Space Improvement in a Veterinary Pharmaceutical Warehouse

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Abstract *– This project design presents and analyze how a space problem was solved, inside a veterinary pharmaceutical warehouse, located in Panama City, Panama Republic. This veterinary pharmaceutical facility needs more space capacity specifically at dry season due to low demand and less orders at that year time. The Six Sigma DMAIC methodology was used to improve the warehouse space of this facility, by improving the space distribution layout, where existing non-use spaces were re-organized to use it as new warehouse areas, incrementing the racks and sacks capacity in a significant way. The new warehouse layout shows also new circulations areas and access for a new finished product warehouse and for a new product dispatch area at the outside of the facility.*

Key Terms – *DMAIC, Layout, Six Sigma, Warehouse*

INTRODUCTION

This (VP) veterinary pharmaceutical is located at The City of Knowledge (a former military base, next to Panama Canal) and is a very unique type of facility at that zone. Since 2005, they have being affiliated to the Colombian Headquarters. This VP is dedicated to manufactures different kind of animal pharmaceutical products for poultry, hog, and cattle, among others, nevertheless, VP located in Panama City, only manufactures products for poultry and hog. These products are anti-parasitic, antibacterial, for intestinal health, as well as disinfectants products. Many of the products are received from Colombia VP for distribution purposes only in Panama. Future plans include bringing more products to Panama in order to increase local distribution. All the production manufactured in Panama is only for Panamanian customers. The dosage form of all the products manufactures in Panama is powder and their presentation packages are paper sacks.

The VP facilities in Panama consist of one main building which contains both production (manufacturing) and administrative areas, as well as warehouse too. Inside the facility there is a main corridor of 1,022sqft, main warehouse area of 1,316.27sqft, a manufacturing area of 2,152.00sqft, and administrative offices, restrooms, packaging area, dressing area, cleaning rooms and quality control office all of about 4,009.92sqft. The total space of VP is approximately 8,500sqft.

VP Areas Description

The manufacturing area (Figure 1) has one lock for the entrance of raw material, one room for weighing ingredients, one room for blending ingredients, two rooms for product division, one cleaning room, air conditioning machine room, one lock for the exit of finished product, and two more rooms for future projects. The packaging area has three rooms, one for daily use, and another one to storage all products received from Colombia VP for distribution only, there is a third room available, but that is only in use when necessary.

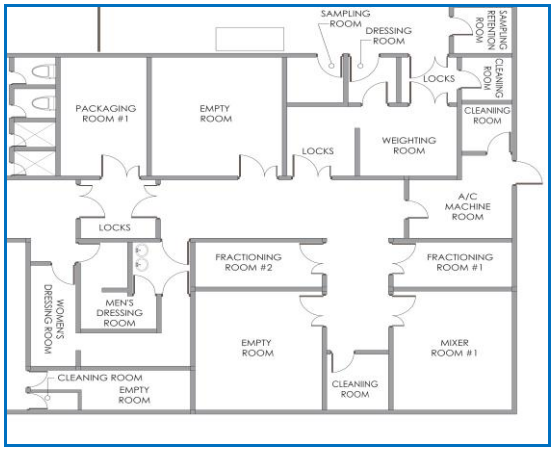

Figure 1
VP - Manufacturing Area

The main warehouse area will be described further. The main corridor works (Figure 2) (among others as packaging corridor) as a circulation area and storage area as well, for several items that do not fit at the main warehouse area. Administrative and the rest of spaces has a regular use for offices, conference room, and some others and offers no major issue for the VP well function ability.

