IMPROVEMENT MATERIAL INVENTORY TRACKING FOR MAINTENANCE AND PROJECT THROUGH LEAN SIGMA METHODOLOGY

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Abstract

A material management is one of the key issues in ensuring that a project can be completed timely and safely. Well Development project is one of the CVX main projects that were performed to maintain oil production in order to support National income of Government of Indonesia. As one of the project resources, material inventory is a point that needs to be managed very well. The purpose of this paper is to present a Lean Sigma case study for reducing surplus materials. Due to lack of monitoring and poor material management system, project team facing that surplus material reaches $3.2 MM. Lean sigma became a very popular as it provides the organization the desired speed with quality. An initiative was done to improve project team performance. An application of Lean Sigma methodology is applied on to reduce surplus materials of project and maintenance. By having this Lean Sigma project, the surplus material can be reduced to $ 2.29 MM

Key words: Lean Sigma, Material handling, Inventory level, Materials process flow, Surplus Materials**.**

1. Introduction

CVX is one of Oil and Gas Company which was operated in Sumatra with has oil production around 370,000 BOPD. To manage this oil production, CVX has varied project. Well Development project is one of project that has significant contribution to keep or even increase oil production as expected. Project is running with some resources needed like manpower, materials, as well as equipment. In this paper writer need to explore one of project resources which is materials; one of the critical items that should be available on time on the jobsite to ensure that project progress can be managed as well. Due to lack of monitoring and poor material management system, the project has surplus materials with the amount of $3.2 MM. An improvement initiative is try to develop to minimize and reduce surplus materials of the project. Lean Sigma is choosing as tools to improve material management system of the project. The LSS methodology adopts the well-defined define-measure-analyze-improve-control (DMAIC) improvement cycle of Six Sigma and the Lean tool and techniques are synergized into the appropriate stages (Snee, 2010; George, 2002). Mostly the LSS application starts with defining process flow either through supplier-input-process-output-customer (SIPOC) or value stream map (VSM), identifying the waste of different kinds and evolving action plan for elimination of such wasteful endeavors. In order to draw the action plan, the LSS tool set is being used.

2. Problem Formulation

CVX has many projects that have been executed. There are many excess materials from previous project but there is no valid data how much they are and where the excess materials spread out some where on the job site. Project team has an initiative to conduct assessment to find out what is the casual factor in making surplus materials increase continuously. After completing investigation, project team found that the root cause of the case is lack of monitoring and poor management material tracking system of the project. Based on the assessment, project team make an improvement on material tracking system and improve flow process of materials procurement by utilizing Lean Sigma methodology.

3. Conceptual Framework

Lean Six Sigma is a holistic approach to solving problems and improving processes through the phases of DMAIC (Define, Measure, Analyze, Improve, and Control). DMAIC is the heart lean six sigma analysis that ensures the voice of the customer walks in the whole process so that products produced satisfactory customers. Lean focus on eliminating waste from the process with waste being defined as anything that is not necessary to produce the product of service.

Define process is to describe the problem and its impact to business performance. During this process, key characteristics that are important to customer and the processes are identified along with existing output condition and process element. The next process is to focus on measuring the process at issue. During this step, key characteristic are categorized, measurement system are verified, and data are collected. Once data are collected, data are analyzed in the six sigma model. The intent is to generate information of the problems. These are including identifying the fundamental and most important causes of defect of the process.

At improve process, potential solutions to process problem are identified and implemented. The results of the process changes are measured and adjustments are made as necessary. If the process is found to be performing at a desired and predictable level, it is put under control process. This process is a maintenance process of six sigma methodology. The process is then monitored to assure that no unexpected changes occur. Basically, Lean sigma is a combination between Lean and six sigma that focus on improving process by improving quality, reducing waste and inventory.

4. Methodology

Lean Six Sigma is simply a process for solving a problem. It consists of five basic phases: Define, Measure, Analyze, Improve, and Control. This process is also known as DMAIC, its acronym.

