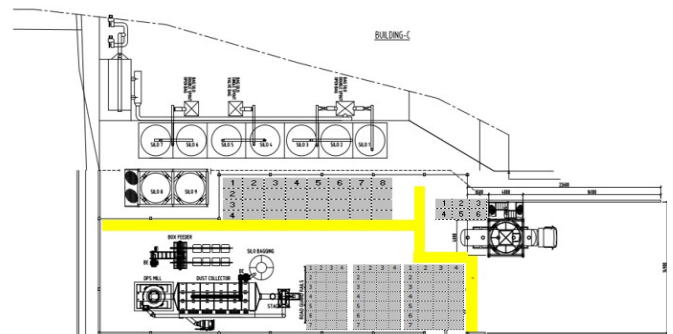
Before

- Total finished goods storage capacity
- 4032 position palette

After

- Total capacity of finished goods storage after fire precautions
- 2,606 position pallets

Sample layout before and after implement the guideline 9 in Production Line with distance required minimum 10 m from fire hazard (burner machine and dryer)



Picture 1.

Layout before implementation of Guideline 9 in DPS mill area

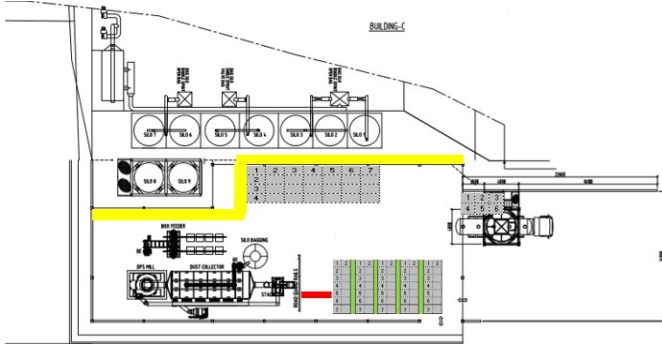
For the type of product itself is divided into two types, namely products with small bag (kg) and jumbo bag (tonnage) packaging. The total capacity before the implementation of guideline 9 was 244 stored in five storage location blocks. Prior to the implementation of the guidelines, product packaging was too close to machines that produce heat energy, from combustion and product drying. This is very dangerous if there is a fire triangle process due to an increase in temperature around the storage environment.

While OSHA (2002) states that the storage requirements for flammable products must meet the protection requirements for a fire accident or explosion. states that because varied injuries may end up improperly handling and storing materials, staff ought to even be aware of accidents which will result from the unsafe or improper handling of kit still as from improper work practices. Additionally, the staff ought to be able to acknowledge the strategies for eliminating — or a minimum of minimizing — the occurrence of such accidents. Employers and workers should examine their workplaces to find any unsafe or unhealthful conditions, practices, or instrumentality and take corrective action.

When utilizing and putting away materials and appraisal carried out beneath the Perilous Substances and Unstable Climate Controls 2002 (DSEAR) ought to be completed to distinguish the bundle of controls that will be required to minimize the dangers. The DSEAR appraisal ought to consider how to: prevent fires starting; restrict the rate of fire spread ensure that within the occasion of fire everybody can

clude safely help fire brigades handle any expansive fire; and reduce the fetched of a fire (HSE, 2020)

The company is very concerned about occupational safety and health and continual improvement of environmentally friendly working conditions, ensuring zero accidents are achieved and product safety for consumers. Guideline 9 is appropriate as a tool to implement this commitment and increase global trust in a sustainable production process in Natural Resources Industry (Clariant International Ltd, 2019)



Picture 2.

Layout after implementation of Guideline 9

In DPS mill area

After implementing guideline 9, the storage area becomes more flexible both for the movement of people and machines. And last but not least, safe distance for packaged products has been fulfilled on all Production Lines.

Although storage capacity has decreased, but this can be arranged in terms of forecasting. And meeting the needs of consumers by increasing good communication patterns with them. When there is demand, the Company is still able to take the best opportunities.