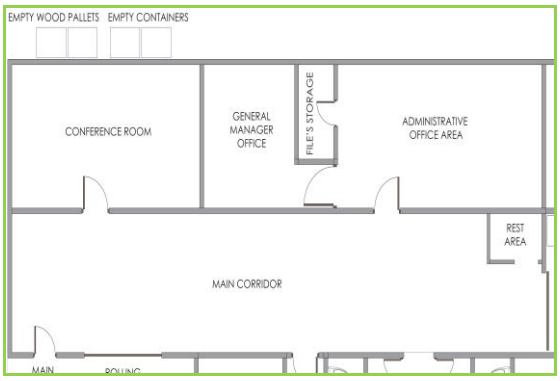

Figure 2
VP – Main Corridor – Administrative Area

The manufacturing process starts with ingredients dispensation, followed by ingredients weigh. After that ingredients blending takes place and finally VP packaged the product into plastic bags. The lots are 500 kg each for most of the products due to the blending machine capacity. The packaging process consists of package plastic bags into paper sacks. Only one product can be manufacture at the same time in the same day because the areas need to be clean after each production session ends. According to that VP manufactures approximately six products per week. The whole process runs under a production manager supervision plus two production assistants.

This VP used to rent a galley next to the main facility building, where materials, equipment, wood pallets, containers, finished products and a counterbalanced lift truck were stored. Recently due to rent cost increase, the VP decided to finished that rent contract of the galley, and after that, every item located in the galley, needs to be moved to the principal facility at VP. Because the warehouse area at VP does not have enough space to store everything that was at the galley, some other areas and rooms like the main corridor, external areas of the facility, empty rooms, and some others, were used to store all items that came from the former galley. The actual condition of spaces at VP is shown in Figure 3, 4, 5 and 6.

Figure 3
Packaging Corridor

Figure 4
Main Corridor (West View)

Is truly evident the lack of space inside VP. Products, materials and some other items are all over the VP facility; also the warehouse area needs more space at this time. A big amount of finished products is stored in the warehouse due to the low season. During dry season in Panama City, between the months of december to april, animals illness decrease and products demands decrease as well, and the warehouse area has not enough space

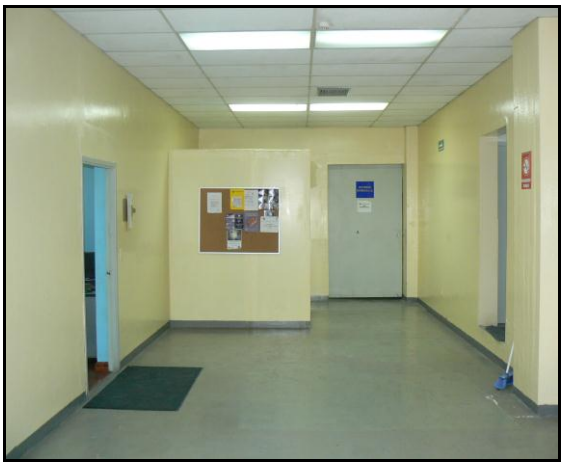

Figure 5
Main Corridor (East View)

Figure 6
Exterior Area

to storage materials, components and finished products. VP manufactures and storage products for the raining season, when demands increases.

The Six Sigma DMAIC methodology was chosen to achieve several goals. The main goal consists on the warehouse space improvement, bringing better product storage criteria, special assignment to the personnel and a significant optimization of space at the VP facility.

Research Description

VP has one main warehouse area, two available rooms and some open corridors to storage finished goods, materials and equipment. The main warehouse area does not have enough space, at least one of the available rooms needs to be clear for other use and the open corridors needs to be clear. Productivity and personnel circulation as well as products flow are affected. During this project investigation at VP, other areas (including some empty rooms) were found in VP that can be used for storage. Many of this empty room and available spaces, only needs organization criteria and items to be used as warehouse in order to clear circulation areas, and existing main warehouse area. This research is about the warehouse space improvement using Six Sigma DMAIC methodology.

LITERATURE REVIEW

Along with all information we have seen so far, three important subjects follows.

Description of The Warehouse Area

The main warehouse area includes a raw material room, a finished product room, both with controlled temperature 24 hours a day; also there is an open space with 3 racks on two levels, for several products storage. Figure 7 illustrates the complete warehouse area.

