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ANALYSIS OF THE EFFECTIVENESS OF RAW MATERIAL WAREHOUSE MANAGEMENT AT PT INDONESIA ASAHAN ALUMINUM

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Abstract

Research Objectives To find out the raw material management process carried out at PT Indonesia Asahan Aluminum, to find outwhether the current raw material storage layout is effective or not and to find out what can be done or improved to increase the effectiveness of raw material warehouse management at PT Indonesia Asahan Aluminum. The type of research used is quantitative descriptive research. This research was conducted at PT Indonesia Asahan Aluminum. Based on the results of the analysis that has been carried out on the implementation of the class-based storage method in the PT Indonesia Asahan Aluminum warehouse, namely the Potential for Increasing Operational Efficiency: The calculation results show that by implementing the class-based storage method, there is the potential for a significant increase in efficiency. Projections show a reduction in the total distance traveled by 630,441 meters or around 28%, which shows that this method can minimize the distance traveled for picking up raw materials, thereby speeding up the process of searching for and retrieving goods. Better Grouping of Raw Materials: The class-based storage method allows grouping of raw materials based on frequency of use and raw material characteristics. This grouping can help in organizing the warehouse layout more efficiently, where frequently used raw materials are placed closer to the picking area, while rarely used raw materials are placed further away but still well organized. Optimizing Space Use: Projections for implementing the class-based storage method show the potential for more optimal use of storage space. By organizing raw materials based on class, each storage space can be used more efficiently, reducing unnecessary buildup or emptiness. Process Time Reduction: Reducing travel distance is also expected to have an impact on reducing the time required for the process of searching for and retrieving raw materials. This has the potential to increase employee productivity and speed up workflow in the warehouse.

*Keywords:**Raw material management, raw material storage layout, raw material warehouse management***

1. INTRODUCTION

In carrying out its goal of producing a product and then marketing the product to obtain a profit, every company needs to manage each sector within its company, this can also be called supply chain management, supply chain management is the management of a series of activities which include planning, receiving , storage, management and delivery of products, each of which is carried out using a cost-based strategy that is efficient, controlled and able to increase profits while prioritizing customers as the main goal. In managing each existing sector, companies generally divide tasks in the supply chain between several people who will later handle the chain that is entrusted, so that the company can move systematically and structured so that there are no problems or excess costs in each supply chain required. to meet customer needs. One of the important supply chain links in an overall supply chain is Raw Material Storage. Raw material storage refers to the process or facility for storing raw materials or components that have not been processed and will be used in the production process. This is an important step in the supply chain because raw materials used in production must always be available when needed to prevent operational failures, and proper storage can help optimize the supply chain and production processes. Effective and organized raw material storage management can help companies reduce costs, increase production efficiency, and ensure the availability of raw materials needed for business operations. However, if raw material storage management is carried out ineffectively and unorganized, it will cause more costs to the company and tend to be detrimental to the company because the raw materials or components stored are damaged before they can be used by the production process. In this case, problems can be seen that arise at PT Indonesia Asahan Aluminium, a company that has a strategic role in producing Aluminum to meet the need for Aluminum in Indonesia, problems with PT Indonesia Asahan Aluminum's raw material warehouse management where the storage of raw materials has not been well organized. as can be seen in Figure 1.1 as follows:

Figure 1.1. Magnesium Metal Storage

From Figure 1.1, we can see that in placing a similar item, namely Magnesium Metal, the raw material is used as an additive alloy which will be melted and mixed with the main product of PT Indonesia Asahan Aluminum to produce derivative products, namely Alloy and Billet, storage of magnesium metal raw materials. placed in 2 different parts, whereas based on the type the two placements should be carried out in 1 dedicated place to facilitate the process of storing these raw materials and other raw materials in the PT Indonesia Asahan Aluminum Warehouse.

Figure 1.2. Aluminum Sulfate Storage

In Figure 1.2. We can see that in the storage of Aluminum Sulphate raw materials, the storage carried out exceeds the permitted line because the space available in the warehouse is not enough at the time of receipt even though in other warehouse areas there is space that is not optimally used by other raw materials. Storage conditions that cross the boundary line will increase the level of risk probability that exists in a storage process in a warehouse, such as being hit by a forklift or truck, damaged materials and incidents with working personnel.