4.1. Define

It was described on the problem formulation that, CVX need to reduce surplus materials of the. Project team saw that lack of monitoring and poor management materials tracking system was the most contributed on increasing project materials surplus. Project team start to identify the factors that contribute to the case.

Project Scope

Objective of this project is to establish material inventory tracking system (Data Base) in the Business Partner (BP) material team and CVX IM MFE HO material team to reduce the surplus materials inventory. Business Objective is to reduce surplus materials inventory:

Problem Statement:

- Not available surplus material inventory tracking system (data base) in the BP's material team and CVX material team
- Many surplus material from previous project and maintenance
- It takes a long time to conduct a physical inventory for project close-outs process
- Surplus Material is up to $ 3.2 MM

Project Goal

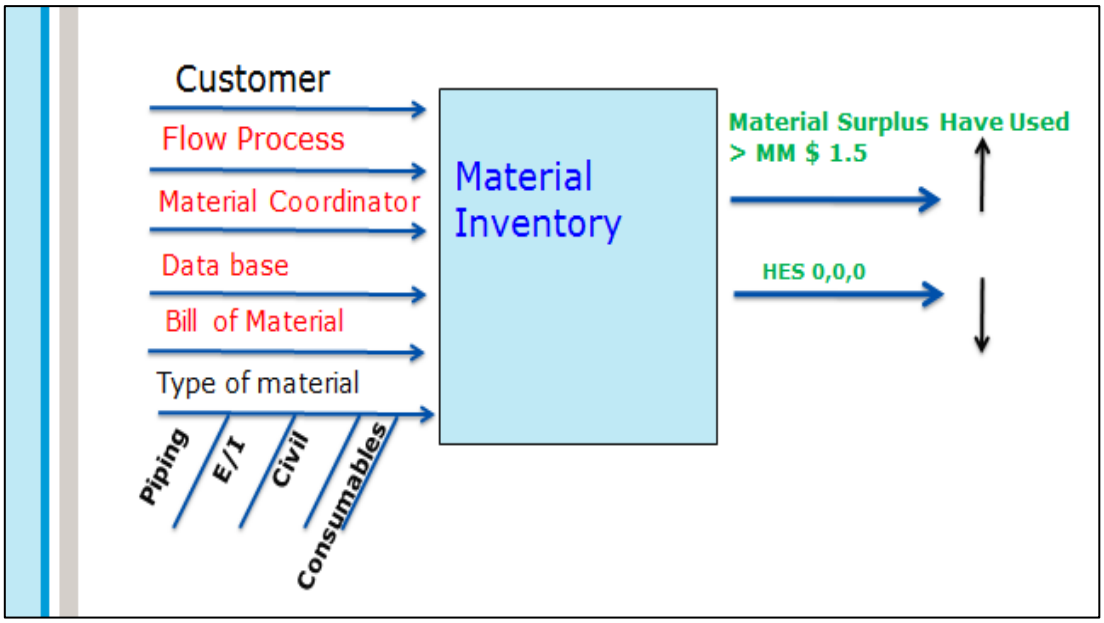
The project goal is to develop surplus material inventory data base and utilized Surplus Material Inventory > $ 1,500,000

- Definition: Surplus Material is Material with status JDE work order >61 mean that the project construction complete.
- Project Timeline: project time line starting from define, measure, analyze, improve and control phase was decided as follow:

Fig 1: Project Timeline

Problem Statement →Surplus material has significant impact to project and team performance such as:

- Increase material handling
- Increase Inventory
- Need more storage space
- Goods Damage
- Generate scrap →later on the material surplus going to be defective or become obsolete



Figur 2. IPO Diagram

In identifying and improving the process, project team generating the questions for the discussion guide, conducting, observing and analyzing the interviews, and extracting and processing the needs statements to know voice of customers. Voice of the Customer studies typically consist of both qualitative and quantitative research steps. This survey technique is to know a detailed set of customer wants and needs. As identified the customers are material team, construction team, project control team. The project team is asking them with some questions as listed below:

Question	Customer
1. Did you know that there is surplus material from the project that you signed?	Didn't know(5 person) Know (1 person)
2. Did you know that there is a surplus of material available on the Contractor Warehouse totaled $ above 2 million?	Didn't know (6 person)
3. Do you know how to utilize this surplus material?	Know, by using material transfer
4. Do you ever use this surplus material ?	Ever (5 person) Never(1 person)
5. Do you have difficulty in using this surplus material?	Have difficulty (1 person) Haven't difficulty (5 person)
6. Would that be difficult for you to utilize this surplus material?	No difficulty, since there is data and good coordination between Contractor with Material team TF/IM/Coreps
7. What do you expect from a Lean Sigma project on Improvement Materials Tracking ?	a. Existing material in the satellite go down could better managed b. Existing surplus material as quickly as possible in use, so the project close-out is completed faster c. Easy to know and control the surplus material in the satellites go down

Table 1: Voice of Customer

From the questionnaire it was found that most of the customers did not know that there are surplus materials available on each project executed. Other customer expected that materials available on the warehouse/go-down can be managed and controlled; existing materials could be utilized as quickly as possible so that the project can be closed out faster.

4.2. Measure

Measure is the second phase of a team's work with the Lean Sigma process improvement strategy. In this phase the focus of the team shifts from qualitative to *quantitative* components` of the Lean Sigma methodology The purpose of this step is to objectively establish current baselines as the basis for improvement. The performance metric baseline(s) from the Measure phase will be compared to the performance metric at the conclusion of the project to determine objectively whether significant improvement has been made. The team decides on what should be measured and how to measure it. Below is the data collection that used for baseline.

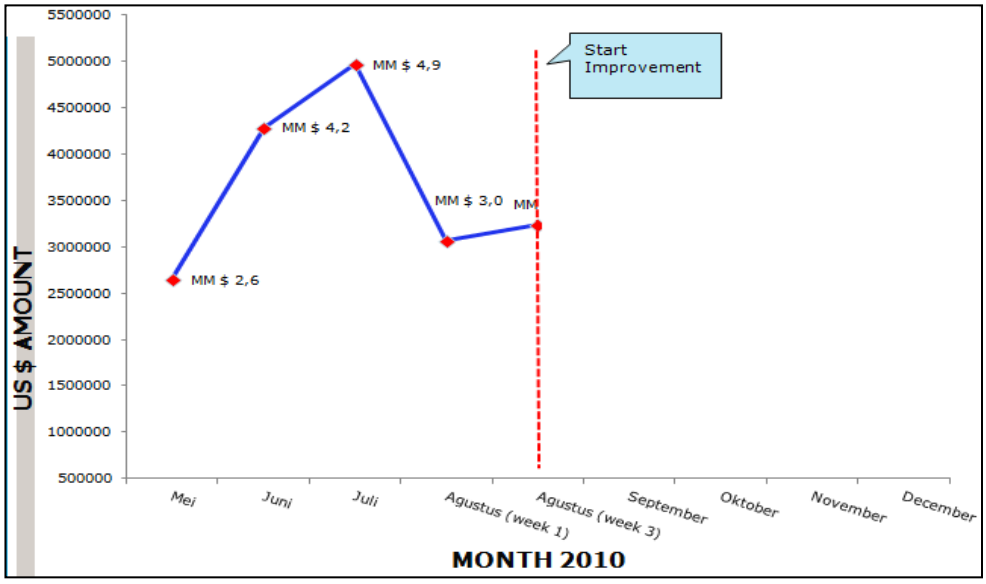


Fig 3: Run Chart Amount Surplus Materials

Project Team also focused in assessing the process flow of materials procurement starting from issuing request up to materials arrive in the satellite go-down and identified for each project. The process flow of materials request up to arrive at go-down can be described on the Figure.4 below.