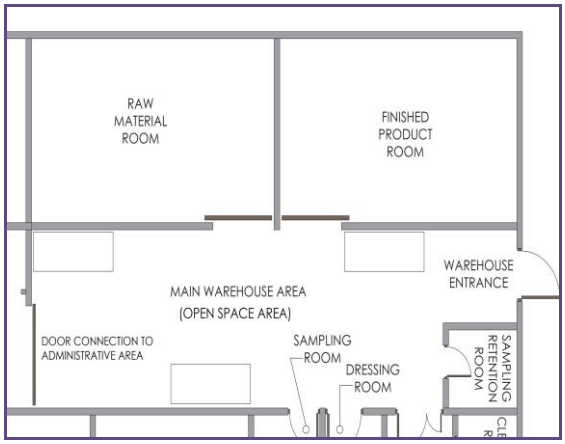

Figure 7
VP - Warehouse Area

The raw material room, consist of a temperature controlled room with five racks of two levels each, containers and all the raw materials needed to manufacture all products. Some raw

materials come from Colombia Headquarters; others are obtained locally in Panama City.

The finished product room has five racks of two levels each, and as VP specifications, it is temperature controlled, and contains finished products that come from VP of Panama City and some other finished goods for local distribution that come from Colombian Headquarters.

The open space has direct access towards the raw material room, the finished product room, the sample retention room, the entrance locks, a dressing room, the sampling room, an entrance/exit of the warehouse and has a direct connection to main corridor. This open space works as a finished product auxiliary storage area, also for packing components (sacks and cylindrical containers) and some other materials. There are three (3) racks of two (2) levels each. One rack has a specific capacity to hold four (4) wood pallets of 40in x 48in each. Almost every day the main warehouse area receives from packaging area one lot of finished product which normally consist of 20 sacks of 25kg each one, for a total of 500 kg per lot. One wood pallet can hold one lot. Finished product is dispatch daily from the VP to many clients. See Figure 8 for existing warehouse open area.

Figure 8
Existing Open Area at Warehouse

Six Sigma - DMAIC

Six Sigma is a business performance improvement strategy that aims to reduce the numbers of mistakes and defects. Six Sigma improvement drive is the latest and most effective technique in the quality engineering and management spectrum. It enables organizations to make substantial improvements in their bottom line by designing and monitoring everyday business activities in ways which minimizes all types of wastes and non-value added activities and maximizes customer satisfaction. [1]

The approach used by six sigma to solve problems is the DMAIC cycle, which stands for Define, Measure, Analyze, Improve and Control. Each one of them offers a variety of alternative processes, investigation resource and improvement activities that can solve what VP is handling at their warehouse. Figure 9 presents every step and follows by description as well. [2]

Figure 9
Six Sigma – DMAIC

- **Define Phase:** identifies and/or validate the improvement opportunity, document the business process, define critical customer requirements, and to prepare the team to be effective throughout the process.
- **Measure Phase:** identifies the critical measures that are necessary to evaluate the success of meeting the customer´s

requirements identified in the Define stage, and to begin developing the methodology to effectively collect data to measure process performance. Key input, process and output indicators, needs to be identify along with the operational definition giving clarity to each indicator, and the collected data itself with the gap between process performance and costumer requirements.

- **Analyze Phase:** identifies and validates the root causes to the problem the team is focused on, to eliminate or reduce the "real" root cause of the issue. Data and problem must be analyze and define easily to understand the problem statement.
- **Improve Phase:** identifies, evaluates and selects the right improvement solutions to optimize the process, as well as define a change management approach that will assist the organization in adapting to the changes introduced through solution implementation. The improved process map, improvement impact and benefits to the organization and individual, should be evident when this is completed.
- **Control Phase:** plans and implement the improvement solutions to determine which approach is the best to achieve the desired results. A pilot must be developed to understand where the variance in the implementation plan occurs and correct it before the entire implementation is completed. Key deliverables here at the implementation plan any training documentation, replication opportunities for the best of the organization, analysis of improved sigma quality level, and the plan to continually measure the process and establish the control methods to "sustain the gains". [3]