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Figure 1.3. Silicon Metal Storage

In Figure 1.3. The Flexible Container used to store Silicon Metal raw materials is in poor condition and has suffered a lot of damage, this is caused by not taking the raw materials by operations or users either for reasons of specifications or the buyer's need for the mixture has decreased compared to the forecast. . A clear status needs to be given to this raw material so that if it is necessary to replace the flexible container with a new one, this can be done before the existing flexible container is damaged and cannot be transported by a forklift.

Figure 1.4. Soft Pitch Storage

In Figure 1.4. there is storage of raw materials that have expired where the tags or labels on the raw materials have faded, this material is no longer consumed, but its status is still in the storage warehouse and takes up part of the available raw material warehouse space or space. In managing the raw materials warehouse at PT Indonesia Asahan Alumunium, there are 96 items of active raw materials that are stored and managed starting from receipt, storage, inspection, delivery and/or collection.

1.1 Warehouse

A warehouse is a place for receiving, temporary storage and inventory of parts, materials and goods that will be used for production or production support needs.

1.2 Effectiveness

According to Martani and Lubis (2007) effectiveness is the main element of activity to achieve predetermined goals or targets, in other words, an organization is said to be effective if it achieves predetermined goals or targets.

1.3 Layout

Layout according to Heizer and Render (2009) is an important decision that determines the efficiency of an operation in the long term. Layout has many strategic impacts because layout determines a company's competitiveness in terms of capacity, processes, flexibility, and costs, as well as the quality of the work environment, customer contact, and company image. An effective layout can help an organization achieve a strategy that supports differentiation, low costs, or rapid response.

2. RESEARCH METHODS

2.1 Types of research

The type of research used is quantitative descriptive research. The reason why researchers use quantitative descriptive research is because the nature and purpose of the research they want to obtain is how much efficiency the warehouse management of PT Indonesia Asahan Aluminum currently has and how much effectiveness can be increased through this research.

2.2 Place and time of research

This research was conducted at PT Indonesia Asahan Aluminum, the first aluminum production industry in Indonesia with its address in Kuala Tanjung. Sei Suka District 21657. Batu Bara Regency, North Sumatra, Indonesia. The warehouse discussed here is a warehouse intended for use by PT Indonesia Asahan Aluminum as a place to store raw materials only. The research period is from October 2023 to December 2023.

2.3 Research Stages

1. Preliminary Stage: through direct initial observations in the raw material warehouse and a little discussion with related personnel until an initial definition is obtained regarding the problems raised regarding the effectiveness of current warehousing or warehouse layout;
2. Data collection and management stage: collect the required data and information regarding the management of the existing raw material warehouse at PT Indonesia Asahan Aluminum, including existing warehouse layout data including the width and height of the warehouse, the tools contained in the raw material warehouse and their dimensions. This data is used as initial data in evaluating the effectiveness and layout of the warehouse to serve as a reference for improvements. Data on the characteristics of each raw material in the warehouse, this data describes the characteristics of the raw material such as chemical properties, type, expiration date, supplier and dimensions of the raw material. This data is used as input data in improving the layout of raw material warehouses using the class-based storage method. Data on the flow of goods in the raw materials warehouse. This data shows the flow of raw materials in the raw materials warehouse from the time it is entered for storage until it is used. This data is used as input data in improving the raw material warehouse layout. Schedule data and the number of raw materials taken, this data shows the amount of each raw material stored and its placement in the raw materials warehouse. This data will be used as input data for improving the warehouse layout. In data processing, policy design is carried out based on warehouse layout design principles, policy analysis that will be used in placing each type of raw material in the proposed warehouse layout simulation.
3. Analysis stage: analyzing the current raw material warehouse layout and the old placement policy to then create a proposed warehouse layout obtained with a new placement policy based on the class-based dedicated storage method by considering all existing factors. So that it can streamline processes in the raw material warehouse and increase the effectiveness of raw material warehouse management.

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4. Conclusion and suggestion stage: Summarizing the results of the analysis carried out on the effectiveness of current raw material warehouse management and providing recommendations in the form of effectiveness values that can be achieved, accompanied by a new layout of goods based on the results of previously collected data analysis, which can later be taken into consideration to be able to implemented by the raw material warehouse manager of PT Indonesia Asahan Aluminum in increasing the effectiveness of its management.