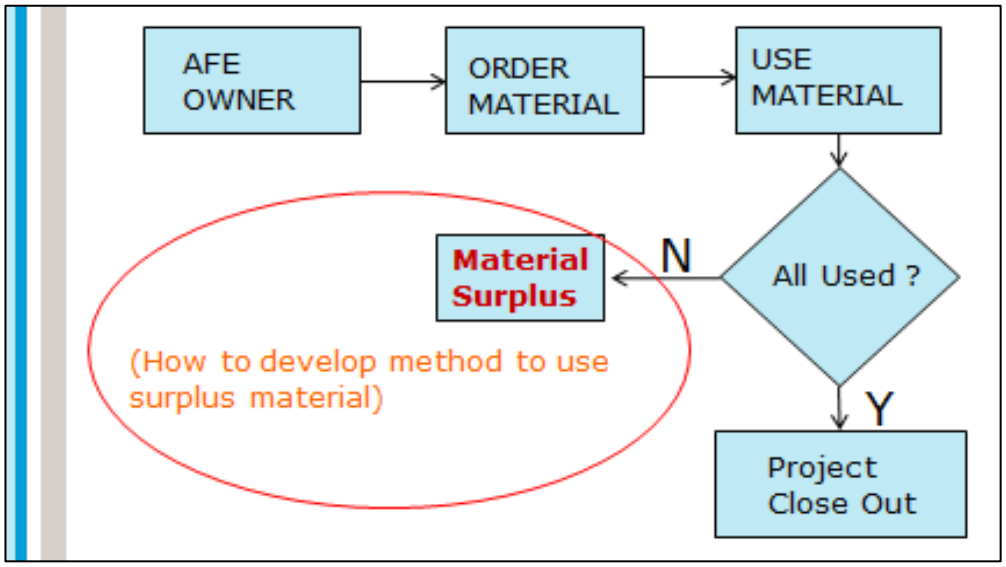


Fig 4: Marco Flow Process

Note: AFE Owner is the person who has authority to approve expenditure

Pareto Chart below show the total surplus material identified and this is contributed by sub team who runs project which were Well Program Team, Backbone Team, Share Facility Team and Support Team.

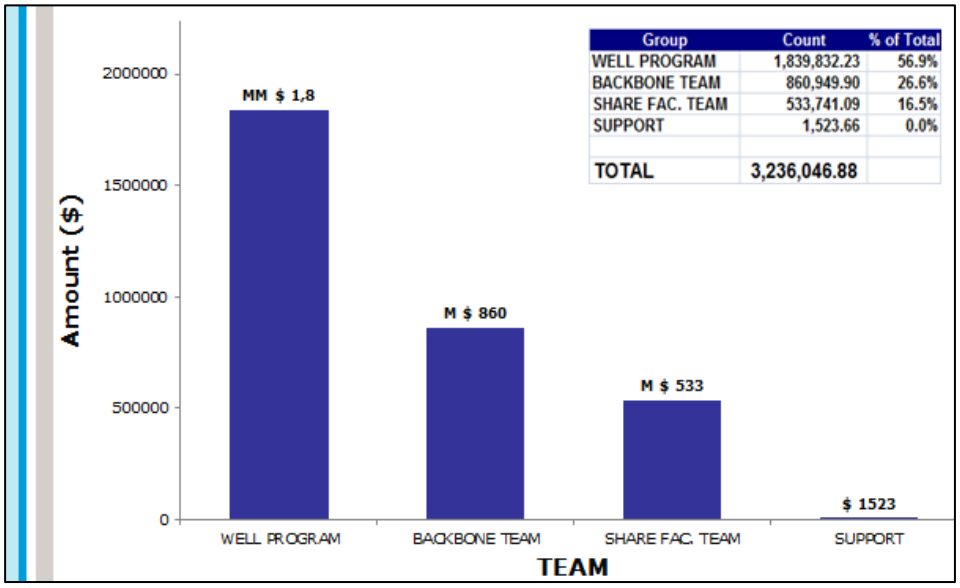


Fig 5: Surplus Materials by Sub Team

4.3. Analyze

The purpose of this step is to identify, validate and select root cause for elimination. A cause and effect diagram is developed to identify what are the potential root causes that have significant effect to contribute adding surplus materials and what can be eliminated to improve the process.