Cause and Effect Diagram

A cause and effect diagram is used to identify and analyze a problem in a team setting. Teams brainstorm to generate categories such as materials, machines, personnel, environment, etc. Within each category, the team identifies causes that contribute to the effect (a problem). A cause and effect diagram visually displays these causes, and helps the team to locate the most significant causes that lead to the problem. [2]

METHODOLOGY

Due to the fact that the main warehouse area of VP has not enough space and after an evaluation; and considering the actual empty spaces and open areas; the main corridor and packaging room #3 (both areas) were selected for new storage areas. These alternatives will allow a better personnel and product circulation direct from existing main warehouse to packaging areas. Also the main corridor, being warehouse area, will allow better circulation to administrative areas and some others.

Applying Six Sigma – DMAIC

Six Sigma DMAIC tool will help to improve the warehouse storage capacity for materials, components, and finished products as well in at least a 7% of what it has now.

- **Define**
  - Development of a Project Charter
    The project charter is a key deliverable of the define phase that explains why the team should do the project. Figure 10 presents the project charter for VP.
  - Problem Statement
    Define a problem statement with Sig Sigma methodology is a very frequent practice that helps in the first steps of the solving problem process to define the actual situation and first actions in the process. After a General Manager consulting meeting, a real fact is that the warehouse area space needs, is the most important issue to develop thru this project. Since the original warehouse galley that VP used to rent for storage, was close, all items were stored around circulation spaces and some others outside

Project Charter		
Project Title: Space Improvement in a Veterinary Pharmaceutical Warehouse		
Project Leader: Blanca I. Jiménez		
Project Start Date: March 2012		
Project End Date: July 2012		
Process : The process in which the opportunity exist		
Distribution of the facility		
Problem Description: Describe the problem that need to be solved, or the opportunity to be addressed		
Not enough space for storage purposes due to the fact that the adjadcent galley was closed and all the equipment, components, and finished product in that area have to be re-located.		
Objective: What improvement is targeted?		
Improvement at the warehouse space by using the principal corridor.		
Metrics: What are the measurements that quantify program process and success?		
Metric	Baseline	Goal
VP Warehouse Space	15.49% (current storage)	Increase 7% of storage
Benefit to Internal and External Customers:		
The internal customer will have more space to storage. The external customer will be able to receive the products requested in timely manner.		
Schedule: Give the key milestones and dates		
Key Project Dates		
Define: March 2012		
Measure : April 2012		
Analyze: May 2012		
Implement: June 2012		
Control: July 2012		

Figure 10
VP - Project Charter

of the building. Also, the existing warehouse area (finished product room, raw material room and open space) was not enough to hold all items already mentioned. These come to be an important statement to work with, and lead to a re-organization of warehousing concepts all over the VP facility and the enabling of existing spaces (rooms, corridors among others) for warehousing.

- **Measure**

  This phase presents a process mapping, warehouse operational definition, evaluation of the existing warehouse area distribution system, and the assessment of the current level of storage performance at VP. There is no specific collected data for specific metrics on this phase. Nevertheless under the evaluation of General Manager and part of the personnel team, it is established that the existing warehouse distribution criteria must be performed in a different way, in order to improve space utilization warehouse area functions.

  - Process Map

    This process map shows warehouse area distribution which principally consist on material receiving products from several sources: from packaging rooms, from Colombia VP headquarters, some finished products from packaging area, manufacturing components, office items, maintenance items and some others. See Figure 11 for Process Map illustration.

- **Analyze**

  On this phase is very important to determine the real causes of the problem stated before. For that a cause and effect diagram (Figure 12) illustrates, all elements so far founded that sustained this storage problem.

  To list some causes, the high cost level of the former galley VP used to rent to store several items. Also, this lack of space lead to another cause, is the more space needed to storage no just finished products or goods, but material components. As a reference, the dry season, brings an important space matter, because productions decrease and so products demands as well, on the contrary for raining season, demands increase and so is production too.