3. RESULTS AND DISCUSSION

3.1 Proposed Layout (Class-Based Storage)

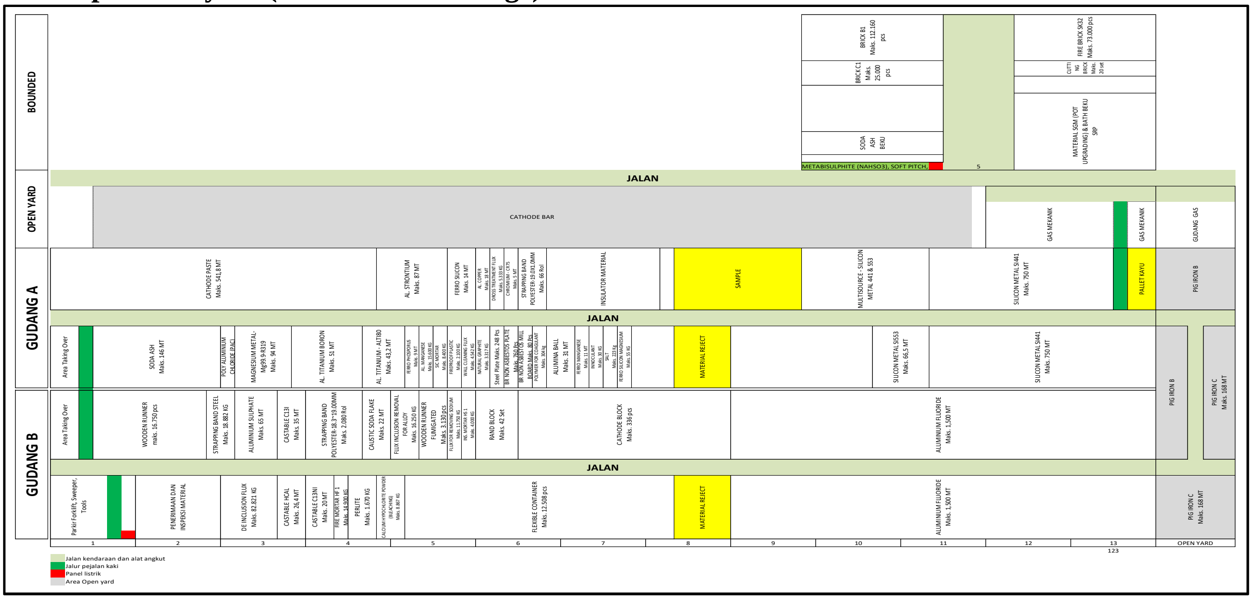

Figure 3.1 Proposed Warehouse Layout (Class-Based Storage)

In Figure 4.7 above, there is a layout that has been adapted to the following conditions:

1. Item No. 1 – 11 in Table 3.1 are grouped as class A, Item No. 12 – 27 in the same table are grouped as class B, and Item No. 28 – 65 are grouped as class C.
2. PT Inalum's Raw Material and Material Warehouse is operated as a whole so that the position is closer to the user and the handover point is more optimal.
3. Raw Materials and Materials that have a high Frequency of Movement which have been grouped in Class A, are then positioned closer to each available Door while still paying attention to the characteristics of each raw material and material.
4. Raw Materials and Materials that have a very low Frequency of Movement or no movement are in Class C and other supporting equipment such as wooden pallets, are positioned in the middle of the warehouse or in the corner of the bounded warehouse.

By paying attention to the things above, calculations will then be carried out using the same method as Table 4.4 to determine the effectiveness obtained with the existing proposed layout.

3.2 Class-Based Storage Method Calculation Results

After grouping and arranging raw materials based on the class-based storage method in the previous layout, the calculation results show an increase in efficiency in the use of space and management of raw material stocks. Below in Table 4.5 are the calculation results showing the comparison before and after implementing the class-based storage method.