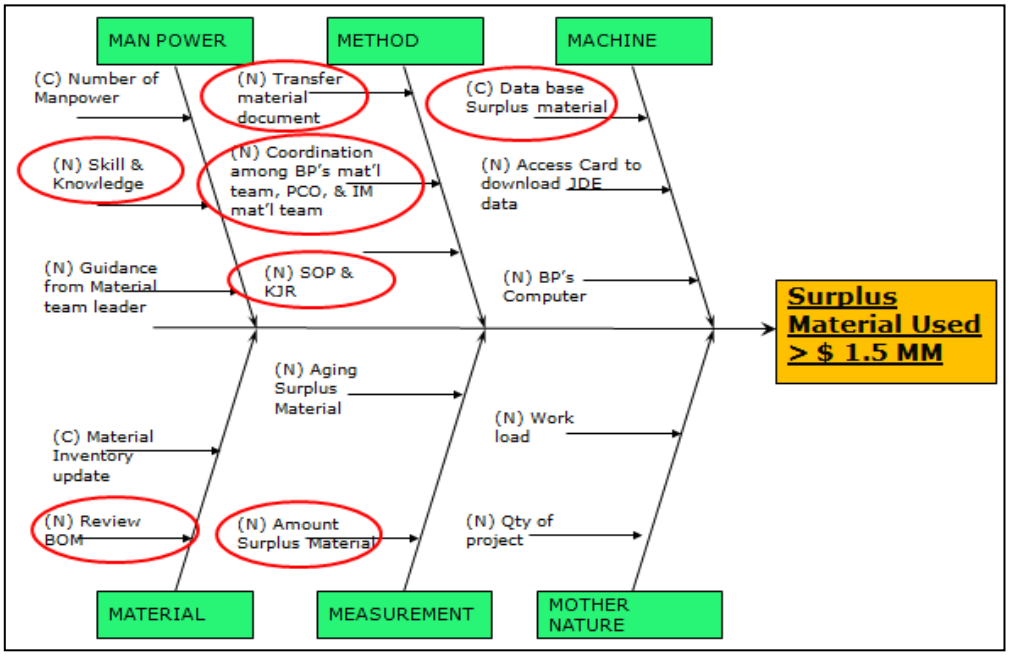


Fig 6: Cause and Effect Diagram

From cause and effect diagram above, it was found Data Base Surplus Materials is variable as C variable constant and some noise (N) variables that often fluctuate and have effect on the surplus materials that can be improved such as:

- Review BOM,
- Amount surplus materials,
- SOP and KJR,
- Coordination among BPs and CVX material team,
- Transfer materials document. Meanwhile, noise (N) variable was identified which skill and knowledge was not analyzed.

4.4. Improve

Improvement phase is to identify, test and implement a solution to the problem; in part or in whole. Identify creative solutions to eliminate the key root causes in order to fix and prevent increasing surplus material problems. One of process that can be improved is material process flow. On this project, existing process shows that material team create material request based on bill of material (BOM) without checking material which was available on the satellite go-down or material surplus. Improvement was done especially on creating material request process below:

- check the material availability before create material request
- utilizes surplus materials if available
- use material data base tracking system
- develop SOP and KJR of material team bot CVX and BPs
- review bill of materials (BOM)
- complete transfer materials document when transferring materials from one project to other project (using standard form F-137)
- improve communication and coordination among material team both CVX and BPs