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- **Improve**

  Project Leader, in accordance with VP General Manager and VP Production Manager, brings to the table different alternatives to improve the actual warehouse area. An architect advisory helped on the process to be able to consider and performed the better space improvement as possible.

  In the first place is very important to notice the existing layout of VP on Figure 13.

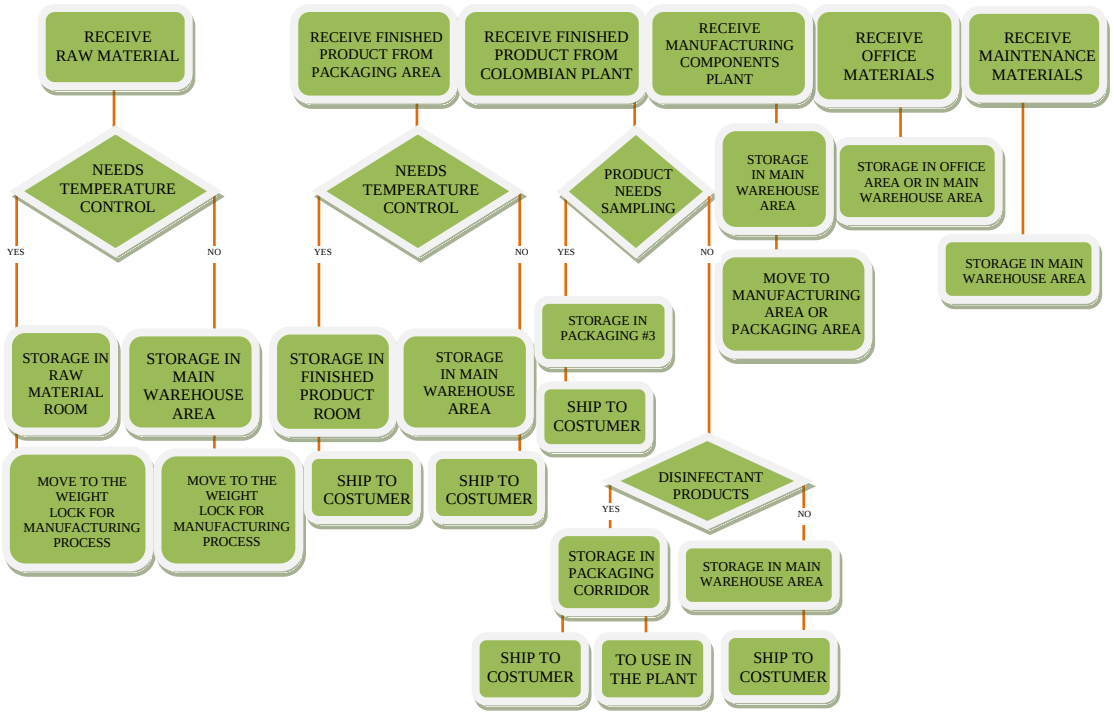

Figure 11
VP - Process Map

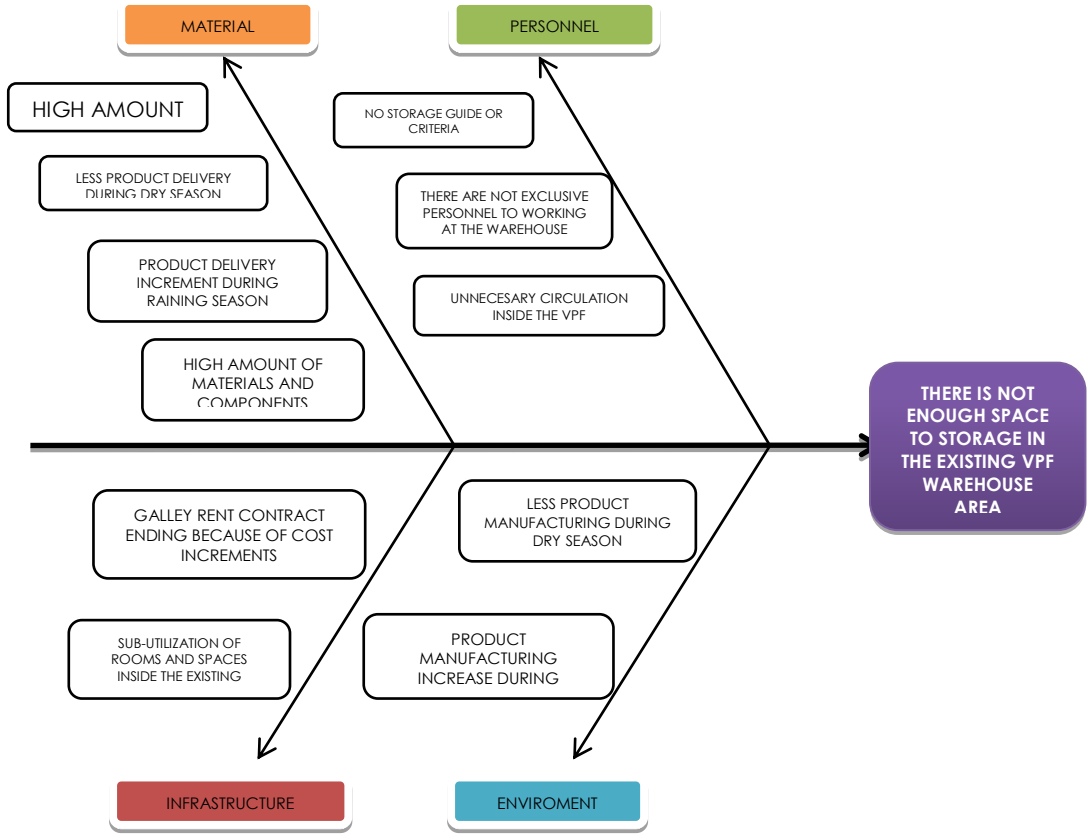

Figure 12
VP - Cause and Effect Diagram

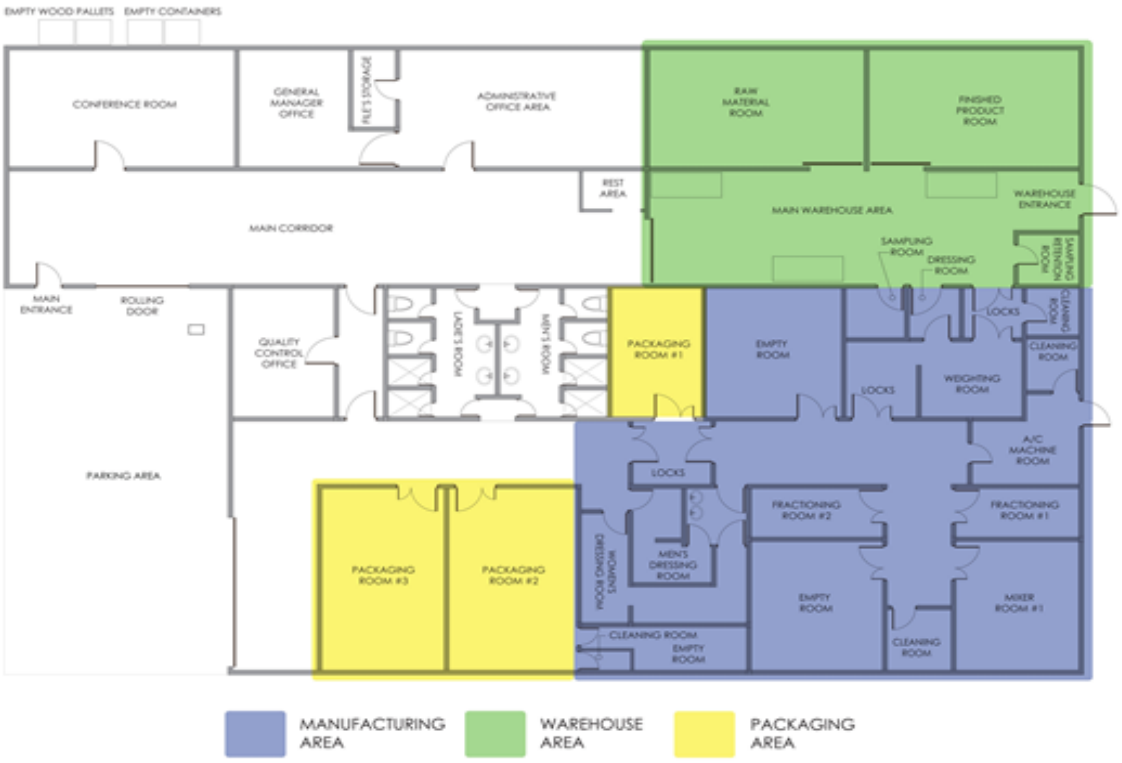

Figure 13
VP - Existing Layout

On this phase of improvement, results were evaluated, from the analyze phase, and brings to the table the idea of using the actual main corridor, many layouts alternative were drafted, in order to ended with the best one. The most important characteristic is a significant increment on space capacity that can be measure around the amounts of racks already located at these areas. For example, in the original layout, there were three racks of two levels each one, representing a total amount of 12 wood pallets (4 wood pallets per rack), and with the implementation of improvements