Table 3.1 Calculation of Mileage for Existing vs Proposed Layouts

Material Name	Existing Distance (m) (A)	Proposed Distance (m) (B)	Existing Distance in 2024 (m) (C)	Proposed Distance in 2024 (m) (D)	Difference (AB) (m)	Difference (CD) (m)	Difference (CD) (%)
Aluminum Fluoride	267.34	214.5	836,641	671,278	52.84	165,363	-20%
Silicon Metal-Si441	696	504.33	1,029,036	745,652	191.67	283,384	-28%
Cathode Block - 3500MML	0	0	-	-	0	-	
Cathode Bar - 220MMW	0	0	-	-	0	-	
Cathode Paste	67.33	30	63,829	28,440	37.33	35,389	-55%
Brick B-1	28.86	16.1	21,587	12,043	12.76	9,544	-44%
Fire Brick SK-32	28	16.1	15,988	9,193	11.9	6,795	-43%
Pig Iron B	23.2	23.25	11,298	11,323	-0.05	-24	0%
Soda Ash	153.67	24.67	67,461	10,830	129	56,631	-84%
Wooden Runner	4.67	24	1,882	9,672	-19.33	-7,790	+414%
Strapping Band Steel-25.4X0.80MM	72	30.67	16,344	6,962	41.33	9,382	-57%
Poly Aluminum Chloride (PAC)	70	31.33	15,400	6,893	38.67	8,507	-55%
De Inclusion Flux	23	33.33	4,577	6,633	-10.33	-2,056	+45%
Magnesium Metal-Mg99.9-R319	35.11	34.67	6,566	6,483	0.44	82	-1%
Brick C-1	35.65	25,125	5,954	4,196	10,525	1,758	-30%
Pig Iron C	23.2	17.25	3,712	2,760	5.95	952	-26%
Cutting Brick SK-32/D3-2	90	22.9	14,400	3,664	67.1	10,736	-75%
Aluminum Sulphate (AL2(SO4)3)	42	34	6,552	5,304	8	1,248	-19%
Castable CA-13-I	92	37.33	12,880	5,226	54.67	7,654	-59%
Castable HC-AL	91.67	37.33	9,717	3,957	54.34	5,760	-59%
Aluminum Titanium Boron-AlTiB5/1	32.89	40.67	2,845	3,518	-7.78	-673	+24%
Aluminum Strontium-AlSr10	30.44	48.67	2,648	4,234	-18.23	-1,586	+60%
Aluminum Titanium-AlTi80	31.17	46	2,712	4,002	-14.83	-1,290	+48%
Castable CA-13-NI	92	40	7,360	3,200	52	4,160	-57%
Silicon Metal-Si553	705.67	517	56,454	41,360	188.67	15,094	-27%
Strapping Band Polyester-18.3~19.00MM	61.33	60	4,109	4,020	1.33	89	-2%
Fire Mortar SK-32 HF I	168	42	10,080	2,520	126	7,560	-75%
Perlite	77.33	44	4,485	2,552	33.33	1,933	-43%
Ferro Silicon	96.22	54	5,485	3,078	42.22	2,407	-44%
Caustic Soda Flakes	40.67	45.33	2,196	2,448	-4.66	-252	+11%
Aluminum Copper	38	55.33	1,596	2,324	-17.33	-728	+46%
Calcium Hypochlorite Powder (Bleaching)	54.66	46.67	2,186	1,867	7.99	320	-15%
Flux Inclusion Removal For Alloy	28	48	1,092	1,872	-20	-780	+71%
Flexible Containers	82	60.67	3,116	2,305	21.33	811	-26%

Material Name	Existing Distance (m) (A)	Proposed Distance (m) (B)	Existing Distance in 2024 (m) (C)	Proposed Distance in 2024 (m) (D)	Difference (AB) (m)	Difference (CD) (m)	Difference (CD) (%)
Wooden Runner, Fumigated	4.67	50.67	177	1,925	-46	-1,748	+985%
Ferrous Phosphorus	90	48.67	3,330	1,801	41.33	1,529	-46%
Flux For Removing Sodium (NA)	46.66	52.67	1,353	1,527	-6.01	-174	+13%
Non Asbestos Sheet Super Wool	84.66	66.67	1,863	1,467	17.99	396	-21%
Aluminum Manganese-AlMn75	22	50	341	775	-28	-434	+127%
Insulation Mortar HS I	248.07	54	3,969	864	194.07	3,105	-78%
Rand Block (SIC Brick) 100 MM	78.5	56.67	1,256	907	21.83	349	-28%
SIC Mortar	250.62	51.33	3,509	719	199.29	2,790	-80%
Fire Proof Plastic	70.34	52.67	914	685	17.67	230	-25%
Dross Treatment Flux	20.66	56.67	269	737	-36.01	-468	+174%
Chromium-CR75 (Flux Balance)	20.66	58	248	696	-37.34	-448	+181%
Soft Pitch	0	0	-	-	0	-	0%
Strapping Band Polyester-19.0X1.0MM	57.33	60	688	720	-2.67	-32	+5%
Epoxy Glass Type	163.67	66.67	1,964	800	97	1,164	-59%
Non Asbestos Type	163.67	66.67	1,964	800	97	1,164	-59%
Glass 5 Mica Type (2-2)	163.67	66.67	1,964	800	97	1,164	-59%
Wall-Cleaning Flux, Coveral 88	90	54	990	594	36	396	-40%
Natural Graphite	90	55.33	720	443	34.67	277	-39%
Steel Plate-I/O 224X160MML/272X215MML	108.66	56.67	543	283	51.99	260	-48%
BR Non Asbestos Plate-I/O 221X156MML/281	90	58	360	232	32	128	-36%
BR Non Asbestos Mill Board	92.66	59.33	278	178	33.33	100	-36%
Polymer For Coagulants	108.66	59.33	326	178	49.33	148	-45%
Alumina Ball / Ceramic Ball	65.67	62.67	131	125	3	6	-5%
Ferro Manganese	108.66	64.67	109	65	43.99	44	-40%
Inoculant	108.66	66	109	66	42.66	43	-39%
Ferro Silicon Magnesium	108.66	68.67	109	69	39.99	40	-37%
Salt	100.54	67.33	101	67	33.21	33	-33%
Heavy Antrance Oil	0	0	-	-	0	-	
Aluminum Chromium AlCR75 (Al Balance)	0	0	-	-	0	-	
Copper (Recycling)	0	0	-	-	0	-	
Fiber K-57 Type (5-1)	0	0	-	-	0	-	
Total	6,096	3,835	2,277,771	1,647,331	2,261	630,441	-28%