The total capacity before the implementation of Guideline 9 was 244 bags/jumbo from 5 blocks of storage area. After applying the guidelines reduced to 208 bags/jumbo to 7 storage area blocks. This reduction is not a setback, but an improvement. And this stimulates various departments to start moving simultaneously. Every action moves from the mindset of salvation is the main thing before starting everything.

VI. DISCUSSION

Fire and explosion hazard knowledge This section is especially vital in storage things. Storage has got to make sure that venturous materials are not exposed to temperatures at that they may ignite (flammability limits) or explode (explosive limits) (Departement of defense, 1979). This conjointly section provides you with the flash purpose - the temperature at which ignitable liquid vapors might change state if they contact the associate ignition supply (Reliable Plant, 2019).

OSHA (2002) states that stored materials must not create a hazard for employees. Employers should make workers aware

of such factors as the materials' height and weight, how accessible the stored materials are to the user, and the condition of the containers where the materials are stored when stacking and piling materials. To prevent creating hazards when storing materials, employers must keep storage areas free from accumulated materials that cause tripping, fires, or explosions, or that may contribute to the harboring of rats and other pests.

Provide suitable fire detection and fire-fighting equipment, including fire hydrants, in all TTSP storage areas and ensure that (WHO, 2014):

- a. Systems and equipment are appropriate for the class of occupancy and product storage arrangements and are approved by the local fire authority; and
- b. Equipment is regularly serviced in accordance with the equipment manufacturers' recommendations and local regulations.
- c. Follow standard operating procedures (SOPs) for fire prevention, detection and control.
- d. Train staff and carry out regular fire drills. Prohibit smoking in all areas.

The fire danger potential is reliable in tie capacity operations with huge amounts of combustible fabric can be best controlled by a positive fire anticipation beneath the coordinate supervision of the upper level administration program. This program ought to incorporate the taking after (NFPA 230, 2003): (1) Choice, plan, and course of action of capacity zones and fabric taking care of hardware based on sound fire anticipation and protection principles (2) Offices for early fire location, transmission of alerts, and fire engineering. (3) Fire paths to partitioned expansive stacks and give get to viable terminating operations (4) Partition of yard capacity from process buildings and other uncovering properties (5) An compelling fire avoidance up to the program, counting normal yard reviews by prepared personnel.

In line with the assessment, the Company has implemented Guideline 9 quite well correlated woth International Standard. Evidenced by the industry's natural resources in processing Bentonite products in Indonesia have met the minimum safety requirements for storing materials and products (ESHA, 2020).

The implementation of guideline 9 also complies with OSHA regulations 1926-151 (2019), which contain regulations that the whole capacity location might be kept free from the collection of superfluous combustible materials. Weeds and grass should be kept down and a normal method given for the intermittent cleanup of the whole region. When there is a peril of an underground fire, that arrive might not be utilized for combustible or combustible capacity. The strategy of heaping should be strong wherever conceivable and in deliberate and customary heaps. No combustible fabric might be put away outside inside 10 feet of a building or structure. Convenient fire quenching gear, reasonable for the fire danger included,

should be given at helpful, obviously open areas within the yard region. Convenient fire quenchers, appraised not less than 2A, should set so that the greatest travel remove to the closest unit should not surpass 100 feet.

VII. CONCLUSION

After making improvements to the layout of finished goods in the warehouse with a special pyramid method for barnag to become a 1T jumbo bag stacking layout in accordance with the guidelines, and for finished goods with a pallet position without the pyramid method still meet forecasting. The implementation of guideline 9 also complies with International regulations that successfully to kept the storage area free from fire hazardous.

VIII. RECOMMENDATION

For the next study, a long period of time, the researchers recommends making more complex calculations of the capacity of finished goods and correlating with forecasting and fire other safety regulations, so that it will help management determine the implementation of appropriate guidelines so that quality costs can be reduced

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