alternative. The main corridor became part of the warehouse area, with a total amount of 9 extra racks, representing a total amount of 36 new wood pallets, plus the existing 12 ones, it come with a total of 48 pallets, which represents a 300% increment on capacity for warehouse area (in pallets terms). See Figure 14.

- Modify warehouse layout and some other areas of VP facility by:
  - ✓ Using the main corridor as a new main warehouse area. These changes means:
    - To change the main entrance of VP.
    - To change the administrative office area.
    - To eliminate the rest area (cafeteria).
    - To eliminate the conference room door.
    - To change the outside parking area position.
  - ✓ Relocate Quality Control room, this change includes:

Figure 14
VP - Improved Layout

- Use an existing room that is able today, to re-locate the Quality Control room.
- Use the actual Quality Control room area to divide into two separates offices, one for the production manager office and the other for future vaccine room.

✓ Using the packaging room #3 to storage finished product that came from Colombia Headquarters and that is distributed into Panama City.

✓ Opening a new door at the actual packaging room #1 in order to access directly to the main warehouse area.

➢ Assigning specific personnel to work at the warehouse and to be in charge of deliver product to local clients.

✓ To be in charge of dispatch and receipts.

✓ To be in charge of warehouse paperwork.

✓ To be in charge of warehouse general work.

✓ To be in charge of local product deliverance.

➢ Improving main warehouse function, by:

✓ Using stretch wrap in order to prevent the sacks falling.

✓ Tagging each rack in order to organize them by product (disinfectants, finished product, components and others).

✓ Identifying the warehouse floor with movement yellow lines.

✓ Adding 9 new racks of 4 pallets capacity per rack each adding a total of 36 new pallets.

✓ Relocating and adding new bugs lamps and fire extinguisher.

✓ Improving the sacks accommodations in order to prevents damages and falls.

✓ Adding a cartoon layer upon the pallet before the sacks, to prevent sacks damages and product leak.

- Creating a better flow for the VP warehouse.
- Identifying every room within VP with door labels.
- Relocating containers upon wood pallets from the outside, between the packaging area and the entrance/exit door.
- Relocating empty wood pallets from the outside, to a space next to a column near the new dispatch area.