From Table 3.1 above, the use of the Proposed Layout reduces the total distance traveled in delivering materials by warehouse managers from 2,277,771 m to 1,647,331 m or a decrease of 630,441 m or 28%.

4. DISCUSSION

4.1 Analysis of the Effectiveness of Class-Based Storage Methods

The implementation of the class-based storage method showed significant results in increasing the efficiency of PT Indonesia Asahan Aluminum warehouse management. From the calculation results above, there is a total distance reduction of 630,441 meters or 28% of the total existing distance. This indicates that grouping raw materials based on frequency of use while still paying attention to the characteristics of the raw materials can minimize the distance traveled in the warehouse, thus speeding up the process of finding and retrieving raw materials.

4.2 Benefits and Challenges of Implementation

The main advantages of implementing the class-based storage method are increasing warehouse operational efficiency, reducing pick-up and delivery times for raw materials, as well as increasing the use of storage space. However, there are several challenges in implementation, such as the need for training warehouse management staff to understand the new system and adjusting the warehouse layout which requires time and costs when operational needs continue.

4.3 Implications for Future Warehouse Management

The results of this research indicate that the class-based storage method can be applied in the PT Indonesia Asahan Aluminum warehouse to increase operational efficiency. The implementation of this method can be used as a reference for future warehouse management, taking into account the need for further adjustments and development to optimize warehouse performance. This research also opens up opportunities for further development, such as the use of information technology in warehouse management and integration with supply chain management systems. In this way, PT Indonesia Asahan Aluminum can continue to improve the efficiency and effectiveness of managing raw materials and materials in the future. Based on the results of calculations and analysis, the implementation of the class-based storage method in the PT Indonesia Asahan Aluminum warehouse succeeded in increasing operational efficiency significantly. There is a reduction in total distance of 630,441 meters or 28% of the existing total distance, which shows that grouping raw materials based on frequency of movement while still paying attention to the characteristics of raw materials is effective in minimizing travel distance in the warehouse. Apart from that, this implementation also reduces the time for searching and retrieving raw materials, as well as increasing the use of storage space. Thus, the class-based storage method can be used as a reference for more efficient and effective warehouse management in the future.

5. CONCLUSION

Based on the analysis that has been carried out on the implementation of the class-based storage method in the PT Indonesia Asahan Aluminum warehouse, several main conclusions can be drawn:

1. Potential for Increasing Operational Efficiency: The calculation results show that by implementing the class-based storage method, there is the potential for significant efficiency improvement. Projections show a reduction in the total distance traveled by 630,441 meters or around 28%, which shows that this method can minimize the distance traveled for picking up raw materials, thereby speeding up the process of searching for and retrieving goods.
2. Better Grouping of Raw Materials: The class-based storage method allows grouping of raw materials based on frequency of use and raw material characteristics. This grouping can help in organizing the warehouse layout more efficiently, where frequently used raw materials are placed closer to the picking area, while rarely used raw materials are placed further away but still well organized.

3. Optimizing Space Use: Projections for implementing the class-based storage method show the potential for more optimal use of storage space. By organizing raw materials based on class, each storage space can be used more efficiently, reducing unnecessary buildup or emptiness.
4. Process Time Reduction: Reducing travel distance is also expected to have an impact on reducing the time required for the process of searching for and retrieving raw materials. This has the potential to increase employee productivity and speed up workflow in the warehouse.

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