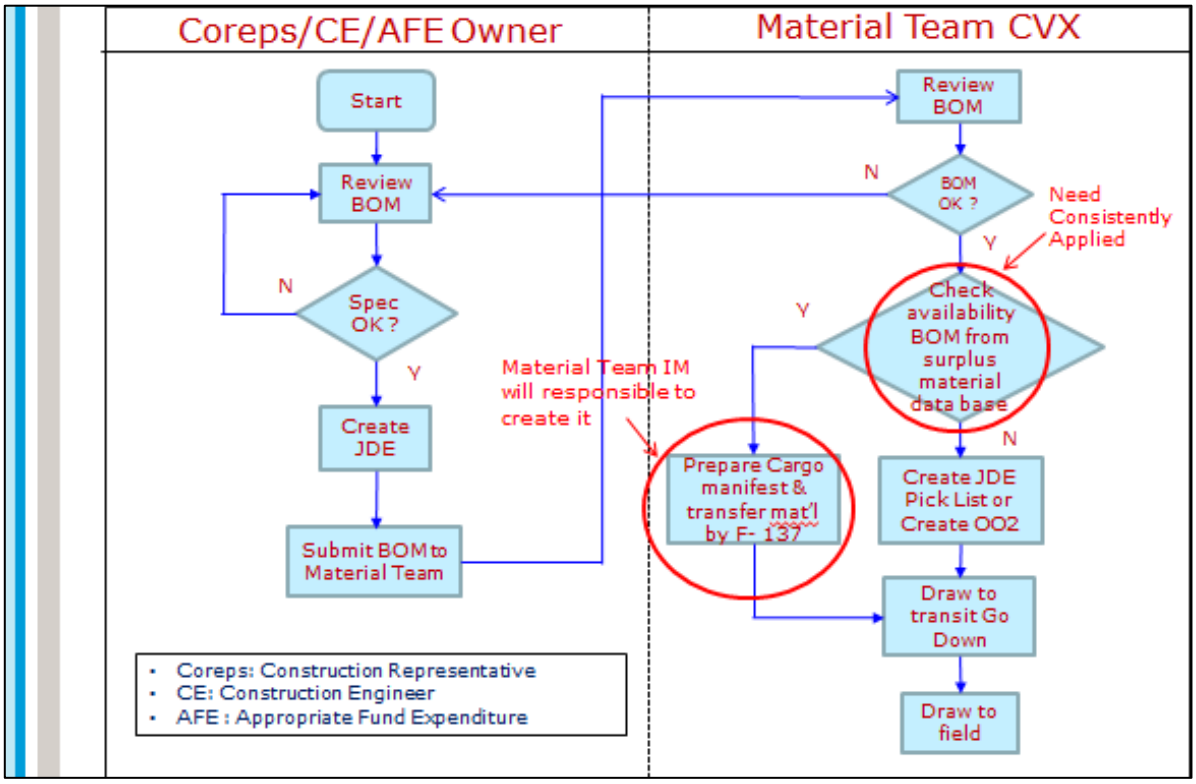


Fig 7: Material Request Flow Process

Beside of improving materials process flow, other improvement is developed by establishing materials management tracking system which calls infrastructure maintenance application system (IMAS) as follow:

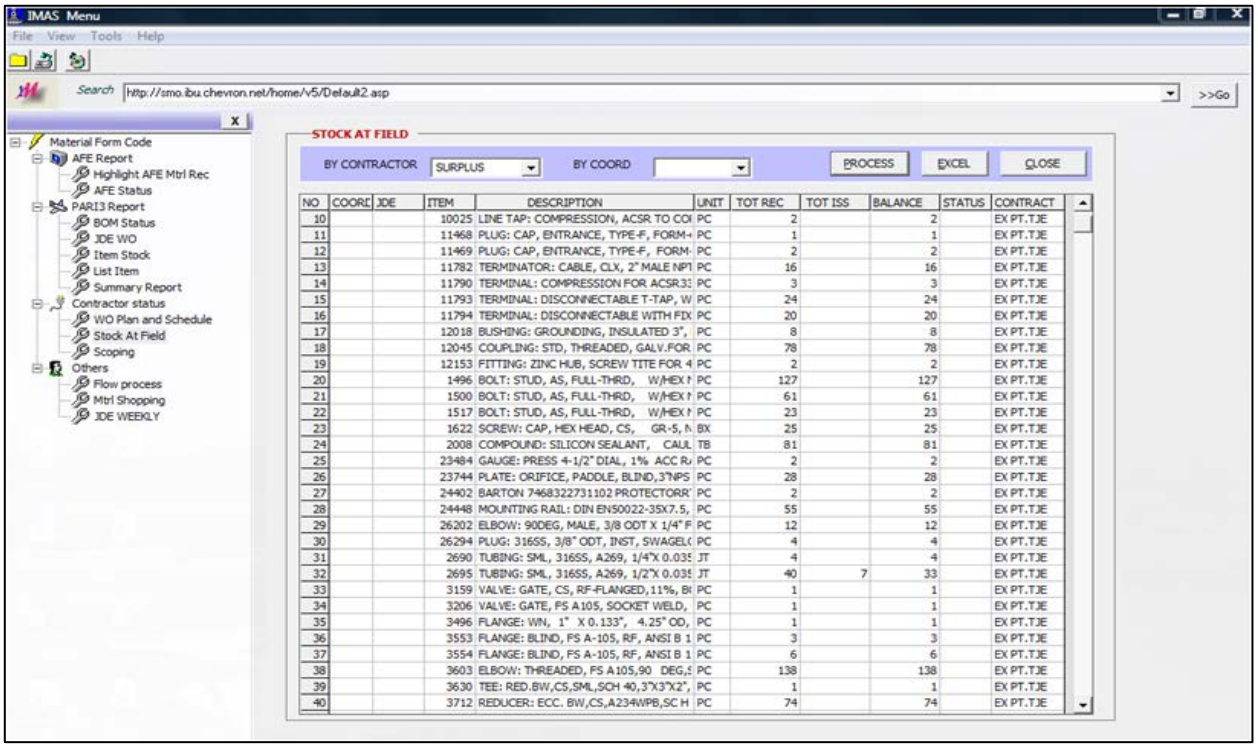


Fig 8: Data Base Infrastructure Maintenance Tracking System

Data base inventory materials tracking system will provide some information that can be used by each parties of project team like construction team, project control team and material team the status of each project in term of materials.

- materials in and out
- materials purchase → how many materials were purchased
- materials installed → how many materials were installed
- materials surplus each project → total material surplus of each project
- materials need each project → based on actual condition in the field
- bill of materials each project → each project has update BOM

By knowing this information, project team can monitor materials needs and surplus that will guide project team to initiate materials request as needed and utilize or transferring it to other project that still need the materials.

Implement Change

1. Material Inventory Process Change
   - Develop software data base (IMAS : Infrastructure Maintenance Application System) for Material team (done)
   - Updated surplus material data daily (done)
2. Material Flow Process Change to reduce surplus materials
   - Establish flow process to reduce surplus material (done)
   - Emphasize to each Construction Reps/CE/Project Owner/Material Team to give more attention to the material surplus on projects by update on data base (in progress)
   - Dispose of material that had long been not in use/broken to the junk yard (in progress)
     - ✓ *BP5* : $ 227,583.85
     - ✓ CVX yard :$ 88,314.42
     - ✓ TOTAL : $ 315,898.27
   - Perform Inventory Audit at BP's W/H to identify surplus material
     - *BP1* → found 11 items differences compared to the material released from the IM (closed) →done
     - *BP2* → found 165 items differences compared to the material released from the IM (Closed) →done
     - *BP3* →found 27 items differences compared to the material released from the IM (closed) →done
     - *BP4* →found 3 items differences compared to the material released from the IM (closed)
     - *BP5* (Closed) → in progress
     - Material Ex BP6 (Closed)
   - Offering to others team to receive material Surplus (in progress)

4.5. Control

- Ensure the new process (improved process) is followed as the SOP for materials inventory handling consistently
- Keep tracking the surplus materials inventory
- Keep close communication among project team