Applying all these resources and in accordance with team members (General Manager and Production Manager) all improving ideas generated new space layout for VP were the most significant change on floor plan distribution. See Figure 15. With the warehouse layout improved there are some important changes:

- Significant reduction of items all around the VP corridors and none-storage spaces.
- Enable empty spaces that were not in use for new storage area.
- Packaging room #3 is now a finished product warehouse and the actual parking area has moved to the left side of VP to allow this new area for finished product dispatch to clients connecting with the new finished product warehouse area mentioned before.
- In order to accelerate the process of circulation of materials, products and personnel, a new door located at the actual packaging room #1, to make a direct connection with the main warehouse area to the packaging area.

- **Control**

This phase is about holding the improvement achieved so far. The control on the VP will be performed by periodical reviews of production manager team (including his assistants) to check on how fast or slow the amount of finished products, gets in and out of warehouse areas. All the changes addressed in the improvement phase must be included into the new personnel guide to assure all employees in the future, know about the storages criteria for VP. The following process must take place also on the specific dry and raining season was production goes up and down, incrementing or decreasing the need of space.

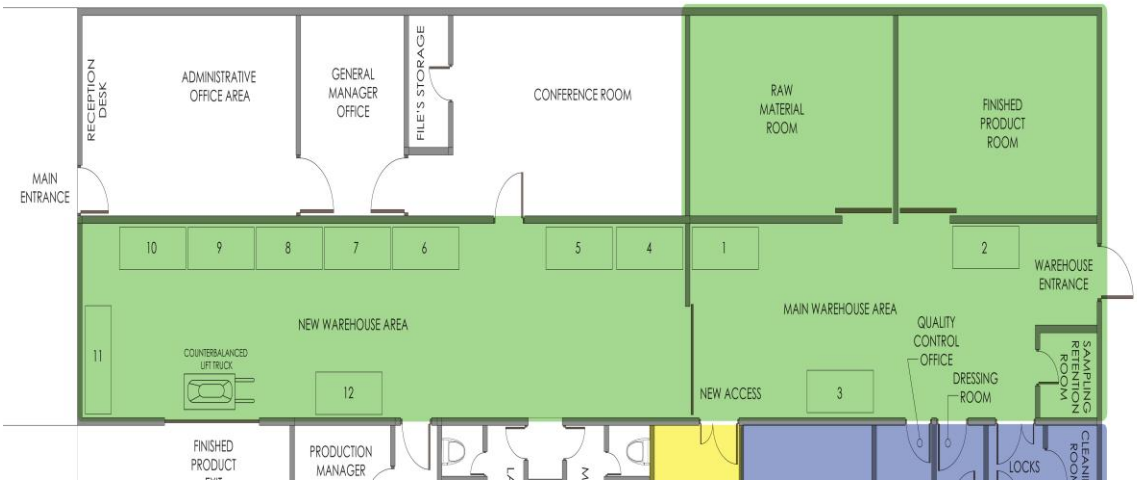

Figure 15
VP - Improved Warehouse Area Layout

RESULTS AND DISCUSSION

The Six Sigma based methodology has been used to space improvement on VP. The results obtained after implementing the layout improvement changes, can be measured in several ways:

- Cost/Benefit Impact – By reducing the cost of renting the former galley, all items and products that were accommodated there, now can fits properly at the existing VP. This reduction represents cost and space adjustment as well.
- Space Impact – Considerable time is saved by opening new door way between the packaging area and the main warehouse area, to help on circulation. Also, the using of spaces that was not in use, creating best circulation, and extra space available for raining season.
- Improvement In Productivity – Time saved from manufacturing team, and warehouse personnel using new criteria for storage and relocate items. For higher demands season, more products can be dispatch because there is more and good space for storage.

CONCLUSIONS

Using the Six Sigma methods can yield impressive results. Improving space in VP warehouse, maximize resources/equipment and also increase productivity and space utilization at the warehouse of the VP.

All the goals were achieve. The warehouse space was improved in a significant way. According to actual racks and sacks storage on existing layouts, there were and increment of 300% on VP, after identifying existing none-used spaces for storage materials, finished products, and raw materials. Personnel circulation and counterbalanced lift truck flow was optimized and the production process time was reduced by adding a new door as a access between packaging room #1 and main warehouse area.

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