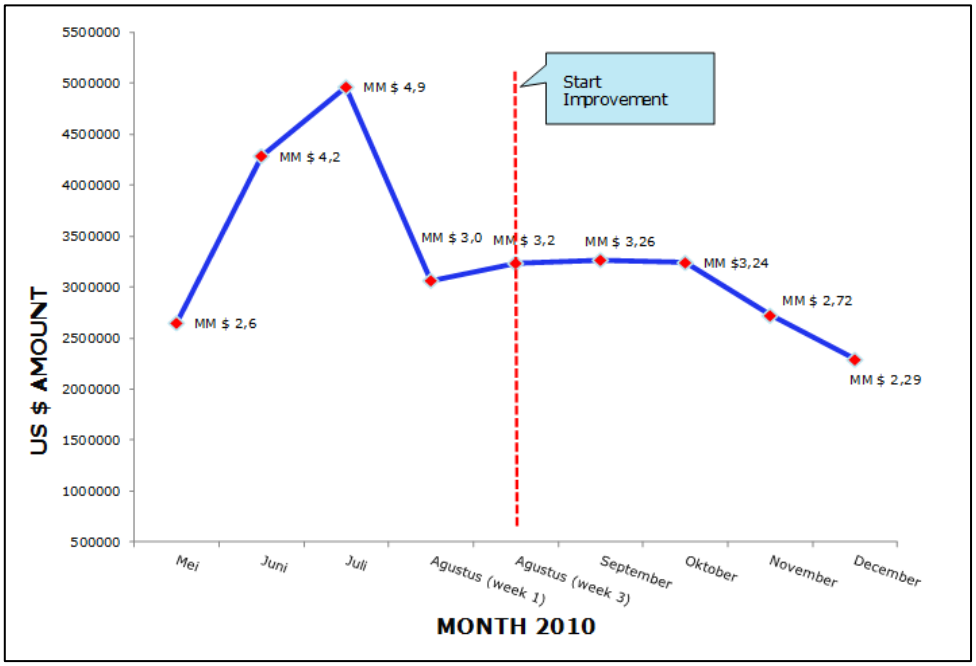


Fig 9: Surplus Materials Tracking

5. Solution

Based on improvement that has been done, Project Team did some changes to the process procedures. Flow Process was changed to ensure that the process could run effectively. The Process Flow Diagram on Figure.7 explained improvement process series of activities starting from materials request up to materials arrived at go-down. Procedures/SOPs and KJR were rewritten to ensure the consistency of Material Team. Below are some solutions that have been established based on the lean sigma project assessment.

1. Developed data base material inventory tracking system and already implemented
2. Develop and establish SOP and KJR of materials team
3. Utilized surplus material until $ 1,9 MM
4. There is changing project objective from Reduce inventory surplus material < MM $ 1, become surplus material have used/utilized > $ 1.5 MM

6. Recommendation

Lean sigma can be applied in every process improvement. The Lean Sigma methodology was used by Project Team to improve process by focusing on process that was critical, simplest, easiest solutions, and had highest impact to the process performance. After defining the problem, it was clear which performance measures needed to be re-fixed, simplified. From this project assessment, improvement opportunities were analyzed and action plans were created to help implement those plans. At the end monitoring and tracking system of materials, clear key job responsibility (KJR) and standard operating procedure (SOP) is very critical to ensure that every project was running well. With good data base system and close monitoring of the project will reduce material surplus, good materials balance. This effort had successfully improved materials utilization up to & $1 MM and reduced material surplus from $ 3.2MM to $ 2.29 MM within 5 months controlled. In relation with improvement process that have been done, below is some recommendations that project team done.

1. Need more direction and control from CVX to guide its BP's Material Team how to reduce and use surplus material also update status material daily on IMAS data base

2. Make key job responsibility (KJR) clearly among BPs Material Team
3. Strengthen the organization of CVX's Material Team
4. Perform inventory audit at BP's Warehouse at least once a year
5. Collects surplus materials from BP's transit go down to the specified location, making it easier to control and use

7. Reference

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